

## Enhancing Chinese Vocabulary Retention through Game-Based Learning: The Role of Seewo Interactive Whiteboard

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### Abstract

As digital technology continues to reshape educational practices, game-based learning (GBL) has gained prominence in Chinese as a Foreign Language (CFL) instruction. However, the specific impact of integrating interactive technologies into vocabulary learning remains underexplored. This study examines the effectiveness of GBL using the Seewo Interactive Whiteboard—a tool that incorporates multimedia resources, real-time feedback, and gamified instructional activities—in enhancing vocabulary retention and learner engagement in CFL classrooms. A quasi-experimental design was implemented with 65 second-year students from Bancherngdoi School, divided into experimental (GBL-based instruction) and control (traditional instruction) groups. Data were collected through pre-and post-tests to measure vocabulary gains and a post-intervention questionnaire to assess student attitudes. Results indicate that students in the GBL group demonstrated significantly higher vocabulary retention and reported greater motivation and classroom participation than those in the control group. These findings highlight the pedagogical potential of interactive whiteboard technology in fostering more engaging and effective language learning environments. The study offers practical insights for educators and curriculum designers, emphasizing the value of incorporating GBL elements to support active learning. It also suggests future directions for research on AI-assisted feedback, adaptive learning models, and the long-term impact of digital GBL tools in second language acquisition.

**Keywords:** Game-Based Learning, Chinese as a Foreign Language (CFL), Seewo Interactive Whiteboard, Vocabulary Retention, Educational Technology Integration

### Introduction

With China's increasing global influence, the demand for Chinese as a Foreign Language (CFL) instruction has grown significantly. More than 3,000 institutions in 109 countries currently offer Chinese language courses, making Chinese one of the most sought-after foreign languages (Yuxiu Chen, 2024). In Thailand, interest in learning Chinese has continued to rise, yet challenges in CFL instruction remain,

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particularly in vocabulary acquisition, which is fundamental to language comprehension and communication. Despite its importance, traditional vocabulary teaching methods often rely on rote memorization and passive learning, which limits student engagement and retention. Many learners struggle with long-term vocabulary retention, lack of classroom interaction, and difficulty in applying learned words in real-world contexts (Samar Nourhane, SAADI, & Maria, HA MOUDA, 2023). To address these challenges, game-based learning (GBL) has emerged as a promising instructional approach. By integrating interactive and competitive elements, GBL enhances motivation, engagement, and retention, ultimately improving language acquisition outcomes (K.C. Yu, H.S. Hsiao, & F.H. Tsai, 2006; Dixon et al., 2022). The Seewo Interactive Whiteboard is an advanced digital tool that facilitates real-time interactivity, multimedia integration, and immediate feedback (Yifang Huang, 2024; Zhanni Luo & Xiaoyong Tan, 2023). Its gamified features, such as digital flashcards, interactive quizzes, and scenario-based exercises, provide a more engaging and effective learning experience compared to traditional teaching methods. While previous studies have explored the benefits of GBL in general, limited research has examined its impact on CFL vocabulary retention, particularly when using interactive whiteboard technology. This study aimed to bridge this gap by providing experimental evidence on how Seewo-based GBL enhances vocabulary acquisition and student motivation in CFL instruction.

This research sought to transform the conventional Chinese learning environment by leveraging technology to enhance vocabulary retention and motivation among CFL learners. The introduction of the Seewo Whiteboard created a more engaging and dynamic learning environment by utilizing advanced educational technology tools. Through GBL, students improved their vocabulary usage abilities and communication skills in a gamified environment. This approach not only supported the development of Chinese proficiency but also boosted student engagement and motivation, ultimately leading to more effective vocabulary retention and overall learning outcomes.

## ■ Significance and Purposes

- 1) Implement game-based learning (GBL) strategies in Chinese vocabulary instruction to enhance students' language application skills.
- 2) Compare learning outcomes between students using GBL-based instruction and those using traditional methods, measuring vocabulary retention before and after the intervention.
- 3) Assess students' satisfaction and attitudes toward Seewo Whiteboard-based GBL, evaluating its effectiveness in CFL instruction.
- 4) Analyze the interaction effects between time (pre/post) and group (experimental/control) using Repeated Measures ANOVA to evaluate vocabulary retention improvements over time.

## ■ Literature Reviews

This research was based on game-based learning (GBL) theory and synthesized findings from multiple studies, demonstrating the effectiveness of Seewo-based GBL in enhancing students' language application skills and improving vocabulary retention.

### *Game-Based Learning (GBL) in Language Education*

Game-based learning (GBL) has gained increasing attention in educational research, particularly in language learning, due to its potential to enhance engagement, motivation, and retention. GBL integrates game elements such as challenges, rewards, and interactivity into the learning process, creating an immersive and participatory experience that fosters active learning. Several studies have demonstrated the effectiveness of GBL in language acquisition. Trybus (2015) defines GBL as integrating gaming principles into real-life educational settings to increase learner engagement. K.C. Yu, H.S. Hsiao, and F.H. Tsai (2006) highlight that GBL improves learning outcomes, enhances memory retention, and fosters a proactive attitude toward learning. Similarly, Ma Zhaodi (2024) suggests that GBL allows students to acquire knowledge through interactive experiences rather than passive memorization. These findings align with constructivist learning theories, emphasizing active engagement's role in effective learning.

Despite these advantages, most existing studies focus on short-term engagement and motivation, leaving a gap in understanding how GBL strategies impact long-term learning outcomes. While GBL has been widely adopted in various educational contexts, research exploring its impact on vocabulary retention over extended periods remains limited. This study seeks to contribute to this area by evaluating the sustained effects of GBL on language acquisition.

In addition to the general benefits of GBL, some researchers have examined how gender may influence students' attitudes and engagement with educational technologies. While studies such as Raman et al. (2014) and Lester et al. (2014) report no statistically significant gender differences in responses to game-based platforms, other research suggests that male and female learners may exhibit differing preferences or comfort levels in digital learning environments. These mixed findings underscore the importance of examining gender-related factors in the implementation of technology-enhanced instruction. Consequently, this study includes an analysis of gender differences in student attitudes toward GBL in CFL classrooms, aiming to foster a more inclusive understanding of how gamified strategies can support diverse learner needs.

### *GBL in Teaching Chinese as a Foreign Language (CFL)*

GBL has been increasingly applied in Chinese as a Foreign Language (CFL) instruction, particularly in enhancing listening, speaking, and vocabulary skills. Research by Kun-Hsien Li and Tsai-Feng Cheng (2012) confirmed that GBL fosters a more positive learning attitude in CFL learners, making them more engaged and willing to practice language skills. Similarly, Zhang Lu and Fang Lu (2024) found that gamified virtual environments significantly improved Chinese learners' discourse comprehension and cognitive processing.

Yang Miao (2020) also highlights that GBL can address CFL learners' challenges by creating an interactive and engaging classroom environment. Using digital tools, such as gamified quizzes and real-time feedback mechanisms, enhances vocabulary acquisition, sentence structure comprehension, and overall learning effectiveness.

While these studies confirm that GBL enhances student engagement and comprehension in CFL learning, further research is needed to examine its specific effects on vocabulary retention—an area this study aims to address. In particular, integrating technology-based GBL tools such as interactive whiteboards may present new opportunities for optimizing CFL instruction.

### ***Seewo Interactive Whiteboard in Language Learning***

The Seewo Interactive Whiteboard is an interactive multimedia teaching platform that enhances classroom interactivity. It provides digital tools such as real-time handwriting recognition, Pinyin input, vocabulary-building exercises, and multimedia resources, making it a promising tool for language education. Han Dong (2023) found that Seewo Whiteboard promotes student engagement and facilitates an interactive classroom environment. Similarly, Al-Kahlan and Khasawneh (2023) emphasize that Seewo's ability to integrate multimedia resources, including videos, images, and gamified activities, caters to diverse learning styles and improves instructional efficiency.

In the context of CFL instruction, the Seewo Whiteboard can enhance vocabulary retention by enabling students to interact with digital flashcards, pronunciation guides, and interactive language exercises. However, research on Seewo Whiteboard's direct impact on vocabulary learning and student motivation in CFL classrooms remains scarce. This study seeks to fill this gap by evaluating the effectiveness of Seewo-based GBL in vocabulary instruction.

### ***Research Gap and Study Contribution***

Despite the growing body of research on GBL in language learning, there remains a lack of empirical studies on its impact on CFL vocabulary retention, particularly when integrated with interactive whiteboard technology. This study investigates the effectiveness of GBL in CFL vocabulary retention, focusing on the Seewo Whiteboard and examining student engagement, motivation, and learning outcomes.

## **■ Methods**

This research evaluated the effectiveness of game-based learning (GBL) using the Seewo Interactive Whiteboard in Chinese vocabulary instruction to enhancing students' language application skills and academic performance. It examined the disparities between using a traditional approach and a new approach using Seewo, including considering the impact toward different genders. The following section will provide a thorough explanation of the experiment.

### Participants

This study was conducted with 65 second-year students from Bancherngdoi School, all of whom were enrolled in a Chinese as a Foreign Language (CFL) program. To ensure unbiased results, students were randomly assigned to either the experimental group (n = 30) or the control group (n = 35). The experimental group received game-based learning (GBL) instruction using the Seewo Interactive Whiteboard, while the control group was taught using traditional vocabulary instruction methods.

### Experimental Procedures

This study employed a quasi-experimental design with a pre-test and post-test approach to investigate the new learning approach to promote student learning achievement and Chinese application skills. Before the intervention, both groups completed a 35-minute pre-test to assess their baseline vocabulary proficiency. The intervention lasted for three sessions (40 minutes each), where both groups were taught the same vocabulary content but with different instructional approaches. The control group followed a lecture-based method, while the experimental group engaged in interactive game-based learning activities using the Seewo Whiteboard. After completing the instructional sessions, both groups took an identical 35-minute post-test to measure learning gains. Additionally, students in the experimental group completed a 20-minute questionnaire to assess their engagement, motivation, and satisfaction with the GBL approach. A summary of the research design is shown in Figure 1.

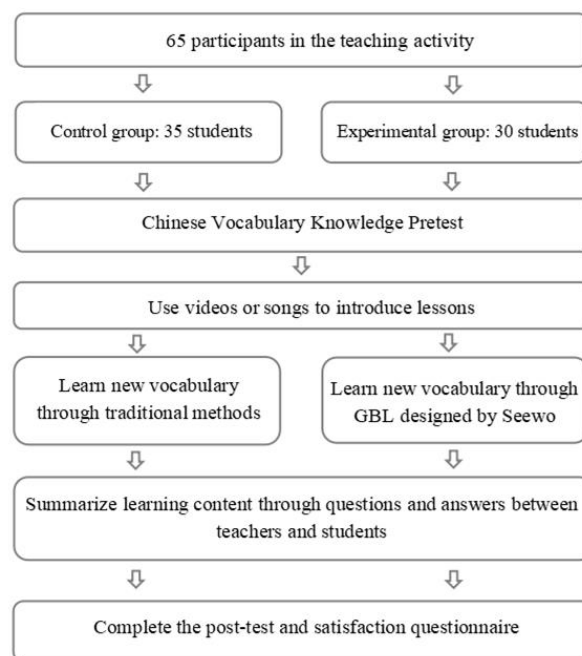


Figure 1. Experimental Procedures

### Instruments and Data Collection

To meet the research objectives and design, the research instruments for this study were utilized as follows:

#### Pre-test and post-test

The pre-test and post-test were designed to assess students' vocabulary knowledge, retention, and application skills before and after the intervention. Each test consisted of 20 questions, including multiple-choice, true/false, and reading comprehension items, with a maximum score of 40 points. Both tests were identical to ensure comparability, and their reliability (Cronbach's Alpha = 0.75) and validity (IOC = 0.775) confirmed their effectiveness as assessment tools. The pre-test was administered before instruction to evaluate baseline proficiency, while the post-test, taken after the intervention, measured learning gains. The score differences between the pre-test and post-test were analyzed using paired t-tests within each group and independent t-tests to compare performance between the experimental and control groups.

### ***Questionnaire on Student Attitudes***

A 12-item questionnaire, adapted from Kit Chu (2010), was used to evaluate students' engagement, motivation, and satisfaction with the Seewo Whiteboard-based game-based learning (GBL) instruction. The questionnaire employed a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) and covered three dimensions: teaching activities, instructor effectiveness, and teaching content. To ensure validity and reliability, the questionnaire was reviewed by three experts, achieving an Item-Objective Congruence (IOC) score of 0.806, indicating strong alignment with the study's objectives. Students in the experimental group completed the questionnaire after the post-test, and responses were analyzed using a one-sample t-test to determine overall attitudes toward the GBL approach.

### ***Teaching Materials and Activities***

The instructional content was based on the first lesson of HSK Level 3, titled "What are your plans for the weekend?", and was designed to progressively enhance vocabulary retention and application. The lesson was structured into four stages: (1) Vocabulary Introduction, where students used digital flashcards displaying pronunciation, usage, and example sentences; (2) Text Learning, focusing on sentence construction and contextual application; (3) Supplementary Content, which introduced additional words related to leisure and entertainment; and (4) Review & Reinforcement, incorporating interactive Seewo Whiteboard-based activities such as matching games, pronunciation exercises, and real-time quizzes to strengthen retention. The experimental group engaged with these gamified activities, while the control group followed a traditional lecture-based approach. A detailed breakdown of the teaching content and activities is shown in Table 1.

Table 1.

The teaching process and content

Teaching Section	Course Contents	Content Display
Vocabulary	The vocabulary section teaches using vocabulary cards. Each card presents the word's writing, pronunciation, meaning, example sentences, and synonym replacements.	
Text	The text focuses on the theme “What are your plans for the weekend?”, which students will learn how to express their plans and arrangements in Chinese	
Supplementary Content	In the supplementary section, additional words related to entertainment and leisure activities have been included.	
Review	<p>The review is conducted in a gamified format, enabling students to reinforce their learning in a relaxed and enjoyable environment, thereby improving memory retention.</p> <p>For instance, in a two-player game of Monopoly, the incorporation of competitive mechanisms and random vocabulary challenges fosters an active recall process characterized by "memory - retrieval - review" within a dynamic and engaging game environment. Similarly, in a sentence formation game, the establishment of a points system motivates students to actively participate and respond accurately. This approach transforms traditional vocabulary memorization methods, allowing for a deeper understanding of words in context.</p>	

### *Analysis of Data*

This research utilized Excel to compile statistical data on academic performance before and after intervention, as well as students' satisfaction toward vocabulary learning using Seewo. Subsequently, the data was analyzed using the SPSS program. To compare academic achievement between the pre-test and post-test in both groups, the mean and standard deviation (S.D.) were calculated, with t-tests and repeated measures ANOVA used for statistical analysis.

## ■ Results and Discussion

### *Results*

#### *Pre-Test and Post-Test Comparisons Between Experimental and Control Groups*

The study assessed students' vocabulary acquisition using a pre-test and post-test design, comparing learning outcomes between the experimental group (GBL using Seewo Whiteboard) and the control group (traditional instruction). Before the intervention, both groups demonstrated similar baseline proficiency, with pre-test mean scores of 15.28 (SD = 3.8) in the control group and 14.26 (SD = 3.47) in the experimental group, indicating no significant initial difference.

Following the intervention, the post-test results revealed significant improvements in both groups, but the experimental group showed a greater increase in vocabulary retention. The control group's post-test mean score increased to 18.66 (SD = 3.05), reflecting a 22.1% improvement, while the experimental group's post-test mean score rose to 21.29 (SD = 3.10), marking a 49.3% improvement. Paired t-tests confirmed statistically significant learning gains within each group (Control:  $t = -3.968$ ,  $p < 0.001$ ; Experimental:  $t = -9.005$ ,  $p < 0.001$ ), demonstrating that both instructional methods contributed to learning but to differing extents, as shown in Table 2 and Table 3.

*Table 2.*

*Pre-test and post-test in the control group*

Test	Mean	S.D.	Mean difference	t	p
Pre-test	15.28	3.8	-3.38	-3.968	< 0.001
Post-test	18.66	3.05			

*Table 3.*

*Pre-test and post-test in the experimental group*



Test	Mean	S.D.	Mean difference	t	p
Pre-test	14.26	3.47	-7.03	-9.005	< 0.001
Post-test	21.29	3.10			

A between-group comparison using an independent t-test and Two-Way repeated measures ANOVA further confirmed the superior effectiveness of the Seewo Whiteboard-based GBL approach. The results displayed in Table 4 and Table 5 indicate that the post-test scores are statistically significant between different learning approaches ( $F = 56.697$ ,  $p = 0.0001$ ;  $t = -3.71$ ,  $p = 0.001$ ). However, the experimental group achieved significantly higher scores, with difference between two groups was 2.61 points. It also showed that a significant interaction effect between time and group factors ( $F = 6.743$ ,  $p = 0.011$ ). These findings demonstrated a significant association between the implementation of distinct learning strategies and measurable improvements in academic performance outcomes, suggesting that strategic pedagogical interventions systematically influence educational achievement. As a result, it could be proved that the integration of interactive and game-based learning strategies in vocabulary instruction provides a more engaging and effective learning experience compared to traditional methods.

Table 4.

*Post-test between experimental group and control group*

Group	Mean	S.D.	Mean difference	t	p
Control group	18.66	3.1	-2.61	-3.71	0.001
Experimental group	21.29	3.1			

Table 5.

*Two-Way Repeated Measures ANOVA between Groups and Time*

Item	MS	F	P	$\eta^2$
Time (Pre-test&Post-test)	633.320	56.697	0.0001	0.371
Group	48.586	4.350	0.040	0.043
Time * Group	75.320	6.743	0.011	0.066

### ***Analysis of Students' Overall Attitudes Toward Seewo-Based GBL***

Student attitudes toward GBL using the Seewo Whiteboard were highly positive. A one-sample t-test and percentage analysis of the student attitude questionnaire indicated that the majority of students found the interactive and game-based learning approach engaging and effective for vocabulary acquisition. Among the three dimensions assessed—teaching activities, instructor effectiveness, and teaching content—students expressed the highest satisfaction with the

teaching content, suggesting that the integration of game-based elements contributed to their motivation and interest in learning Chinese vocabulary (Table 6, Figure 2).

Table 6.

*Students' overall attitude*

Dimension		Mean	S.D.	t	p
1. Teaching Activities	1.1 Games designed by Seewo are fun and easy to understand.	4.742	0.514	51.335	<0.0001
	1.2 The number of games used in teaching is appropriate.	4.387	0.667	36.61	<0.0001
	1.3 Games designed by Seewo are help for learning Chinese.	4.355	0.486	49.852	<0.0001
	1.4 Games' formats are suitable for Chinese learning and playing atmosphere.	4.258	0.773	30.662	<0.0001
2. Instructors	2.1 Teacher has knowledge of Chinese.	4.323	0.748	32.186	<0.0001
	2.2 Teachers help stimulate active learning.	4.355	0.661	36.697	<0.0001
	2.3 Teachers use technology and encourage learning.	4.742	0.514	51.335	<0.0001
3. Teaching Content	3.1 The content of games is suitable for Chinese vocabulary learning.	4.871	0.499	54.299	<0.0001
	3.2 The sequence of the game is attractive.	4.452	0.675	36.708	<0.0001
	3.3 Game-based learning can help develop Chinese language skills.	4.419	0.564	43.615	<0.0001

*Note: The t-values were obtained using one-sample t-test.*

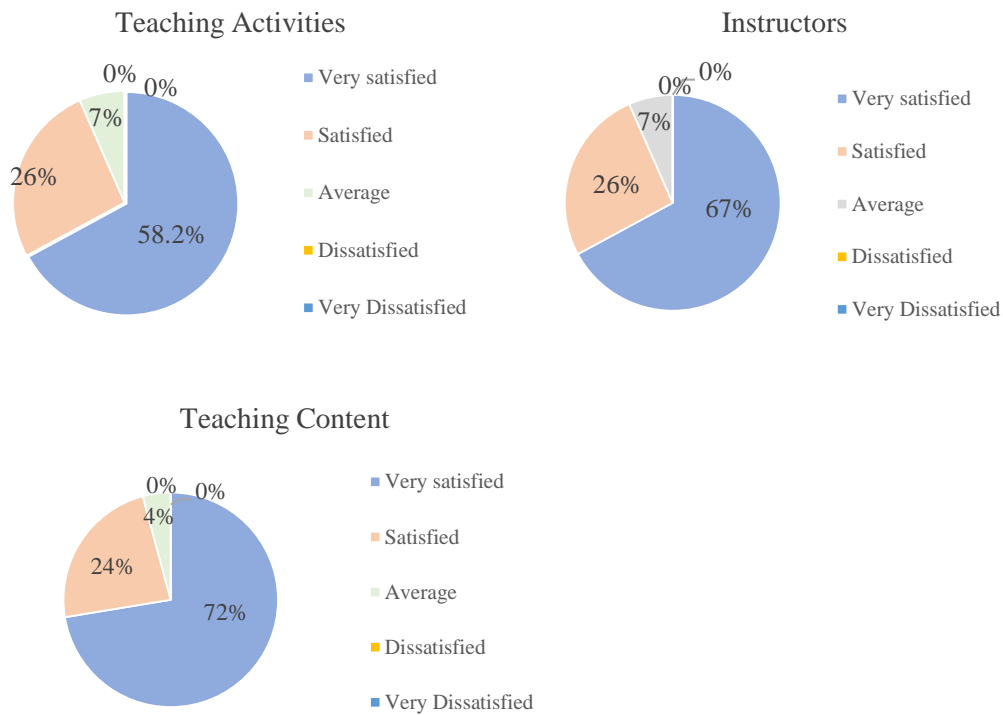


Figure 2. Proportion of each dimension

**Gender Differences in Attitudes toward Seewo-Based GBL**

A t-test and chi-square analysis were conducted to examine potential gender-based differences in students' perceptions of GBL instruction. Although the mean satisfaction score for male students (M = 4.59, SD = 0.31) was slightly higher than that of female students (M = 4.48, SD = 0.32), the difference was not statistically significant (t = -2.419, p = 0.146 > 0.05). These findings suggest that Seewo-based GBL was equally effective in engaging both male and female students, reinforcing its applicability across diverse learner demographics (Table 7).

Table 7.

*Gender Differences in Attitudes*

Gender	Mean	S.D.	Mean difference	t	p	$\chi^2$
Girls	4.48	0.32	-0.11	-2.419	0.146	58.319
Boys	4.59	0.31				

**Discussion**

This study proved that game-based learning (GBL) with the Seewo Interactive Whiteboard enhanced CFL learners' Chinese vocabulary acquisition and retention. The experimental group, which received GBL-based instruction, exhibited a 49.3% improvement in post-test scores, compared to a 22.1% increase in the control group. This result underscores the effectiveness of GBL in reinforcing vocabulary retention, consistent with prior research that highlights the role of interactive and gamified elements in language

learning (Zhang Lu & Fang Lu, 2024). A between-group comparison further confirmed that students in the GBL group outperformed their peers in the traditional instruction setting, demonstrating statistically significant gains in learning outcomes ( $p = 0.001$ ). These findings aligned with previous studies indicating that interactive digital tools facilitated engagement, motivation, and active learning, which all contributed to improved vocabulary acquisition (Li et al., 2012; Han Dong, 2023). The integration of real-time feedback, multimedia resources, and interactive exercises provided by the Seewo Whiteboard likely contributed to the increased effectiveness of this approach.

In addition to academic performance, students expressed overwhelmingly positive attitudes toward GBL. Questionnaire results indicated high satisfaction with teaching content, interactivity, and engagement. These responses reinforce the notion that game-based instructional methods enhance student motivation and participation in the learning process (Yang Miao, 2020). The gender-based analysis revealed no significant differences in learning effectiveness between male and female students, suggesting that Seewo-based GBL broadly applies across different learner demographics. This finding was consistent with previous studies that explored the impact of gender differences on attitudes in the context of Game-Based Learning (GBL) and Chinese as a Foreign Language (CFL) instruction. For instance, Raman et al. (2014) discovered that gender does not significantly influence Performance Expectancy (PE), Effort Expectancy (EE), or Social Influence (SI) regarding Behavioral Intention (BI) in their investigation of 65 postgraduate students in Malaysia using Moodle. Similarly, Zhang Lu et al. (2024) conducted an experiment with 65 Chinese learners and found that gamified virtual scenarios significantly enhanced vocabulary retention and discourse comprehension for both male and female participants, with no statistically significant gender differences observed. Additionally, studies by Dorji et al. (2015) and Lester et al. (2014) also found no significant gender differences in learning achievement of GBL. Based on these findings, educators should have integrated interactive digital tools like the Seewo Whiteboard to enhance engagement and effectiveness in language learning environments. The ability to provide immediate feedback, gamified reinforcement, and adaptive learning opportunities makes GBL a promising strategy for CFL instruction. However, while the short-term benefits of this approach are evident, further research is necessary to explore its long-term impact on language proficiency and retention.

## ■ Conclusion

This study demonstrates the effectiveness of integrating game-based learning (GBL) tools, specifically the Seewo Interactive Whiteboard, into Chinese as a Foreign Language (CFL) instruction. The results indicate that GBL significantly improves vocabulary retention, engagement, and learning motivation compared to traditional teaching methods. The experimental group achieved a 49.3% increase in post-test scores, substantially outperforming the control group. Furthermore, student feedback highlighted the benefits of interactivity, real-time engagement, and digital reinforcement in facilitating language acquisition. These results add to the expanding research supporting technology-enhanced learning environments. GBL-based instruction provides a more immersive and student-centered learning experience when integrated

with interactive whiteboard technology. As modern educational approaches continue to evolve, implementing digital tools in CFL instruction can enhance language learning outcomes and foster greater student participation. To maximize the benefits of this approach, educators should focus on developing well-structured, game-based activities that align with curriculum objectives. Additionally, institutions should invest in teacher training programs to ensure the effective integration of interactive technologies in classrooms. Future research should explore the long-term impact of GBL on language proficiency and examine its applicability across different learning levels and contexts.

## ■ Limitations and Recommendations

### *Limitations*

While this study provides valuable insights into the role of GBL in CFL instruction, several limitations should be acknowledged. First, this study focused on short-term learning outcomes, making it difficult to assess long-term retention. Language acquisition is a continuous process, and further investigation is needed to determine the sustained effects of GBL on vocabulary retention and overall language proficiency. Second, the study's sample consisted of a specific age group of CFL learners, limiting its generalizability to other populations. The findings may not necessarily apply to intermediate or advanced learners requiring different instructional strategies. Additionally, as all participants were from the same institution, contextual factors such as institutional support and technological infrastructure may have influenced the results. Third, the study did not compare Seewo-based GBL with other digital learning tools like Kahoot or WordWall. A broader comparison could provide insights into whether the Seewo Whiteboard offers unique advantages or whether combining different tools yields more effective learning outcomes.

### *Recommendations*

To address these limitations, future research should consider extending the study duration to evaluate the long-term impact of GBL on vocabulary retention and language proficiency. Longitudinal studies tracking students' progress over several months or years would offer deeper insights into the sustained benefits of interactive learning approaches. Broadening the research scope to include various age groups and proficiency levels would enhance the generalizability of the findings. Future studies should also explore how GBL can be adapted to suit learners with varying prior knowledge and language exposure levels. Furthermore, comparative studies should be conducted to assess the effectiveness of Seewo Whiteboard relative to other gamified learning platforms. Investigating whether integrating multiple tools enhances learning outcomes would provide educators and curriculum designers valuable guidance. Incorporating qualitative methods such as student interviews and classroom observations could also offer richer insights into learners' experiences and engagement with GBL-based instruction. By addressing these areas, future research can further refine the implementation of game-based learning strategies, optimizing their effectiveness in CFL instruction and beyond.

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