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THE EFFECTS OF INTERACTIVE RESPONSE SYSTEMS ON UNIVERSITY STUDENTS' CHINESE LANGUAGE SKILLS: A CASE OF PEAR DECK

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ABSTRACT

This study investigates the effectiveness of the Interactive Response System (IRS), Pear Deck, in improving Chinese reading and writing skills among university students in Thailand. Using an experimental design, 109 first-year General Education students were divided into experimental and control groups. The experimental group used Pear Deck for interactive lessons, while the control group followed traditional teaching methods. Pre- and posttests revealed significant skill improvements in the experimental group, supported by statistical analysis. Students rated Pear Deck highly for enhancing engagement and learning, with no significant gender differences in satisfaction. Feedback highlighted the benefits of real-time feedback and collaborative activities, though challenges like response pressure and technical limitations were noted. These findings demonstrate Pear Deck's potential as a tool for enhancing language skills in higher education, while underscoring the importance of culturally relevant content and addressing platform challenges. Future research should focus on long-term impacts and broader applications.

KEYWORDS: Chinese Language, Pear Deck, Second Teaching Machine, Thai University Students.

1. INTRODUCTION

Chinese has increasingly become a globally significant language, attracting learners from numerous countries due to China's economic power as one of the world's leading economies (Mok, 2019). Learning Chinese opens up opportunities in business and key industries such as technology and exports (Chesbrough & Heaton, 2020). Furthermore, the Chinese government has actively promoted Chinese language education worldwide through initiatives like the Confucius Institutes (Hanban, 2018). Learning Chinese provides access to educational opportunities at top universities in China and enhances knowledge of technology and innovation (Mei, 2020). Additionally, it fosters an understanding of China's rich cultural heritage, attracting global tourists and enthusiasts (Hanban, 2018).

In 2004, the Chinese Ministry of Education established the Confucius Institute Headquarters (Hanban), an international organization dedicated to advancing the Chinese language and culture (Hanban, 2004). Hanban has established 492 Confucius Institutes and 819 Confucius Classrooms across 160 countries, engaging over 1.5 million students (Hanban, 2022). In 2024, the total number of learners in Confucius Institutes and Confucius Classrooms worldwide reached 2.32 million, and the audience for various cultural activities amounted to 12.72 million people. However, the field of teaching and learning Chinese as a foreign language remains underexplored, especially when it comes to the management and implementation of instructional activities.

Even though Chinese is becoming more popular worldwide, language learners face challenges that can be viewed from a variety of perspectives, including Chinese culture, which may be unfamiliar in some areas, language structure, vocabulary, Chinese characters or Hanzi, and tones, among others (Xu, 2022; Chen et al., 2024; Huang, Grant, & Yan. 2024). These difficulties pose challenges for Chinese language instructors, including how to build knowledge and enhance language abilities while encouraging students to better understand language and its context of use.

This study significantly contributes to current knowledge by addressing an underexplored context Thai students learning Chinese as a foreign language using an IRS-based tool (Pear Deck). Unlike previous studies focusing mostly on English or general content, our research examines the effects of Pear Deck on beginner-level Chinese listening and speaking skills. The instructional design is contextually adapted to Thai learners, based on TQF and HSK frameworks, and applied in a tightly controlled experimental setting. This localized and skills-specific application of IRS in a logographic language context adds a novel and valuable dimension to existing literature.

Therefore, this work seeks to offer knowledge to Chinese language instruction by suggesting that employing the Interactive Response System (IRS) to stimulate students' learning progress will result in more efficient approaches to improving students' capacities. This approach differs from traditional approaches and gives more satisfactory results for learning progress (Wang et al., 2022; Miles et al., 2023; Alviar & Gamorez, 2024). This study selected Pear Deck, one of the most effective IRS tools, because it is simple to use and does not require a paid subscription (Hashim, 2021; Haryani & Ayuningtyas, 2021; Randall et al. 2023). Nevertheless, paid subscriptions offer unique features that can significantly help with efficient teaching (Anggoroa, 2021; Anggoroa & Pratiwi 2023). Finally, the issue of gender is introduced to help learners better grasp the differences and complexities that influence their capacity to learn and enhance language skills.

This study employs a Pear Deck technique, taking into account perspectives on the roles of technology, IRS, cultural and gender views in order to fill Chinese learning gaps. The primary goals are to determine the impact of Pear Deck on university students' Chinese language skills, to evaluate student engagement and participation with Pear Deck, and to examine Pear Deck's effectiveness in improving specific language skills. Ultimately, this study will provide a better knowledge of how Pear Deck, an IRS tool, might be used in Chinese language classes.

Even though Pear Deck has been studied in language teaching contexts in several countries, including Thailand, the focus has primarily been on its use in English as a Foreign Language (EFL) classrooms (Rosyidah et al., 2024; Anggoroa, 2021; Anggoroa & Pratiwi 2023, online education (Jaga, 2022; Anggoro et al., 2023), students' emotional engagement (Margaretta et al., 2024), and self-regulated learning (Anggoro, 2025). There is a gap in the literature regarding the platform's application in tonal, character-based languages like Chinese, especially in relation to productive and receptive literacy skills. This focus on both script recognition (reading) and character production (writing) within a technologically enhanced learning environment distinguishes this study from prior IRS-based interventions. Furthermore, this study was conducted in the context of higher education. **The research questions of this study are as follows:**

1. What are the effects of using Pear Deck technology on students' Chinese reading and writing achievement in a Daily Life Chinese course?
2. What is the level of students' satisfaction with Pear Deck technology in a Daily Life Chinese course?

2. LITERATURE REVIEW

2.1. Interactive Response System (IRS) in Education

Contrary to traditional teaching approaches, the Interactive Response System (IRS) offers an effective way to boost student engagement, enabling them to ask questions and receive prompt feedback from teachers (Wang et al., 2022). The technology also improves learning competencies. Students who studied with the IRS reported significantly higher satisfaction with the lessons compared to those who studied without the IRS (Getenet & Tualaulelei, 2023; Miles et al., 2023; Doğru et al., 2023; Alviar & Gamorez, 2024).

Past studies have examined IRS tools such as Clickers to understand further how IRS encourage student-teacher engagement, particularly in a large classroom where a single instructor cannot efficiently oversee student-team activity (Bauer, 2020; Shea et al. 2020; Yürüm et al. 2023; Marty et al. 2022; Chen & Chen 2022). For example, Ciriglianoa et al. (2020) and Shea et al. (2020) suggested that understanding how clicker frequency affects student success will allow teachers to better use this technology. Furthermore, evaluating students' click-level behavior will reveal a correlation with a test measure, which might be used to guide instructional design in future classes. Several studies also investigate Kahoot, Quizizz™, Duolingo, and game-based learning (Li & Bonk, 2023; Pascu 2024; Fernando & Premadasa 2024). For example, (Hu, 2023) suggests integrating Kahoot! into the course appears to improve students' test performance. At the same time, teachers maintain positive perceptions of using the tool in terms of its learning effect, expected outcome, and engagement. According to the research findings mentioned above, the IRS improves students' learning styles, and it can help teachers develop and increase student involvement in the

2.2. Impact of Technology on Language Learning Outcomes

Since the Pandemic era, there has been an increase in the use of technology in language learning practices (Shadiev et al., 2024; Barrett et al. 2020; Bahari and Li 2024). This phenomenon necessitates a move from a teacher-led to a teacher-curated environment, in which learners will be provided with a variety of materials tailored to their requirements at their current level of autonomy (Stockwell & Wang, 2024). Moreover, as artificial intelligence (AI) advances, educators increasingly use AI in classrooms, such as Chatbot and ChatGPT, and other automatic speech recognition-based language learning systems with satisfying results (Mei et al. 2022; Kohnke, 2023; Kohnke et al., 2023; Polakova & Klimova, 2024; Bashori et al. 2024; Chen et al. 2024). The incorporation of generative AI tools into language learning has the potential to significantly accelerate the transition from outcome-oriented to process-outcome-balanced educational practice. These AI tools can help teachers enrich course content, design hands-on tasks, provide prompt feedback, and analyze student learning data (Chiang et al., 2024).

However, it should not be used without caution. It is vital to be aware of AI's inaccuracy and inconsistency. Also, there is a need to draw up guidelines for using AI and thoroughly consider how to best prepare students for a world where AI-driven digital tools are used in daily life practices (Mei et al., 2022; Kohnke et al., 2023; Hasumi and Chiu, 2024; Kohnke et al., 2024).

2.3. Pear Deck in Language Learning

Pear Deck, an add-on for PowerPoint or Google Slides, has increased in popularity among interactive educational programs. Several research found that the application boosted students' focus on meaningful learning, helped them absorb the subject better, and made them feel like they had transitioned from passive to active learners. Pear Deck also allowed teachers to monitor students' development using a variety of formative assessment options (Hashim, 2021; Haryani & Ayuningtyas, 2021; Randall et al. 2023).

(Anggoroa2021; Anggoroa & Pratiwi, 2023) conducted research on the unique features of Pear Deck, which resulted in significant benefits for instructors. The first feature is the teacher dashboard, which provides real-time monitoring of students' responses along with their names to a prescribed template. This function enables the sending of instant feedback to specific individuals. The second feature is the 'show response'. This allows students to learn from their peers' accomplishments and failures while remaining anonymous. The third feature is the session review, which gives the teacher access to a detailed report of each student's responses. Another component is a spreadsheet with responses. This

provides the students' responses in a concise format. The full individual report and the spreadsheet can provide further comments or lessons to the entire class or individual students.

Nevertheless, one of the issues is that the free version of Pear Deck does not provide the teacher dashboard, session review, and students' reports and spreadsheets, which are critical features of the application (Anggoroa & Pratiwi, 2023; Oded and Oded 2022). Therefore, this limitation needs to be considered for future use of Pear Deck.

2.4. Gender Differences in Technology Use and Perception

In comparison to other areas of educational study, there is limited literature on gender discrepancies in technological use. A number of studies found no difference in language learning and the use of technology between male and female students (Yu, 2020; Agudo, 2022). However, other research has found that gendered beliefs influence students in learning practices. For example, males' semantic space is based on trustworthiness, openness to communication, new information and activity, whereas females' is based on evaluation, diligence, and interpersonal contact. Furthermore, females exhibited a more optimistic attitude and a growth mentality when it came to foreign language acquisition (Rafikova & Voronin, 2024). In some cases, extreme anxiety can cause male students to struggle in foreign language classrooms, with substantial effects for their linguistic and productive performance (Kök & Kantar , 2024).

Aside from research on male and female student differences in the classroom, various studies indicate that teachers can have gender-related effects on male and female students, such as differentiated feedback practices (Tarrayo 2020; Guo 2021). These studies demonstrate the complexities and influences of gender differences on learning. As a result, adopting contextualized and gender-themed teaching resources, as well as promoting class interactions and activities, promotes gender inclusion in the classroom.

2.5. Effectiveness of IRSs in Improving Language Skills

In the field of language learning, interactive learning can produce better learning outcomes than traditional schooling (Mahdi, 2022; Youn, 2023; Sénécal et al. 2024). Mahdi (2022) stated that non-native students learn the language more quickly through interactive lessons because today's learners are tech-savvy, which can simplify the facilitators' role in imparting knowledge. Alharthi (2024) also looked into how Siri, a voice assistant technology, may be combined with in-class instruction to help language learners improve their pronunciation. As a result, Siri may provide students with more effective learning outcomes than traditional in-class instruction.

There has been special research on employing IRS in Chinese classrooms, such as games and WeChat to boost learning performance when studying Chinese characters and lexical material (Zhou & Wang, 2024.) These include using game-based learning to improve student attention and engagement. Various gaming techniques greatly increase children's attention and self-efficacy. Furthermore, the performance-contingent reward game greatly improved students' attention, but the completion-contingent reward game increased their emotions and confidence (Yua & Tsuei, 2022). These findings indicate that IRS has a significant impact on student attention and language learning.

2.6. Challenges in Learning Chinese

Although learning Chinese is becoming more popular around the world, there are some hurdles, such as the difficulty of the language, students' unfamiliarity with the Chinese language and culture, and boredom when objectives are not completed or attained. As a result, it is vital to support learners by integrating teachers' understanding with the usage of technology and AI (Wang et al., 2021; Hong et al., 2023; Chen et al. 2024). For example, Loh et al. (2021) proposed that educators might purposefully and gradually present different subtypes of orthographic norms to help students develop systematic orthographic knowledge. Additionally, character construction games may be a useful way for students to improve their orthographic expertise. Understanding character structures would help learners increase their positional regularity understanding when applying diverse components.

Contextualizing factors such as gender, specific language skills, and cultural perspectives might be an option. Class activities can draw on students' experiences with Chinese culture outside of the classroom, allowing them to connect and establish links between their language study at school and at home (Huang et al., 2024; Kennedy, 2020). Furthermore, given students' improved performance and attitudinal adjustments towards the Chinese language, particularly in regions where students are unfamiliar with Chinese culture (Xu, 2022).

2.7. IRS in Chinese Language Learning

The use of Interactive Response Systems (IRS) like Pear Deck, Kahoot, and Quizlet in Chinese language learning has gained significant attention for its ability to boost student engagement and enhance learning outcomes. IRS platforms transform traditional

classrooms by providing real-time interaction, personalized feedback, and dynamic learning environments, which help students overcome challenges such as mastering tones and character recognition. Studies by Anggoro and Pratiwi (2023) and Javed and Odhabi (2018) show that IRS tools promote active participation and increase motivation to continue learning. Additionally, IRS tools support writing and reading skills by offering real-time error correction and aiding in character recognition and vocabulary comprehension (Fan et al., 2024; Chen & Yuan, 2023). They also integrate cultural elements through multimedia, enriching the learning process with Chinese traditions, idioms, and festivals Jing, 2023. Furthermore, the real-time feedback and personalized approach offered by IRS tools enable teachers to track progress and adapt lessons to individual student needs, which enhances motivation and improves learning outcomes (Mache et al., 2017; Liu et al., 2019).

The "novelty effect" refers to a phenomenon where students achieve better outcomes or display greater enthusiasm simply because they are interacting with a new or unfamiliar technology, rather than due to the technology's inherent advantages. In education, students may initially perform better with tools like Pear Deck because (Häkkilä & Colley, 2018) the novelty captures their interest, not necessarily because it improves learning. (Parmaxi & Demetriou, 2020) Therefore, it is crucial to distinguish between the novelty effect and the actual long-term educational benefits when evaluating the influence of Pear Deck on students.

2.8. Novelty Effect and Hawthorne Effect

Pear Deck, an Interactive Response System (IRS), has recently been introduced in Chinese language instruction and has been reported to improve students' reading and writing skills. However, the potential impact of the novelty effect a temporary boost in engagement and motivation triggered by new technology should be carefully considered, as it may lead to an overestimation of the tool's effectiveness (Rodrigues et al., 2022; Lee et al., 2025).

Although Pear Deck is new in the context of Chinese learning, many students have prior experience with similar IRS tools like Kahoot! and Quizlet Live, which may reduce the novelty effect. Previous research (Shyr et al., 2021) has also shown that IRS platforms can provide lasting educational benefits. With thoughtful integration and proper evaluation, Pear Deck may serve as a sustainable instructional tool.

Interpreting the outcomes of educational technology interventions requires attention to potential confounding factors. For instance, participants' prior experience with similar interactive tools may influence their comfort and performance, making it difficult to attribute results solely to the intervention itself (Shih et al., 2004). Additionally, the Hawthorne effect where individuals improve their performance simply because they are aware of being observed may temporarily boost motivation and effort, thus distorting the actual impact of the tool (Adair et al., 1989; Chua et al., 2023).

These considerations highlight the importance of applying control measures and adopting longitudinal research designsin future studies to accurately assess the true effectiveness and lasting value of educational innovations.

3. METHOD

3.1. Research Objectives

3.1.1. Research Design and Participants

The research employed an experimental design with controlled conditions and systematic manipulation of variables to establish causality, using simple random sampling. Conducted in a university in Southern Thailand within a course titled Daily Life Chinese, the study followed the university's policy that allows students to enroll in Chinese language studies for one academic year, comprising three consecutive courses. A total of 109 students, aged 18 to 21 and representing various majors such as English, marketing, communication arts, medical technology, veterinary science, and pharmacy participated in the study.

A total of 109 students, accounting for approximately 45.87% of the total course enrollment, were selected using simple random sampling. Due to the instructor's workload and the university's scheduling constraints, only 50 of these students could be assigned to the experimental group. This group was divided into three subgroups and taught by a single instructor. The remaining 59 students were assigned to the control group, which was divided into two subgroups and taught by a different instructor. Thus, the sample consisted of 109 students in total 50 in the experimental group (3 subgroups, 1 teacher) and 59 in the control group (2 subgroups, different teacher).

First, we identified all first-year General Education (GE) students enrolled in the course and created a comprehensive list, ensuring each student had a unique identifier, like a student ID number. We decided on a sample size of 109 to balance statistical power and practical constraints. Using a random

number generator, we selected 109 unique identifiers from the list, giving each student an equal chance of being chosen. Most students have taken a Daily Life Chinese course focusing on writing and reading skill, without studying Chinese characters, and, having not engaged with the language for about a year. After selecting the sample, we approached the chosen students and obtained their consent before starting the experiment. These 109 students were then divided into two groups: an experimental group and a control group. The experimental group consisted of 50 students (Male: 6, Female: 44), while the control group comprised 59 students (Male: 8, Female: 51).

3.1.2. Data Collection Method

This section describes the data collection process in alignment with the research objectives. Before gathering data, the instruments were designed through several stages. For the test, the process began with an analysis of the course outline and learning objectives, which included expanding vocabulary by approximately 500 words, introducing learners to basic sentence structures, communication techniques, emotional expressions, and listening skills in Mandarin for everyday scenarios. The vocabulary and sentence structures covered were designed to help learners develop the ability to listen, speak, read, and write effectively. A test incorporating foundational dialogues and lesson content was developed and submitted for an Index of Consistency (IOC) evaluation.

For the questionnaire, the initial stage involved defining its purpose and objectives to ensure alignment with the study's goals. Key themes were identified to organize the questionnaire, prioritizing clarity and relevance. The finalized questionnaire was also submitted for IOC evaluation to confirm high content validity and a strong correlation between the questions and the research objectives.

Table 1: Intervention Steps and Pear Deck Integration.

Step	Details	Use of Pear Deck	Writing and Reading Skills in Chinese
1. Introduction and Objective Setting	- Explain the lesson objectives - Highlight the importance of the topic - Demonstrate basic usage of Pear Deck		Introduce the importance of **character recognition** (汉字认读) and **vocabulary writing** (词汇书写) as foundational Chinese language skills.
2. Warm-Up Activity	- Pose open-ended questions or surveys about the topic - Encourage participation from all students - Assess prior knowledge	Use interactive slides, such as open-ended questions or polls (Polls)	Conduct a quick check on **character recognition** (汉字认读) or prior knowledge of vocabulary through polls or surveys.
3. Core Content Delivery	- Explain key concepts or vocabulary - Check comprehension with interactive questions or activities - Use features to aid understanding	Utilize interactive features like draggable pins, multiple-choice questions, or matching activities	Focus on **sentence writing** (**句子**书写) by checking word order and conjunction use. Practice **vocabulary comprehension** (词汇理解) via matching exercises.
4. Guided Practice	- Assign activities like completing sentences or categorizing information - Address students' errors promptly	Use interactive slides for practice activities, and monitor responses through the teacher dashboard	Practice **vocabulary writing** (词汇书写) by completing sentences and categorizing characters or phrases.
5.Collaborative Learning	- Divide students into small groups for teamwork - Have students discuss questions or scenarios - Submit group answers through Pear Deck	Use students' response features and display results for class discussion	Collaboratively construct **grammatically correct sentences** (**句子**书写) or summarize key points of texts to enhance **reading comprehension** (阅读理解).
6. Assessment and Feedback	- Assess understanding with formative assessments - Provide feedback and correct errors collaboratively	Use your response Check features to evaluate and offer real-time feedback	Conduct formative assessments for **reading comprehension** (阅读理解) and provide immediate feedback on sentence structure or vocabulary use.
7. Reflection and Wrap-Up	- Have students reflect on their learning, such as what they learned or questions they still have - Summarize key points and link to future topics	Use Reflection slides to gather student insights and conclude the lesson	Reflect on improvement in **character recognition** (汉字认读) and **vocabulary comprehension** (词汇理解), and link to future lessons on writing tasks.

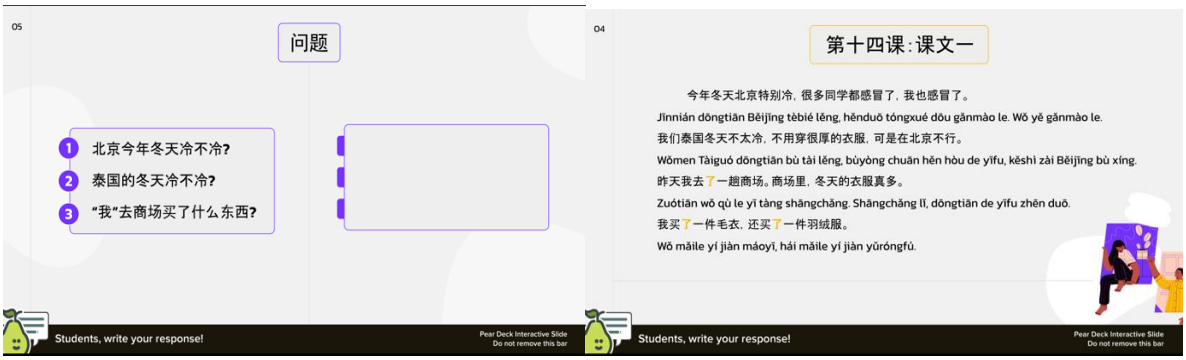

Figure 1: Comparison of Testing Slide, Learning Slide.

3.1.3. Data Analysis Method

For the first research question, the data were analyzed using both descriptive and inferential statistical approaches. A series of t-tests were performed to evaluate the app's effect on students' Chinese language acquisition. Specifically, paired t-tests were conducted to compare pre-test and post-test results within the experimental group, while independent t-tests were used to assess differences in outcomes between the control and experimental groups.

For the second research question, quantitative data from the closed-ended survey items were examined through descriptive statistics, such as averages (means) and standard deviations. Regarding the open-ended survey responses, content analysis was employed to systematically identify and categorize the key themes, trends, and ideas expressed in the students' feedback.

To ensure the reliability of the analysis, three researchers engaged in the coding process. Each researcher independently examined and coded the open-ended responses to establish initial themes and categories. The consistency of their coding was then assessed by comparing results among the researchers. Any inconsistencies were discussed and resolved collectively. Final themes were determined by integrating common ideas along with varying perspectives shared by participants, offering a holistic understanding of their experiences and views regarding the use of Pear Deck in the learning process.

3.2. Research Question 1

To address the first research question, "What are the effects of using Pear Deck technology on students' Chinese reading and writing achievement in a Daily Life Chinese course?", pre-assessments and post-assessments were administered to students using Pear Deck. Specialists in Chinese language pedagogy evaluated the test content, and an analysis of the items was conducted to ensure that the assessments were suitable for the participants' proficiency levels.

Both groups completed the same pre-assessment and post-assessment to evaluate vocabulary learning, comprehension, recall, and retention. Utilizing identical assessments ensures uniformity in gauging students' initial knowledge and subsequent progress (Moser, 2019). To prevent students from merely recalling answers, the vocabulary items were presented in a randomized sequence. Although the same vocabulary set was used, each student encountered the specific items in varying orders during the assessments. This randomization decreases the probability of students encountering the same word sequence, reducing repetition bias and providing a more precise measure of vocabulary learning and retention (Lim, 2019). Randomizing the vocabulary items helps safeguard the validity of the evaluation while accurately reflecting authentic learning advancements (Onghena, 2018).

Both groups utilized the application for testing to ensure uniformity in the testing conditions, which enables reliable comparisons between the groups. This strategy minimizes variability in instructions, format, and data collection, allowing the research to concentrate on the effects of Pear Deck features compared to non-pear deck features. It also streamlines data collection related to learning behaviors and reduces potential confusion and anxiety by using a familiar tool. A standardized and controlled environment is crucial for ensuring that both the experimental and control groups undergo the same conditions, thereby maintaining the experiment's integrity and reducing initial variability. This approach enables a more accurate evaluation of the intervention's impact (Moser, 2019). The pre-assessment was conducted in Weeks 1 and 2, while the post-assessment took place in Weeks 9 and 12, with both evaluations consisting of vocabulary-related questions.

Table 2: Comparison of Instructional Approaches: Experimental VS Control Group.

Aspect	**Experimental Group** (Pear Deck-based learning)	**Control Group** (Traditional learning)	Comparison
Learning Approach	Pear Deck Chinese writing and reading	Conventional methods (textbook, flashcards, etc.)	Both groups engage with the same vocabulary content but use different teaching tools.
Vocabulary Scope	Identical vocabulary list	Identical vocabulary list	Both groups cover the same number and scope of vocabulary words.
Instructional Time	Equal session durations	Equal session durations	Both groups receive the same amount of instructional time per session.
Evaluation Method	writing and reading quizzes and tests using the Pear Deck	Writing and reading quizzes/tests via Pear Deck	Both groups are evaluated using identical tools to measure vocabulary retention and understanding.
Instructor	Same teacher conducting lessons	Same teacher conducting lessons	A single instructor teaches both groups to ensure consistency in delivery and teaching style.
Classroom Environment	Equipped with speaker, projector, whiteboard, tables and chairs, air conditioning, and Wi-Fi	Equipped with speaker, projector, whiteboard, tables and chairs, air conditioning, and Wi-Fi	The only variation is the use of Pear Deck technology in the experimental group.
Student Profile	First-year GE students	First-year GE students	Both groups include students with comparable demographics (age, education level, etc.).
Technology Use	Pear Deck devices (tablets, smartphones) for interactive learning	Minimal or no technology	The experimental group incorporates Pear Deck tools, whereas the control group relies on traditional methods.

3.3. Research Question 2: Students' Satisfaction

Based on the data in the table, students' overall satisfaction with teaching and learning in the General Education (GE) course is high. This is reflected in the fact that the average scores for each item exceed 4 out of 5, with a low standard deviation (SD). This suggests that the scores are consistently distributed.

4. RESULTS

This section presents a detailed analysis of the writing and speaking test results from the pretest and posttest, aiming to provide a comprehensive understanding of the model's impact.

Tables 3 and 4 illustrate the comparison between students' reading pretest and posttest scores. The tables indicate that both groups experienced improvement. Table 4 demonstrates that the posttest scores are significantly higher than the pretest scores in both the experimental group, t (49) = -11.63, p=0.00, and in the control group, t(58)=-5.44, p=0.00.

Table 3: Descriptive Statistics for Pretest and Posttest-Reading.

		Mean	**N**	**SD**
Experimental	Pre-test	9.68	50	0.324
	Post-test	12.76	50	0.281
Control	Pre-test	9.66	59	0.233
	Post-test	11.19	59	0.239

Table 4: Parried Samples Test-Reading.

		Mean	**Full Score**	**N**	**SD**	**T**	**df**	**Sig.(2-tailed)**
Experimental	Pre-test- Post-test	-3.080	20	50	0.324	-11.635	49	0.00
Control	Pre-test- Post-test	-1.525	20	59	0.233	-5.444	58	0.00

Table 5: Independent Samples Test for Posttest-Reading.

		Levene's Test for Equality of Variances		**T-Test for Equality of Means**						
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
Experimental	**Equal variances assumed**	0.078	0.781	4.299	107	0.001	0.001	1.574	0.366	0.848
Control	**Equal variances not assumed**			4.270	100.898	0.001	0.001	1.574	0.369	0.843

Even though both groups had better posttest results, the experimental group did score a higher average score (M=12.76, SD=0.28) than the control group (M=11.19, SD=0.23), as shown in Table 3. However, Table 5 indicates that despite the experimental group scoring higher than the control group, the difference is not statistically significant, t(107)=4.29, p=0.78. From this result, the treatment given to the experimental group did not significantly improve the reading scores compared to the control group.

In addition, tables 6 and 7 compare students' writing pretest and posttest results. Table 7 shows that the posttest scores are significantly higher than the pretest scores for both the experimental group, t (49)=-10.10, p=0.00, and the control group, t(58)=-3.41, p=0.00.

Table 6: Descriptive Statistics for Pretest and Posttest-Writing.

		Mean	N	SD
Experimental	Pre-test	10.86	50	2.06
	Post-test	12.90	50	1.73
Control	Pre-test	10.59	59	1.73
	Post-test	11.08	59	1.52

Table 7: Paired Samples Test-Writing.

		Mean	Full score	N	SD	T	df	Sig.(2-tailed)
Experimental	Pre-test- Post-test	-2.040	20	50	0.202	-10.102	49	0.00
Control	Pre-test- Post-test	-0.492	20	59	0.144	-3.419	58	0.00

In addition, table 8 indicates that even though the experimental group (M=12.90, SD=1.73) scored higher than the control group (M=11.08, SD=1.52), the difference is not statistically significant, t(107)=5.82, p=0.71. From this result, the treatment given to the experimental group did not significantly improve the writing scores compared to the control group.

Table 8: Independent Samples Test for Posttest-Writing.

			Levene's Test for Equality of Variances		**T-Test for Equality of Means**						
			F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
										Lower	**Upper**
Experimental	**Pre-test**	**Equal variances assumed**	0.136	0.713	5.827	107	0.001	0.001	1.815	0.312	1.198
Control	**Pre-test**	**Equal variances not assumed**			5.766	98.612	0.001	0.001	1.815	0.315	1.191

In addition, table 9 illustrates that the analysis of effect sizes for reading score differences underscores the substantial impact of the intervention. The experimental group demonstrated a very large effect size (Cohen's d = -1.645, 95% CI [-2.069, -1.215]), while the control group showed a medium to large effect size (Cohen's d = -0.709, 95% CI [-0.992, -0.420]).

The magnitude of these effect sizes, particularly for the experimental group, indicates that the observed improvements are not only statistically significant but also practically meaningful. The larger effect size in the experimental group provides strong evidence that the intervention was substantially more effective than standard instruction in improving reading skills, suggesting its potential for significant educational impact.

The effect sizes for writing score differences further corroborate the intervention's effectiveness, particularly in enhancing writing skills. The experimental group exhibited a very large effect size (Cohen's d = -1.429, 95% CI [-1.820, -1.029]), while the control group showed a small to medium effect size

(Cohen's d = -0.445, 95% CI [-0.711, -0.176]).

The stark contrast between these effect sizes highlights the intervention's superior efficacy in improving writing abilities compared to standard instruction. The magnitude of the effect size for the experimental group suggests that the intervention led to substantial and meaningful improvements in writing skills, reinforcing its potential as a powerful tool for enhancing students' writing proficiency.

Table 9: Analysis of Paired Samples Effect Sizes - Reading Score Differences with Effect Size (Cohen's d).

Paired Samples Effect Sizes						
			Standardizer	Point Estimate	95% Confidence Interval	
					Lower	Upper
Experimental	Pretest -Posttest	Cohen's d	1.872	-1.645	-2.069	-1.215
		Hedges' correction	1.901	-1.620	-2.037	-1.196
Control	Pretest -Posttest	Cohen's d	2.152	-0.709	-0.992	-0.420
		Hedges' correction	2.181	-0.699	-0.979	-0.415

Table 10: Analysis of Paired Samples Effect Sizes–Writing Score Differences with Effect Size (Cohen's d).

Paired Samples Effect Sizes						
			Standardizer	Point Estimate	95% Confidence Interval	
					Lower	Upper
Experimental	Pretest -Posttest	Cohen's d	1.428	-1.429	-1.820	-1.029
		Hedges' correction	1.450	-1.407	-1.792	-1.014
Control	Pretest -Posttest	Cohen's d	1.104	-0.445	-0.711	-0.176
		Hedges' correction	1.119	-0.439	-0.702	-0.173

From Table 11, the satisfaction survey results on teaching through Pear Deck showed no significant differences between men and women across all categories. Both genders had similar ratings for engagement, media, teaching management, advantages, and disadvantages of Pear Deck. Specifically, men and women reported comparable satisfaction levels in each area, with no statistically significant differences in their responses (p-values ranging from 0.827 to 0.976).

These findings suggest that gender did not influence the perceived effectiveness or satisfaction with Pear Deck as a teaching tool.

Table 11: The Results of the Satisfaction Survey on Teaching through Pear Deck, Categorized by Gender.

Teaching through Pear Deck	Gender				t	sig
	Man		Woman			
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Engagement	4.56	0.726	4.27	0.708	1.097	0.914
Media	4.44	0.726	4.29	0.716	0.575	0.976
Teaching Management through Pear Deck	4.11	0.782	4.37	0.662	-1.013	0.968
Advantages of Pear Deck	4.33	0.707	4.39	0.666	-0.230	0.827
Disadvantages of Pear Deck	3.22	1.302	2.61	1.202	1.365	0.958

4.1. Research Question 2: Students' Satisfaction

From Table 12, the overall satisfaction of students with the teaching and learning in the General Education (GE) subject is significant. This is demonstrated as the ratings for each item have a mean of more than 4 out of 5 points, coupled with a low standard deviation (SD), suggesting that the ratings are consistently distributed.

Table 12: Descriptive Statistics for the Survey.

No	Items	Means	SD
1	Interest	4.32	0.71
1.1	The learning material is modern.	4.64	0.60
1.2	The learning material is engaging.	4.48	0.71
1.3	The learning material captures the students' attention.	4.28	0.78
2	Media	4.32	0.71
2.1	Clear presentation and explanation of the content.	4.74	0.44
2.2	Well-organized and easy-to-understand content structure.	4.66	0.48
2.3	Graphics and text align appropriately with the content.	4.50	0.65
2.4	Multimedia corresponds with the content and effectively captures the students' attention.	4.46	0.73
3	Teaching and Learning through Pear Deck	4.32	0.68
3.1	Helps achieve learning objectives.	4.48	0.68
3.2	Promotes self-learning skills.	4.56	0.54
3.3	Examples used in explanations align with the lessons.	4.66	0.48
3.4	Exercises are varied and relevant to the lessons.	4.72	0.45
3.5	Encourages greater enthusiasm for learning.	4.60	0.61
3.6	Content is suitable for the presentation format.	4.66	0.56
3.7	Learning activities enhance understanding of the lessons.	4.62	0.57
3.8	Encourages participation and sharing of opinions.	4.70	0.54
4	Advantages of Pear Deck	4.38	0.67
4.1	Motivates students to learn more.	4.58	0.58
4.2	Enhances learning capacity.	4.46	0.73
4.3	Convenient and time saving.	4.36	0.72
4.4	Contributes to academic success.	4.38	0.70
5	Disadvantages of Pear Deck	2.72	1.23
5.1	Time constraints for immediate responses can pressure students and limit their ability to analyze, potentially affecting comprehension.	3.26	1.23
5.2	Reduces opportunities to develop teamwork skills.	2.44	1.45
5.3	Uncertainty about the quality of learning students receive.	2.36	1.41
5.4	Overreliance on technology may hinder learning independence.	2.46	1.52

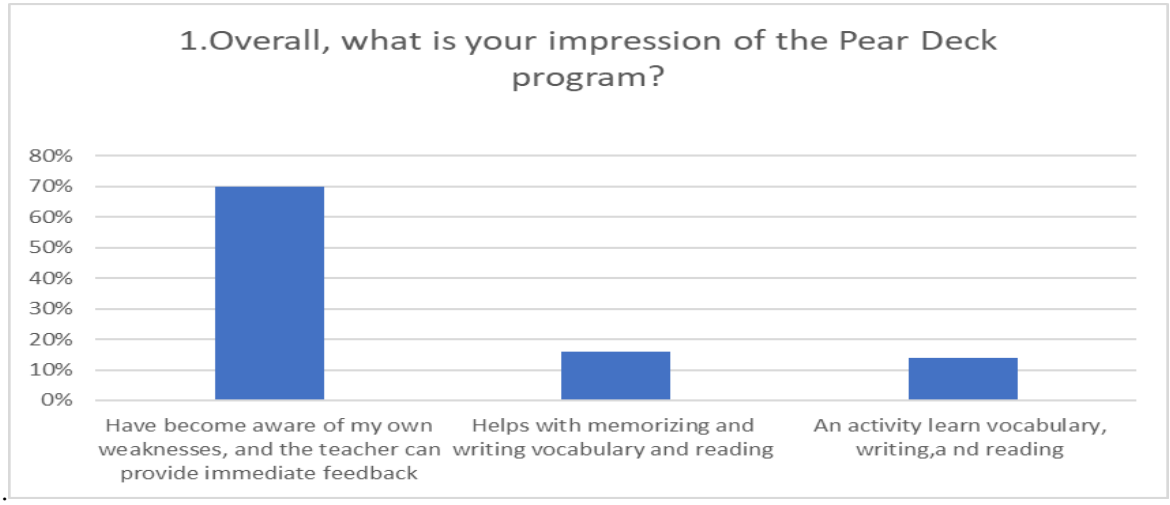

Figure 2: Percentage Distribution of Student Impressions of the Pear Deck program.

In the follow-up survey gathering qualitative data on students' perceptions of the Pear Deck program,

there were four questions. Question one is, "Overall, what is your impression of the AR program?" 43% of the respondents said that the program helps them learn vocabulary. 40% of the respondents said that the program interesting program/ fascinating softwore. 17% of the respondents said that the program help to remember vocabulary. The following table shows students' comments and their English translation

Table 13: Students' Comments to Question One.

No	Students' Comments	English Translation
1.	ได้ทราบข้อบกพร่องของตัวเองและอาจารย์สามารถให้คำแนะนำได้ทันที	Have become aware of my own weaknesses, and the teacher can provide immediate feedback.
2	ช่วยในการจำและเขียนคำศัพท์และช่วยพัฒนาการทำข้อสอบการอ่าน	Helps with memorizing and writing vocabulary and improves reading test skills.
3	เป็นกิจกรรมที่ได้เรียนรู้คำศัพท์ การเขียนและการอ่านที่สามารถเล่นได้ ไม่น่าเบื่อ สนุก โปรแกรมน่าสนใจ	An activity where I can learn vocabulary, writing, and reading in a fun and engaging way, not boring. The program is interesting.

Question two asked, "Does it benefit your learning? Why? Please mention the benefits, if any." In response, 37% of the helps to identify my weaknesses, and the teacher could provide immediate guidance. Additionally, 33% stated that it helps learning how to use vocabulary to form sentences while also being engaging,16% helps to practice reading in a way similar to exam questions, which improved my understanding of vocabulary and content, Finally 14% helps to develop thinking and analytical skills for answering and completing exercises.

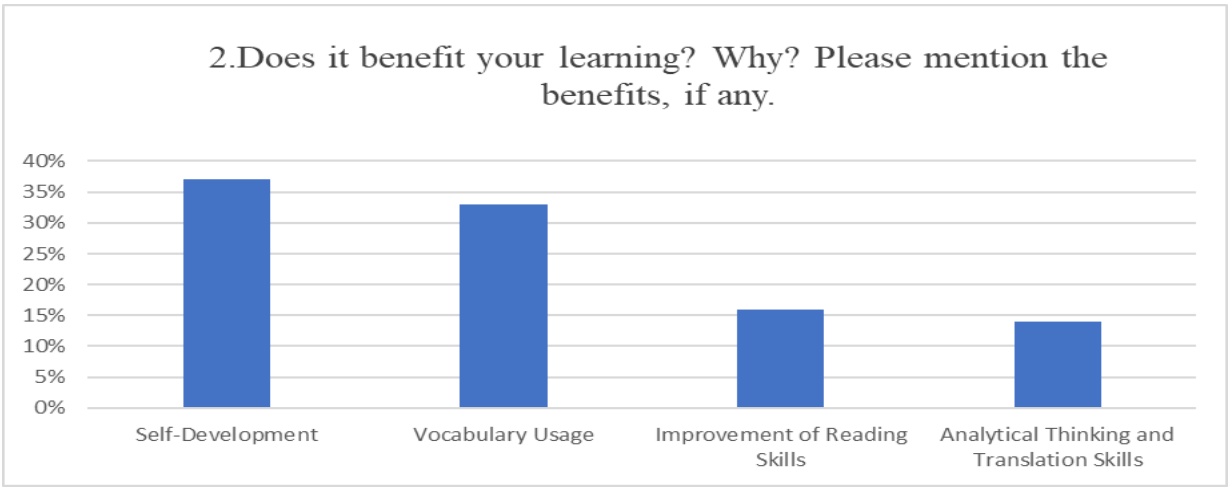

Figure 3. Percentage Distribution of Student Perceptions of the Learning benefits gained from the Program.

Table 14: Students' Comments to Question Two.

No	Students' Comments	English Translation
1.	มีประโยชน์ ได้ทราบข้อบกพร่องของตัวเองและอาจารย์สามารถให้คำแนะนำได้ทันที	It was beneficial and helps to identify my weaknesses, and the teacher could provide immediate guidance.
2	มีประโยชน์ ในการนำคำศัพท์มาแต่งประโยค	It was beneficial and helps learning how to use vocabulary to form sentences.
3	มีประโยชน์ ได้ฝึก Reading เสมือนข้อสอบ และเข้าใจคำศัพท์ เนื้อหามากขึ้น	It was beneficial and helps to practice reading in a way similar to exam questions, which improved my understanding of vocabulary and content.
4	มีประโยชน์ ช่วยฝึกทักษะ คิด วิเคราะห์ในการตอบและทำแบบฝึกหัด	It is beneficial and helps to develop thinking and analytical skills for answering and completing exercises

Question three is, "What challenges did you find? Please explain" 50% of the respondents, said answering questions in real-time. 40% of the respondents said Challenges in writing Chinese characters and recalling Chinese vocabulary. 10% of the respondents said Trying out a program that has

never been used before.

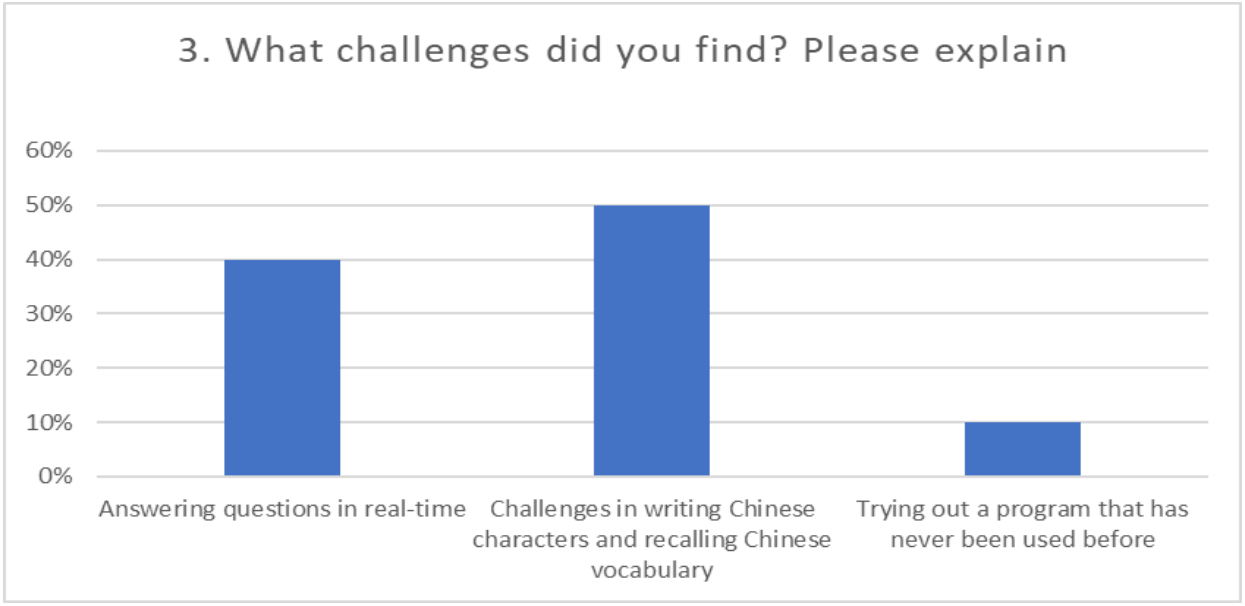

Figure 4: Students' Challenges Experienced During the Activity.

Table 15: Students' Comments to Question Three.

No	Students' Comments	English Translation
1	การตอบคำถามแบบ real-time	Answering questions in real-time
2	ความท้าทายในการเขียนตัวจีนและนึกคำศัพท์ภาษาจีน	Challenges in writing Chinese characters and recalling Chinese vocabulary
3	การลองใช้โปรแกรมที่ไม่เคยใช้มาก่อน	Trying out a program that has never been used before

Question four is, "What can be improved about the Pear Deck program". 50% of the respondents said Would like the Pear Deck app to be available. 29% of the respondents said the initial login process is quite challenging. 21% of the respondents said I would like to have pens in various sizes and a dedicated eraser tool.

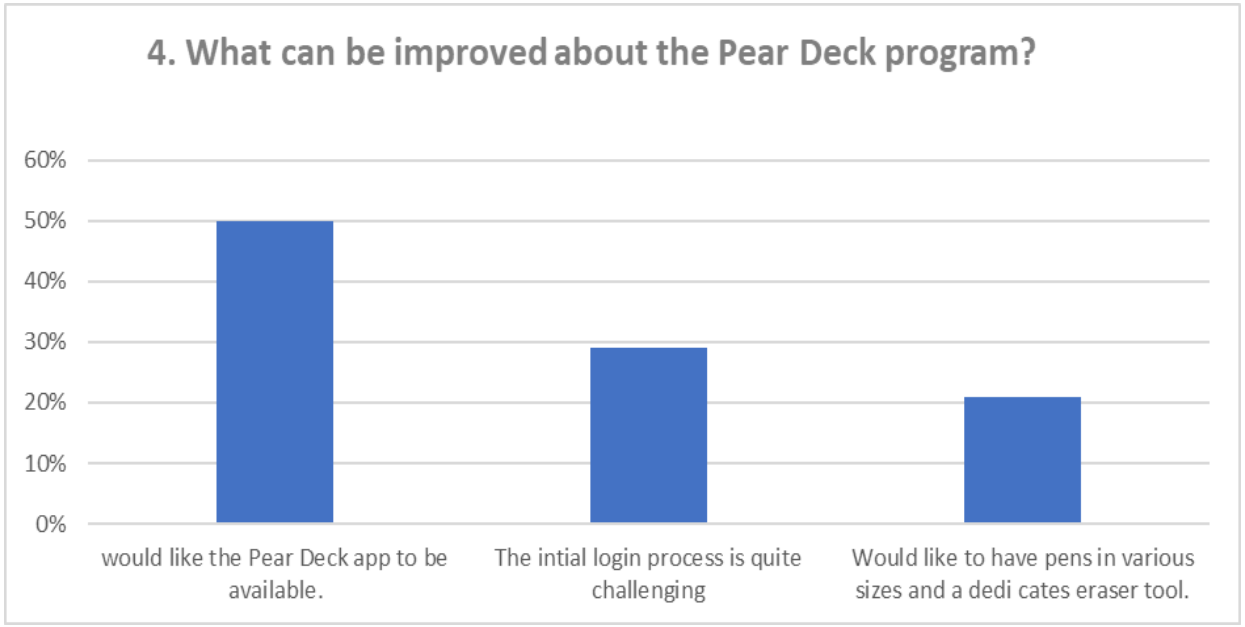

Figure 5: Percentage of Student Suggestions for Enhancing the Pear Deck Program.

Table 16: Students' Comments to Question Four.

No	Students' Comments	English Translation
1	อยากให้มี APP Pear Deck	Would like the Pear Deck app to be available.
2	การเข้าให้ระบบครั้งแรกค่อนข้างยาก	The initial login process is quite challenging.
3	อยากให้มีปากกาที่หลายหลากขนาด และมียางลบเฉพาะชุด	I would like to have pens in various sizes and a dedicated eraser tool.

5. DISCUSSION

The findings of this study reinforce the growing body of evidence supporting the use of Interactive Response Systems (IRS), particularly Pear Deck, in language learning. The results highlight the platform's potential to enhance student engagement, improve Chinese language skills, and foster a more inclusive and interactive classroom environment.

5.1. Impact on Chinese Reading and Writing Skills

The significant improvement in both reading and writing post-test scores observed in the experimental group highlights the effectiveness of Pear Deck in enhancing students' Chinese language proficiency. The platform's interactive features such as real-time feedback, anonymous responses, and session reviews enabled students to receive immediate correction of errors and reinforcement of appropriate language use. These functions contributed to an active learning environment, fostering student engagement and deeper retention of linguistic knowledge. These findings are consistent with previous research suggesting that Interactive Response Systems (IRS) promote student-centered learning and improve language outcomes (Anggoro & Pratiwi, 2023). The experimental group outperformed the control group, indicating that the interactive and learner-focused pedagogical approach facilitated by Pear Deck was more effective than traditional teacher-led instruction. Additionally, it was found that students achieved higher writing scores when composing responses on paper rather than typing on digital platforms (Loh et al. 2021). This can be attributed to their greater familiarity with traditional handwriting and limited proficiency in typing. Such familiarity likely boosted students' confidence during handwritten tasks, thereby enhancing their ability to articulate ideas more clearly and effectively.

5.2. Student Engagement and Satisfaction

Student feedback revealed high satisfaction with Pear Deck's ability to make learning engaging, enjoyable, and efficient. Features like interactive quizzes, collaborative activities, and instant feedback were particularly appreciated. These results are consistent with research by Anggoro (2021), which found that Pear Deck motivates students and enhances their participation. Additionally, the anonymity feature reduced anxiety, fostering a safe space for learning a critical factor in mastering the complexities of Chinese, such as tonal pronunciation and character writing.

5.3. Gender Perspectives

Research on gender and technology use presents a complex picture, revealing both similarities and differences. Interestingly, the current study found no significant gender differences in satisfaction levels or the perceived effectiveness of Pear Deck, suggesting that the platform effectively supports both male and female students equally, fostering an inclusive learning environment. However, prior studies, such as those by Rafikova and Voronin (2024), identified subtle variations in engagement patterns, indicating the need for further investigation to optimize the platform for diverse learner profiles.

Several studies support the view that technology benefits both genders equally. For instance, Cooper et al. (2020) and Cheung et al. (2019) reported no notable differences in satisfaction, engagement, or learning outcomes between male and female students when equal access and training were provided. These findings emphasize the potential of well-designed educational technologies, like interactive learning platforms, to meet diverse student needs and promote equitable learning opportunities.

Conversely, some research highlights persistent gender disparities in technology use and adoption. Lee, (2021) found that males often display higher confidence and exploratory behaviors with technology, leading to greater adoption rates. These differences are often attributed to societal norms, gender stereotypes, and unequal early exposure to technology.

These differing perspectives underscore the need for further research to identify the conditions under which technology can equitably benefit all learners. Customizing tools like Pear Deck to address subtle engagement differences could improve inclusivity and effectiveness, ensuring that educational

technologies meet the needs of diverse student populations.

5.4. Addressing Challenges

Although Pear Deck has proven to be an effective tool, there are some challenges, such as real-time response pressure and the complexity of writing Chinese characters. When using paragraphs with students, a time limit is set for reading. After reading, students are required to answer 2-3 questions to test their understanding of the content. Sometimes, students are asked to write on a tablet using a tablet pencil, or at times, they use Pinyin input to select Chinese characters. However, writing with a tablet pencil may sometimes lack stability, which could be caused by internet connection issues or the app used for teaching and learning. Additionally, Chinese characters that are missing or have one extra stroke can alter the meaning, making the character incorrect. These problems highlight areas for improvement in the platform's design, such as incorporating flexible timing for activities and tools that better support character writing practice. Furthermore, the lack of advanced features in the free version of Pear Deck, such as in-depth analytics and session reviews, limits its full potential (Anggoro, 2021). Addressing these limitations could further enhance the platform's effectiveness and impact.

5.5. Novelty Effect and Hawthorne Effect

Although this study reports notable gains in students' Chinese reading and writing skills through the integration of Pear Deck, it is critical to acknowledge the potential impact of the "novelty effect" on these outcomes. The novelty effect refers to the heightened learner engagement and motivation that often accompanies the initial introduction of innovative technology or teaching methods. Such increased interest may temporarily inflate performance metrics, making it difficult to determine whether improvements are due to the intrinsic pedagogical value of Pear Deck or merely its newness and interactive appeal. Without accounting for this effect, there is a risk of overestimating the tool's true educational efficacy (Rodrigues et al., 2022; Lee et al., 2025). Therefore, longitudinal studies or follow-up assessments are essential to discern whether the observed benefits persist beyond the initial excitement phase, ensuring that the instructional advantages are sustainable and generalizable across contexts. Addressing the novelty effect transparently also strengthens the study's validity and provides clearer guidance for educators considering the adoption of similar technologies.

It is crucial to acknowledge possible confounding factors that might have affected the outcomes of this research. For example, participants' previous experience with comparable interactive technologies could have influenced their ease and confidence in using the tool, thus affecting their participation and results independently of the actual intervention (Shih et al., 2004). Moreover, the Hawthorne effect where individuals modify their behavior simply because they know they are being observed might have led to temporary boosts in motivation or effort. These considerations emphasize the importance of interpreting the findings with caution and indicate that subsequent studies should incorporate control procedures or adopt longitudinal approaches to more accurately determine the genuine impact of the teaching tool (Chua et al.2023, Adair et al. ,1989).

5.6. Broader Implications and Future Research

This study emphasizes the importance of integrating interactive technologies like Pear Deck in language education, particularly for challenging languages such as Chinese. The findings suggest that Interactive Response Systems (IRS) can bridge gaps in traditional teaching methods by offering a more personalized and engaging learning experience. However, it is essential to consider the novelty effect, which may have influenced the results due to the initial excitement associated with using new technology (Parmaxi & Demetriou, 2020). Therefore, long-term studies are necessary to evaluate sustained improvements in language learning outcomes.

It is also crucial to acknowledge possible confounding factors that might have affected the outcomes of this research. For instance, participants' previous experience with similar interactive technologies could have influenced their ease and confidence in using the tool, thereby affecting their participation and results independently of the actual intervention (Lee & Maher, 2021). Moreover, the Hawthorne effect where individuals modify their behavior simply because they know they are being observed (Shah, 2023) might have led to temporary increases in motivation or effort. These considerations highlight the importance of interpreting the findings with caution and suggest that future studies should incorporate control procedures or adopt longitudinal approaches to more accurately determine the genuine impact of the teaching tool (Tsay et al., 2020).

Future research should explore the use of Pear Deck across different educational contexts and language proficiency levels. Additionally, incorporating advanced AI features within Pear Deck could offer opportunities for adaptive learning, further enhancing its effectiveness.

5.7. Broader Cultural Implications and Future Research

This study highlights the potential of leveraging the deep cultural connections between Thailand and China to enrich language education. The historical relationship between the two nations, shaped by trade, migration, and shared cultural values, offers a meaningful framework for teaching Chinese. Integrating these cultural ties into classroom instruction can help students grasp the practical and cultural relevance of the language, instilling pride in their shared heritage.

Future research should delve into how tools like the Interactive Response System (IRS) and Pear Deck can be customized to incorporate specific Thai-Chinese cultural elements. For instance, lessons could include historical narratives, traditional customs, or contemporary cultural exchanges that resonate with students' lived experiences. Longitudinal studies are particularly needed to assess how such culturally enriched lessons influence long-term retention, application of the language in real-world scenarios, and the strengthening of cultural connections between the two countries.

By weaving cultural context into language learning, Pear Deck serves as more than a linguistic tool; it becomes a bridge for fostering cross-cultural understanding and mutual respect. This approach equips students to engage meaningfully in the evolving relationship between Thailand and China, preparing them to thrive in a globalized world.

6. CONCLUSION

This study examines the potential impact of Interactive Response Systems (IRS), such as Pear Deck, on student engagement in Chinese language learning, a field that is generally known for its challenges (Anggoroa & Pratiwi, 2023). Pear Deck appears to enhance engagement by offering real-time feedback, formative assessments, and interactive features, which may encourage active learning and participation, even in large classrooms. The results suggest that Pear Deck might be effective in improving Chinese language skills, particularly in reading and writing. Students reported relatively high levels of engagement and satisfaction, although there were no significant gender differences in effectiveness. However, further research might be needed to refine the platform for diverse learners.

Additionally, Pear Deck seems to promote a collaborative learning environment by anonymizing student responses, which may enable peer learning. The study also investigates gender differences, finding that female students may tend to be more optimistic, while male students may respond better to feedback and peer interactions. These findings suggest that IRS tools like Pear Deck could potentially be adapted to better suit gender-specific learning preferences.

Pear Deck's teacher-guided approach seems to offer more consistent, high-quality feedback for language learners. However, limitations do exist, particularly in the free version of Pear Deck, which lacks certain advanced features. Since the study primarily focuses on Chinese language learning, further research could be useful to explore the long-term impact of IRS tools across different subjects. Overall, the study suggests that Pear Deck might be effective in fostering an engaging, personalized, and supportive learning environment for students.

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