The impact of chatbots on EFL students' English reading comprehension

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ARTICLE INFO	ABSTRACT
	The advent of Chatbots as potential tools for learning English has provided EFL students with opportunities for interactive English practice and enhanced research skills using open-access sources, offering employment opportunities for college graduates. However, the practical benefits of language learning in Vietnamese higher education institutions need more in-depth research. This study, therefore, was conducted with 45 second-year EFL students at Ho Chi Minh City University in Vietnam, whose English proficiency level was equivalent to B1. It investigates the empirical effectiveness of Chatbots in acquiring English language skills, focusing specifically on reading comprehension, critical thinking, and creativity. Addressing two key questions, namely, the impact on students' reading comprehension, learner autonomy, and perceptions of Chatbots for enhancing comprehension, the study incorporates an 8-week Chatbot-integrated classroom intervention program. Data were collected through surveys and interviews, then compared and contrasted to measure reading comprehension and learner autonomy improvement. Findings indicate that Chatbots significantly enhance reading comprehension, foster learner autonomy, and stimulate critical thinking. The research offers a comprehensive overview of Chatbots in EFL, recognizing associated limitations, and advocates for further exploration of A.I.-linked EFL education, exploring advantages and limitations, especially regarding learners' academic achievement and well-being, as a burgeoning trend in Vietnam and globally.

1. Introduction

In Vietnam, Vietnamese English as a Foreign Language (EFL) students encounter challenges in English reading comprehension, marked by difficulties discerning various text types, a vocabulary deficit, and a lack of mastery in grammatical structures (Nguyen, 2017; T. H. Nguyen, 2021; Nguyen & Kim, 2021; Nguyen & Tran, 2024). These challenges arise from unfamiliarity with diverse text genres and a lack of vocabulary (T. H. Nguyen, 2021; Nguyen & Kim, 2021; Nguyen & Tran, 2024). Additionally, grappling with complex grammatical structures is exacerbated by a perception that grammar lessons are challenging and tedious (Nguyen, 2017; Nguyen & Kim, 2021). Addressing these issues requires strategies to enhance comprehension of text genres, expand vocabulary within specific contexts, and motivate students to engage with and retain grammatical concepts.

In line with the global trend, English teaching and learning are shifting towards incorporating technology, especially AI tools, to enhance proficiency and foster 21st-century skills for future entrepreneurial pursuits (L. T. H. Nguyen, 2021; Tran et al., 2019). Notably, technology, including AI-driven conversational agents (Chatbots), has been recognized for aiding linguistic proficiency development since the 1960s. Chatbots assist users in vocabulary expansion (Kim, 2018), grammar analysis (Bibauw et al., 2019; Kim, 2019), and critical thinking practice (Annamalai et al., 2023; Le et al., 2023; Nergis, 2013). While Chatbots positively affect reading comprehension and leverage students' learner autonomy, their effectiveness in the Vietnamese university environment requires further research. This study delves into how Chatbots can boost reading comprehension and learner autonomy while tackling literacy and educational challenges. Additionally, it contributes to the literature review on the Vietnamese context, guided by specific research inquiries:

1. Does the Chatbots application help students improve their reading comprehension and learner autonomy?

2. What is students' perception of using Chatbot applications to improve reading comprehension?

2. Theoretical basis

2.1. The definition of reading comprehension

Reading comprehension relies on vocabulary, grammar, and the ability to analyze texts based on personal experiences (Elwér, 2014; Nguyen & Tran, 2024). Integrating new information with existing knowledge is crucial for creating insights (Kintsch & Kintsch, 2005, as cited in T. H. Nguyen, 2021). Success in reading comprehension depends on seamlessly combining reading skills with thinking, analysis, and synthesis (Elwér, 2014). Difficulties often stem from linguistic limitations, such as a lack of vocabulary or incorrect grammatical analysis (Carrell & Eisterhold, 1983). Adequate comprehension requires sound linguistic knowledge, background understanding, and strong cognitive abilities (Carrell & Eisterhold, 1983; Nergis, 2013). Field-specific knowledge enhances comprehension; for instance, engineering students grasp a passage about control and automation more quickly due to their background, while accounting students may struggle. In the Vietnamese EFL context, non-language majors struggle with reading comprehension due to limited L2 vocabulary and an incomplete grasp of L2 grammatical structures (Nguyen, 2017; Nguyen & Tran, 2024).

2.2. The challenges in reading comprehension of Vietnamese EFL students

2.2.1. Text types

To address challenges in EFL students' reading comprehension, it's crucial to consider the nature of the reading material (Nguyen, 2017; T. H. Nguyen, 2021; Nguyen & Kim, 2021; Nguyen & Tran, 2024). Different text types demand corresponding comprehension skills. Proficient readers navigate various texts using a range of skills. The genre of texts and the frequency of encountering familiar types are closely tied to learners' reading comprehension proficiency (Lee & Musumeci, 1988). Lower-level learners may only comprehend simple or familiar texts. This is crucial for teachers selecting resources for low-level or EFL students. For example, when examining a persuasive paragraph on environmental protection (see Table 1 & 2), the content expression varies significantly between English and Vietnamese. If Vietnamese EFL students are unfamiliar with the text type, comprehension becomes challenging, particularly with specialized texts, due to unfamiliar vocabulary, grammatical structures, and a lack of background knowledge. Educators should introduce new vocabulary, grammatical structures, and text types to support students during pre-reading (T. H. Nguyen, 2021). Regular revisiting of these elements is crucial for facilitating linguistic knowledge acquisition.

Figure 1

A Persuasive Paragraph in English

Source. https://oceanservice.noaa.gov/ocean/earthday.html

Figure 2

A Persuasive Paragraph in Vietnamese

Source. https://hosomoitruong.com.vn/nhung-viec-lam-de-bao-ve-moi-truong/

2.2.2. Lexical resources

The challenge for EFL students in reading comprehension is tied to the extensive nature of vocabulary (Elwér, 2014; Masrai, 2019; T. H. Nguyen, 2021; Nguyen & Tran, 2024). Learners comprehend 80% - 90% of content when their existing vocabulary matches that percentage (Masrai, 2019). Expanding vocabulary enhances comprehension (Nguyen & Kim, 2021). Yet, the challenge intensifies as students often lack an understanding of word meanings within specific contexts, leading them to consult dictionaries or learn new words in isolation (Nguyen & Kim, 2021). In Vietnam, high school graduates are expected to reach a B1 proficiency level, requiring a vocabulary size of 2,750 - 3,250 words (Meara & Milton, 2003, as cited in Milton & Alexiou, 2009). However, about 14% of 12th-grade students in Vietnam achieve a vocabulary size of only 2,000 words, highlighting a notably low proficiency and hindering compelling reading due to insufficient lexical knowledge (Dang, 2020).

To tackle the problem of insufficient vocabulary, the key solution is to enhance lexical knowledge (Nguyen, 2017; T. H. Nguyen, 2021; Nguyen & Kim, 2021; Nguyen & Tran, 2024). Laufer and Ravenhorst-Kalovski (2010) suggest that readers need around 8,000 words to comprehend passages independently, excluding word families. The frequency of vocabulary occurrence is a crucial factor, as a higher frequency provides more learning opportunities, aiding readers in enhancing their vocabulary (Laufer & Ravenhorst-Kalovski, 2010). Word frequency is determined based on its appearance in specific texts or across various texts. Reading lessons should prioritize mid- and low-frequency vocabulary to increase their usage in educational settings. Teachers introducing new words should encourage students to explore word families, for instance, extending "teacher" into "to teach" or "to provide knowledge" by adding the suffix

"-er" or using the prefix "pre-" to indicate doing something first. This method, over time, boosts high-frequency vocabulary, expanding students' overall lexical repertoire.

In addition, adequate understanding relies on proficient lexical-semantic skills; those lacking them may misinterpret words or face difficulty extracting information. The challenge extends beyond vocabulary memorization; focusing solely on isolated vocabulary study leaves EFL students vulnerable to misunderstanding familiar words in different contexts (Corrigan, 2007; Nguyen & Kim, 2021). Effective vocabulary learning entails exploring word meanings in specific contexts, understanding word families, collocations, and the diverse contexts in which words may appear (Corrigan, 2007).

2.2.3. Grammatical range

Besides vocabulary, syntactic knowledge is crucial for second language (L2) comprehension. EFL students lacking adequate syntax knowledge often struggle with reading comprehension due to syntactic differences between Vietnamese (L1) and English (L2) (Carrell & Eisterhold, 1983; Elwér, 2014; Nergis, 2013; Nguyen, 2017; T. H. Nguyen, 2021; Nguyen & Kim, 2021). Numerous grammatical categories in L2 that lack counterparts in L1 make syntax knowledge a significant challenge for EFL students in Vietnam. Firstly, English grammar, with categories like tense and verb forms, presents challenges for Vietnamese learners, who rely on temporal vocabulary to convey temporal meaning. (Nguyen, 2017; Nguyen & Kim, 2021). For instance, "đang" corresponds to the present, "đã" to the past, and "sẽ" to the future.

(a) She **writes** 02 letters every day.   (a') Cô ấy **viết** 02 lá thư mỗi ngày.

(b) Yesterday, she **wrote** 02 letters.   (b') Hôm qua, cô ấy **đã viết** 02 lá thư.

(c) Tomorrow, she **will write** 02 letter.   (c') Ngày mai, cô ấy **sẽ viết** 02 lá thư.

In L2, the verb "write" takes on distinct forms corresponding to each temporal segment (write - wrote - will write). Conversely, in the first language (L1), the verb tense of "viết" (meaning "write" in L2) remains consistent in all three sentences (a'), (b'), and (c'). When referring to past temporal segments, sentence (b') introduces the word "đã" (equivalent to past tense grammar), and in a sentence (c'), the word "sẽ" appears (equivalent to future tense grammar) (viết - đã viết - sẽ viết). EFL students face challenges in reading comprehension related to tenses due to the need for memorization and extensive practice required to master the various tenses and their usage. Another difficulty arises from using complex or lengthy sentences in the reading texts (Carrell & Eisterhold, 1983; Nguyen, 2017; Nguyen & Kim, 2021). Students at lower and intermediate proficiency levels often struggle to analyze or misinterpret sentences with intricate structures, including relative clauses, pseudo-subjects, or more than two clauses. Additionally, some grammatical categories such as prepositions, singular/plural forms, inversion, and subject-verb agreements pose challenges for many EFL students in the reading comprehension process (Nguyen, 2017; Nguyen & Kim, 2021). These grammatical elements differ significantly from those in the L1. For example, in L2, the word "a child" refers to a singular subject and "children" to a plural subject, whereas in L1, a quantifier is added before the word "đứa trẻ" (meaning "child" in L2).

2.2.4. Critical thinking

A thorough understanding of texts requires critical reading (Zin et al., 2014). Beyond literal comprehension, it involves evaluating and scrutinizing ideas, encouraging readers to engage with the content actively. Critical reading demands a skeptical and analytical approach,

focusing on substance and value, and readers should anticipate information, establish connections, and pose questions or critiques, going beyond passive reception (Zin et al., 2014). Critical reading empowers students in the digital era, so its incorporation into foreign language teaching is crucial.

In Vietnam, the Education Law (The National Assembly, 2005) highlighted the development of critical thinking at the university level. The aim was to deepen knowledge of scientific advancements and enhance workforce skills. Asian EFL students, possibly due to traditional memorization methods, struggle with critical thinking, including Vietnamese EFL students (Floyd, 2011; Le et al., 2023). To enhance reading comprehension, teachers should utilize critical reading, encouraging proactive and critical thinking for a deeper understanding of knowledge.

2.3. Learner autonomy in language learning and teaching

Learner autonomy has long been a key focus for educators, known by various terms like 'independent learners,' 'self-study learners,' and 'self-regulated learning' (Hu & Zhang, 2017). Successful learning requires students to develop the ability to manage and control their learning processes, including planning, monitoring, assessing, and reflecting on their activities (Duong, 2021; Nguyen & Habók, 2020; Nguyen & Nguyen, 2020). Achieving learner autonomy hinges on two interdependent factors: possessing knowledge and skills and the willingness to use them independently. More knowledge and skills boost motivation for independent decision-making, while increased confidence and motivation lead to the pursuit of more excellent knowledge and skills.

In the context of Vietnam, the Education Law (The National Assembly, 2005) stressed the importance of promoting learner autonomy to develop a skilled workforce. Despite recognizing its importance, students' ability to act autonomously in language learning is only slightly above average (Duong, 2021; Nguyen & Habók, 2020; Nguyen & Nguyen, 2020). Thus, more effective strategies are needed to enhance learner autonomy for non-major students.

2.4. Learner autonomy development through Chatbot application

Improving language skills requires consistent practice, and AI technology, including Chatbots, is recognized as a highly effective tool for supporting learner autonomy. Chatbots help learners develop their learner autonomy by providing guidance and information for problem-solving, as noted by Aoyon et al. (2022). For instance, Nguyen et al. (2023) and Haristiani et al. (2022) illustrate how Chatbots leverage learning history to support students in refining their learning strategies, overcoming obstacles, setting goals, choosing resources, evaluating progress, and adapting strategy as needed. In the Vietnamese context, Nguyen et al. (2023) and Vo and Nguyen (2024) proved that Chatbots help students gain intrinsic motivation, becoming autonomous and creative learners who acquire new knowledge through self-exploration and active engagement in learning.

2.5. Previous studies

In light of the global trend, teaching English must integrate technology, particularly AI tools, and Chatbots have emerged as potent aids in English instruction and learning. An experiment, Kim (2018) conducted involved students at a Korean university engaging in chat conversations with a Chatbot over eight weeks. The results showed a significant improvement in the vocabulary skills of the experimental group through interaction with the Chatbot. Furthermore, their attitudes toward vocabulary learning experienced a positive shift, enhancing their motivation, interest, and confidence in English. In this context, Chatbots contribute to expanding students' lexical range, enabling EFL learners to improve their vocabulary through interaction, even in grammatically incorrect conversations. In Saudi Arabia, studies conducted by

Qasem et al. (2023) and Mohamed and Alian (2023) demonstrated the impact of Chatbots on enhancing vocabulary acquisition among students. According to the research, 80% of participants reported that Chatbots improved their word recall ability, thereby facilitating learners in advancing their second language (L2) lexical development. Researchers from Belgium and Ecuador also conducted studies highlighting how Chatbots provide feedback on grammatical errors, enabling readers to analyze grammar points and sentence structures (Bibauw et al., 2019), assisting students in enhancing their grammar competence, as demonstrated in Kim's (2019) research at a Korean university in 2019. In 2023, Le et al. (2023) conducted a study at two private institutions in Malaysia and Vietnam, revealing that most students exhibited moderate critical reading skills. Similarly, in the same year, Annamalai et al. (2023) conducted a study involving 360 undergraduate students from three public universities in Malaysia, indicating that problem-based learning with Chatbot applications required students to employ higher-order thinking skills such as analysis, creation, and evaluation. Regarding learner autonomy, Aoyon et al. (2022) in Bangladesh, Haristiani et al. (2022) in Indonesia, Nguyen et al. (2023), and Vo and Nguyen (2024) in Vietnam conducted studies to demonstrate how Chatbots contribute to motivating EFL learners in language learning. These studies collectively underscore the significant potential of Chatbots in enhancing vocabulary and grammar acquisition for learners, thereby improving reading comprehension and fostering learner autonomy.

2.6. Research gap

While Chatbots have shown positive effects on reading comprehension (Annamalai et al., 2023; Bibauw et al., 2019; Nergis, 2013; Kim, 2018; Le et al., 2023), further research is necessary to establish their effectiveness in the university environment in Vietnam. Four main reasons drive this research initiative. Firstly, additional investigation is needed to substantiate the impact of this approach in Vietnamese university contexts. Secondly, recent research on reading skills in Vietnam by Li and Wan (2023) and Nguyen and Tran (2024) highlights the challenges Vietnamese EFL students face, emphasizing the need for critical reading and vocabulary understanding. Thirdly, when using Chatbots for semantic selection, students must employ critical thinking skills, raising questions about whether this process fosters creative thinking over time, as suggested by Annamalai et al. (2023) and Li and Wan (2023). Additionally, there is a need to examine the validity of Coniam's (2014) claim that chatbots lack the capability for sustained goal-oriented conversations essential for language learning purposes.

3. Methodology

3.1. Research design

This study utilized mixed methods to verify if there was an improvement in students' reading comprehension and learner autonomy while examining their perceptions of Chatbot application usage. In addressing the two research questions, data collection will exclusively involve semi-structured interviews, offering participants ample opportunities to express their attitudes comprehensively, along with questionnaires.

3.2. Participants

The study involved 45 male college students specializing in Control and Automation Engineering; their proficiency level was classified as B1 level. The author and the teacher had been instructing this group for two semesters. The choice of participants through convenience sampling, while offering advantages like ease and cost-effectiveness, may introduce biases and limit generalizability.

3.3. Setting and class operation

In the second level of their English course, the students focused on comprehensive English skill development over an 8-week. Students attended the English class once a week, with a total duration of 3.5 hours. The course included one weekly session with four 50-minute periods, totaling 32 offline learning periods. Two segments specifically targeted improving reading comprehension skills, utilizing the 'TOEIC Preparation' textbook and authentic reading materials related to control and automation engineering provided by the teacher. The textbook likely mirrors the format of the actual TOEIC test with various reading passages. The teaching process is summarized in the provided diagram.

Figure 3

The Teaching Process
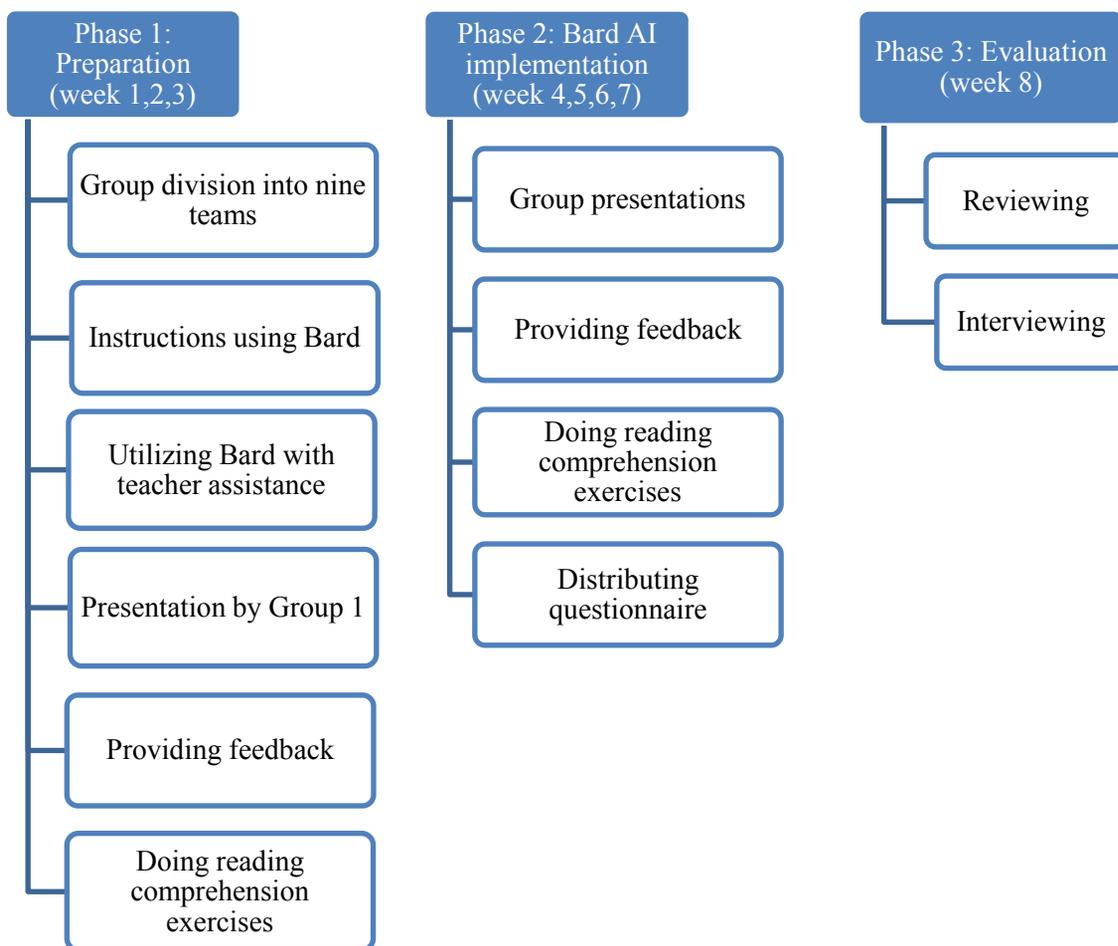
Source. Data analysis result of the research

In Phase 1, the teacher showed students how to input specific words or phrases they wished to explore and highlighted various features of Bard AI, such as its ability to provide definitions, synonyms, and usage examples for each queried term. To illustrate exploring intricate grammatical structures, the teacher inputted complex sentences or phrases into Bard AI, demonstrating how it could break down the grammatical components and provide explanations or alternative interpretations.

In Phase 2, The teacher and other groups provided feedback, addressing inappropriate translations or grammatical errors. For instance, misconceptions arose around the phrase "fast-

paced world" in the sentence "Students now can access a fast-paced world, enabling personalized learning experiences," where students interpreted it literally as "the world is a person who can walk, and the pace is the speed of the world's walks," misunderstanding its societal and industrial context; or grammatical errors, for example, in the sentence "Students now can access a fast-paced world, enabling personalized learning experiences," with the structure S+V, V-ing, instead of interpreting the gerund phrase that students can access a fast-paced world is leading to personalized learning experiences as its often functions as a noun and provides additional information about the state expressed in the main clause, the group members misunderstood that V-ing (enabling) was also the verb of students, meaning that students have the ability and also enable personalized learning experiences.

In Phase 3, students reflected on their Bard AI application.

3.4. Data collection and data analysis

3.4.1. Survey

In the seventh week of the course, a survey was conducted with 45 students, consisting of 32 questions prepared by the author concerning an EFL expert to assess the impact of Chatbots on reading comprehension. The questions covered three themes: understanding reading content, identifying new English words and structures, and analyzing text form (from question 1 to question 12); critical thinking development using Chatbots (from question 13 to question 23); and self-studying English using Chatbots (from question 24 to question 32). A Likert Scale (from 1 = strongly disagree to 5 = strongly agree) was used, with a Cronbach's Alpha of 0.905 indicating high reliability and validity. The questionnaire underwent a pilot phase with 15 students, supervised by an EFL expert for validity, item construct, and wording before distribution to the larger group.

3.4.2. Interview

Based on questionnaire responses, 15 students out of the initial 45 were selected for follow-up interviews. Individual codes (P1, P2, P3, ... up to P15) were assigned for identification. The interview questions sought to explore and clarify participants' survey responses, often framed as "Why" questions.

4. Result and discussion

4.1. Result

During data analysis, the researcher employed the subsequent mean values to assess the degree of agreement: 1.00 - 2.33 indicated *disagreement*, 2.34 - 3.66 represented *neutrality*, and 3.67 - 5.00 indicated *agreement*.

4.1.1. Linguistic proficiency development

A descriptive analysis of linguistic proficiency development using Chatbots is presented in Table 3. The mean scores for 12 questions varied from 3.78 to 4.77 (average mean = 4.21), signifying a high level of agreement and positive feedback across these constructs. Consequently, students have encountered the beneficial impact of using Chatbots.

The data were corroborated through interviews. Concerning Q5 about contextual aspects (mean = 4.77), participants P1, P5, P8, and P14 generally concluded that the Chatbots helped them understand the contexts of words. Participants P2, P4, and P13 said, "*Chatbots help me understand multiple meanings of a word.*" Participants P6 and P15 also concurred, stating, "*When*

using Chatbots, I understand what context is, realizing that in specific situations, translating word-for-word is not always accurate." Additionally, Chatbots "*help me understand the meanings of sentences and words better than a fixed entry in the dictionary*" (P4, P9, P11, P12).

Participant P10 elaborated, "*Generally, Chatbots support the context I desire. I remember a case involving the word 'communication,' where the meanings of 'giao tiếp' (communication) and 'truyền thông' (media) are very close. In that context, it initially translated as 'truyền thông.' Still, after I provided feedback that I intended 'giao tiếp,' it offered a different translation that captured the exact meaning I wanted*".

However, participants P5 and P7 assumed that students played a crucial role in reading comprehension, with Chatbots being optional tools. This perspective explains why they perceived Chatbots as not significantly influencing their vocabulary memory ability (mean of Q2 = 3.80).

Regarding vocabulary range, interviewees concluded Chatbots helped them "*understand and memorize vocabulary*" (P1, P2, P4, P5, P6, P7, P14, P15), "*develop the linguistic ability and increase terminology vocabulary size*" (P3, P8, P12), "*reduce errors related to semantic fields*" (P9, P10, P11, P13).

Related to structure analysis, most interviewees concluded that Chatbots helped them analyze complicated sentence structures (means of Q5, Q6, and Q8 = 4.77, 4.54, and 4.18). Specifically, "*Chatbots break complex sentences down into parts to help me understand more about the meaning and sentence structure*" (P7, P15), and "*I was just learning conditional sentences, and when I inputted them into the Chatbots, they provided examples of various conditional sentence structures, which greatly helped me in my studies*" (P10).

Regarding text type identification support, although students did not perceive the benefits of text type recognition (mean of Q9 = 3.78), they concluded that Chatbots helped them quickly identify the text types. "*After asking Chatbots and knowing that the passage is about an argumentative text, I may have an approach to handling, understanding, and reading related to the discussed issue*" (P4, P12).

Table 1

Mean and Standard Deviation of LR, GR, and TTS Items

Valid N (listwise)	N	Minimum	Maximum	Mean	Std. Deviation
In the realm of lexical resources, Chatbots help me					
Q1. Recognize more English vocabulary	45	2	5	4.27	.809
Q2. Memorize my English vocabulary better	45	1	5	3.80	1.290
Q3. Find the appropriate meaning of the word	45	2	5	4.73	.753
Q4. Explain the meaning of specific words or phrases used in the passage	45	2	5	4.02	.576
Q5. Recognize the semantics more accurately	45	2	5	4.77	.921

Valid N (listwise)	N	Minimum	Maximum	Mean	Std. Deviation
In the realm of grammatical ranges, Chatbots help me					
Q6. Analyze the sentence structures more easily	45	2	5	4.54	.903
Q7. Recognize more English grammar aspects	45	2	5	4.03	.809
Q8. Determine the context of sentences in the reading to select the appropriate meanings for different context	45	2	5	4.18	.806
In the realm of text types and structures, Chatbots help me					
Q9. Identify 4 main text types, including descriptive, narrative, expository, and argumentative	45	1	5	3.78	1.020
Q10. Identify the structure of the reading	45	2	5	4.03	.837
Q11. Identify the main ideas	45	2	5	4.11	.859
Q12. Identify the supporting ideas	45	2	5	4.27	.654
Total				**4.21**	**0.85**

Source. Data analysis result of the research

4.1.2. Critical thinking development

Table 2 summarizes the development of critical thinking facilitated by Chatbots, with mean scores for the 12 questions ranging from 3.78 to 4.80 (average mean = 4.14), signifying strong agreement and positive feedback. This underscores the contribution of Chatbots to the enhancement of critical thinking.

Comparing this with interview data, in terms of enhancing critical thinking through summarizing passages, interviewees expressed their agreement, supported by various perspectives. P1, P3, and P10 mentioned, *"Chatbots help me clearly understand the content of each sentence, making it easier to summarize." "Understanding what each sentence conveys enables me to know how to summarize effectively"* (P9).

Additionally, Chatbots assisted readers in identifying main ideas (P2, P15) and prompted questions to aid in summarizing texts (P4, P11). However, P5 and P7 maintained that they could learn independently without needing support from Chatbots. On the other hand, P6, P12, and P14 expressed concerns about feeling dependent on Chatbots, which seemed to impact their proactive thinking (P8, P13).

In terms of enhancing critical thinking by connecting reading content with practical situations, interviewees expressed neutral responses, not placing significant emphasis on that aspect. P1, P3, P10, and P15 strongly agreed that chatbots helped them improve their critical thinking skills because they can relate what they have read to their lives. *"Chatbots help me imagine real-life situations"* (P1), *"Chatbots significantly increase my general knowledge"* (P3), *"Chatbots help me identify which ideas are right or wrong"* (P10), or *"I have noticed an*

improvement in my logic skills. Chatbots help me break down large issues into smaller parts and identify the relationships between them" (P15). P15 mentioned, *"By comparing the current passage with relevant documents, Chatbots can help me identify similarities or differences in content, meaning, or perspectives between texts. This helps me gain a more comprehensive understanding of the topic and expand my knowledge"*.

However, some interviewees opposed this opinion, stating that *'The connection of reading content with background knowledge may be beyond the capability of Chatbots because it is not the reader itself, and therefore, it cannot understand the reader's background knowledge'* (P5) or expressing concerns about dependence on Chatbots (P6, P8, P12, P13, P14), which aligned with the findings of the questionnaire (means of Q16, 21, 22, 23 = 3.96, 3.98, 3.78, and 3.82, respectively).

Table 2

Mean and Standard Deviation of Critical Thinking Items

Valid N (listwise)	N	Minimum	Maximum	Mean	Std. Deviation
In the realm of critical thinking skills, Chatbot helps me					
Q13. Improved my critical thinking skills through commands to find the best answers	45	3	5	4.80	.919
Q14. Infer the main content of the reading from the context of the passage	45	2	5	4.01	.733
Q15. Apply the content of the reading in practical situations	45	2	5	4.02	.576
Q16. Relate myself to the content of the reading	45	2	5	3.96	1.021
Q17. Summarize the reading	45	2	5	4.04	.903
Q18. Know how to do reading comprehension exercises after reading the passage	45	2	5	4.23	.837
Q3. Find the appropriate meaning of the word	45	3	5	4.73	.809
Q19. Find the appropriate structures for each type of text	45	2	5	4.27	.654
Q20. Be confident in independently exploring regularly updated open-source resources in English	45	2	5	4.00	.879
Q21. Connect my major knowledge with global information	45	2	5	3.98	.690
Q22. Have a habit of raising critical questions whenever I read a passage	45	2	5	3.78	.704
Q23. Have a habit of expressing my own opinions whenever I read a passage	45	1	5	3.82	1.029
Total				**4.14**	**.813**

Source. Data analysis result of the research

4.1.3. Learner autonomy development

The descriptive analysis of learner autonomy facilitated by Chatbots is presented in Table 3. The mean scores for 11 questions ranged from 3.02 to 4.27 (average mean = 3.75), indicating the students' agreement and positive attitude. Some questions show consistent agreement, while others reflect diverse opinions, highlighting the individual experiences and perspectives shaping participants' views. Participants moderately agreed that Chatbots contributed to positive reading habits (means of 3.80, 3.67, and 3.69 for questions 24, 26, and 27). Agreement significantly increased for achieving independent passage reading (means of Q25 and Q28 = 4.27 and 3.69). Participants showed diverse agreement levels regarding the positive impact on learning progress and habit formation. Independent passage reading (Q25) had the highest mean score, suggesting a more significant impact on autonomy.

The data was compared with interview responses for a more precise interpretation. When asked, "*Have you noticed an improvement in any other skills?*" most students reported a slight improvement. However, P3 and P6 expressed specific views, with P3 stating, "*I feel that improving skills in listening and speaking comes through accumulation gained from consistent listening and practice (open source),*" and P6 mentioning, "*I realize that I will have more resources.*" Additionally, P15 contributed by stating, "*If Chatbots can provide information in the engineering field, I can interact with Chatbots to expand my knowledge and understanding of that field. This could help me improve my professional skills and become a valuable resource in work or studies*".

In response to the question about limitations or challenges when using Chatbots for reading comprehension, interviewees shared diverse perspectives. P5 and P6 stressed the importance of users double-checking Chatbots' responses due to their nature as artificial intelligence, acknowledging the potential for incorrect corrections. I6 additionally noted that Chatbots face difficulties in reading comprehension stemming from a lack of context, slang, open-ended questions, or challenges. Furthermore, P7 pointed out a limitation related to Chatbots' knowledge, emphasizing that it can only provide information based on its existing database and may struggle without sufficient training on a specific topic.

Table 3

Mean and Standard Deviation of Learner Autonomy Items

Valid N (listwise)	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
In the realm of self-study English knowledge, Chatbot helps me					
Q24. No longer in the habit of translating word-by-word	45	1	5	3.80	1.290
Q25. Read a passage independently without the help of a teacher or friends	45	1	5	4.27	1.500
Q26. Spend more time reading by myself	45	2	5	3.67	.929
Q27. Significantly improve my autonomy because I no longer feel frustrated when reading	45	1	5	3.69	.874

Valid N (listwise)	N	Minimum	Maximum	Mean	Std. Deviation
Q20. Be confident in independently exploring regularly updated open-source resources in English	45	2	5	4.00	.879
Q21. Connect my major with global information	45	2	5	3.98	.690
Q29. Easily track my learning progress	45	1	5	3.47	1.140
Q28. Know my reading comprehension level	45	1	5	3.69	1.104
Q30. Map out specific methods to improve my reading comprehension skill	45	2	5	3.02	.809
Q31. Continue implementing Chatbot in different courses as guided in this course	45	1	5	3.82	.912
Q32. Develop self-learning English confidently with Chatbot	45	1	5	3.76	1.069
Total				**3.75**	**1.019**

Source. Data analysis result of the research

4.2. Discussion

In light of the integration of Chatbots to address challenges EFL students face in comprehending reading texts, coupled with a dearth of research on this matter at Vietnamese universities, the current study was undertaken to address two specific research questions. (1) Does the Chatbots application help students improve their reading comprehension and learner autonomy? (2) How do students perceive using Chatbot applications to improve reading comprehension?

For the first research question, the results strongly support the positive impact of Chatbots on advancing advanced language skills and learner autonomy among students, aligning with existing literature advocating for the integration of Information and Communication Technology (ICT) in English Language Teaching (ELT) (Annamalai et al., 2023; L. T. H. Nguyen, 2021). Notably, Chatbots significantly aided students in expanding their vocabulary, improving lexical range, and selecting appropriate word meanings, consistent with prior research (Kim, 2018). The study demonstrates enhanced vocabulary acquisition using Bard AI Chatbot, particularly evident during group presentations in week 4, where students showcased improved comprehension and utilization of the Chatbot, providing solutions for the research of Nguyen (2017), Al-Jarrah and Ismail (2018), Nguyen and Tran (2024). Compared to the initial weeks, students evolved from relying on singular dictionary meanings to discerning multiple meanings in various contexts (means of Q3, Q4 = 4.05 and 4.02). Notably, errors in inappropriate translations reduced significantly over weeks, indicating a habit shift towards discerning contextual meanings. This proficiency is pivotal for EFL students, laying the foundation for expanded vocabulary and adequate reading comprehension.

In contrast to Qasem et al. (2023), Mohamed and Alian (2023), who reported an 80% improvement in word recall with Chatbots, this study found that Bard AI Chatbot helped students recognize more vocabulary (Q1 mean = 4.27). However, there was no significant enhancement in vocabulary memory, and recalling words posed a challenge (Q2 mean = 3.80).

This suggests students gained new word knowledge but struggled to retain it for the long term. Bard AI Chatbot did not contribute to establishing lasting memory for new words. It's important to note that this study did not specifically address long-term memory or assess students' memory capabilities. Further research should focus on this aspect, developing appropriate tools to evaluate vocabulary memory in the context of Chatbot integration.

Furthermore, Chatbots, as noted in studies by Bibauw et al. (2019) and Kim (2019), proved beneficial in helping students understand complex grammar structures, fostering improved comprehension of reading texts. Nguyen's (2017) research highlighted students' difficulties in syntax, with Q6, Q7, and Q8 at 4.54, 4.03, and 4.18, respectively. Before Bard AI Chatbot, students struggled to differentiate between sentence types, even though they were introduced to these concepts in high school. Incorporating Bard AI Chatbot in group presentations led to students successfully distinguishing simple, compound, and complex sentences. With improved syntax and context understanding, they adeptly selected appropriate tenses, moving beyond a reliance on simple past. By week 5, Bard AI Chatbot facilitated grammatically correct usage without errors in later presentations. Even at lower levels, students responded accurately to spontaneous questions about various structures in reading texts. This progress reflected students' syntactic knowledge development, enhancing their comprehension of reading texts effectively.

Moreover, interacting with Chatbots enables students to apply critical thinking skills in command formulation actively (Q13 mean = 4.8), word meaning selection (Q3 mean = 4.73), and reading passage analysis (Q14, Q15, Q17 means = 4.01, 4.02, 4.04). Critical thinking, crucial in 21st-century skills, fosters confidence and self-directed learning (Q22 and Q23 mean = 3.78 and 3.82). This research's outcomes, as observed in Li and Wan (2023), offer a valuable solution to enhance critical reading skills. Students learned that specific commands to Bard AI Chatbot yielded more accurate results. For example, refining commands led to contextual meanings and examples, promoting precision in responses. Formulating precise commands improved critical thinking skills, as evidenced in group presentations. Later groups achieved satisfactory results with a single command, in contrast to the multiple commands needed by the initial groups.

Based on findings, students enthusiastically embrace Bard AI Chatbot for the second research question, expressing a commitment to its ongoing use for English language learning and other subjects. They attribute newfound independence in engaging with texts to Chatbots (Q25 mean = 4.27), leading to increased reading autonomy (means of Q27 and Q32 = 3.69 and 3.76), thus reinforcing earlier findings by Aoyon et al. (2022), Nguyen et al. (2023), Vo and Nguyen (2024) and motivation to read more extensively (Q26 mean = 3.67). Chatbots also assist in evaluating comprehension levels (Q28 mean = 3.69) and developing strategies for improved reading comprehension (Q30 mean = 3.02). While not reaching high statistical figures, the study hints at the potential of Bard AI Chatbot in the learning context, consistent with Mohamed and Alian's (2023) findings, where students expressed a strong interest in ongoing Chatbot integration across diverse courses (Q31 mean = 3.82).

Chatbots aid students in evaluating their reading proficiency (Q24 mean = 3.80, Q25 mean = 4.27) and exploring open educational resources (Q20 mean = 4.00, Q21 mean = 3.98), fostering independent learning with reduced reliance on teachers (Q29 mean = 3.47). This active engagement and proactive learning approach align with contemporary trends, preparing students to become global citizens of the 21st century. This study's results differ from Coniam's claim

(2014) that Chatbots lack the capacity for sustained goal-oriented conversations in language learning. On the contrary, directive interactions with Chatbots enhance students' critical thinking skills (Q13 mean = 4.80). In addition, this study innovates upon prior research on Vietnamese reading difficulties, diverging from vocabulary and grammar focus. Unlike previous studies, it addresses critical thinking, independent reading, and effective use of scaffolding. While T. H. Nguyen (2021) found challenges in identifying main ideas, this study shows Chatbots assist in structure identification (Q10 mean = 4.03), main idea pinpointing (Q11 mean = 4.11), and supporting ideas identification (Q12 mean = 4.27). In contrast to Le et al. (2019), suggesting disagreement with linear reading, this study indicates Chatbots aid in connecting ideas, questioning, and evaluating information (Q14, Q15, Q16, Q17 means = 4.01, 4.02, 3.96, 4.04). Chatbots also address issues of reading practice and motivation (Q26 mean = 3.67, Q27 mean = 3.69, Q32 mean = 3.76), highlighted by Nguyen and Tran (2024), making them effective in enhancing critical thinking, self-directed learning, and active reading habits among students.

5. Conclusions and recommendations

5.1. Results, implications and recommendations

Chatbots prove effective for Vietnamese EFL students by enhancing reading comprehension, expanding vocabulary, improving syntax knowledge, motivating students to read, and cultivating critical thinking skills - a crucial aspect of the 21st-century skill set. Post-course, students attribute increased confidence in reading to Chatbots, citing improved lexical range and summarization abilities. Nonetheless, students may still require guidance from teachers in selecting passages for independent study, indicating a continued need for teacher support. In the future, when integrating Chatbots into Reading comprehension lessons, the teacher might consider offering students additional resources for reading practice. Furthermore, their positive impact on critical thinking development makes Chatbots useful for diversifying materials and enhancing critical thinking and linguistic skills, enriching students' 21st-century skill set. Teachers are encouraged to recommend Chatbots for students to engage in intensive reading at home.

5.2. Limitations

However, the study faces limitations associated with time constraints, a restricted number of participants, and the use of a convenience sampling method for data collection. Further research should employ larger population sampling sizes or alternative techniques to enhance diversity, such as considering gender differences. Additionally, the research exclusively focuses on reading comprehension skills. Consequently, further investigation is warranted to deepen our understanding of the broader impact of Chatbots, particularly by examining their impact on a productive skill like writing. Subsequent research could delve into the effectiveness of Chatbots in enhancing students' writing skills by providing corrections, peer feedback, and word recognition based on their written work, utilizing vocabulary acquired from previous reading comprehension lessons, thereby assisting students in advancing their writing skills while also enhancing their ability to memorize vocabulary.

References

Al-Jarrah, H., & Ismail, N. S. B. (2018). Reading comprehension difficulties among EFL learners in higher learning institutions. *International Journal of English Linguistics, 8*(7), 32-41. https://doi.org/10.5539/ijel.v8n7p32

Annamalai, N., Ab Rashid, R., Hashmi, U. M., Mohamed, M., Alqaryouti, M. H., & Sadeq, A. E. (2023). Using chatbots for English language learning in higher education. *Computers and Education: Artificial Intelligence, 5*, Article 100153. https://doi.org/10.1016/j.caeai.2023.100153

Aoyon, R. S., Ara, Y., Baptee, T. A., Hossain, M. S., Afroz, M., Mehedi, H. K., & Rasel, A. A. (2022, October). A self-learning French language learner assistant chatbot leveraging deep learning. In *2022 13th international conference on Information and Communication Technology Convergence (ICTC)* (pp. 598-602). IEEE. https://doi.org/10.1109/ICTC55196.2022.9953013

Bibauw, S., François, T., & Desmet, P. (2019). Discussing with a computer to practice a foreign language: Research synthesis and conceptual framework of dialogue-based CALL. *Computer Assisted Language Learning, 32*(8), 827-877. https://doi.org/10.1080/09588221.2018.1535508

Carrell, P. L., & Eisterhold, J. C. (1983). Schema theory and ESL reading pedagogy. *TESOL Quarterly, 17*(4), 553-573. https://doi.org/10.2307/3586613

Coniam, D. (2014). The linguistic accuracy of chatbotss: Usability from an ESL perspective. *Texts & Talk, 34*(5), 545-567. https://doi.org/10.1515/text-2014-0018

Corrigan, R. (2007). An experimental analysis of the affective dimensions of deep vocabulary knowledge used in inferring the meaning of words in contexts. *Applied Linguistics, 28*(2), 211-240. https://doi.org/10.1093/applin/amm009

Dang, Y. T. N. (2020). Vietnamese non-English major EFL university students' receptive knowledge of the most frequent English words. *VNU Journal of Foreign Studies, 36*(3). https://doi.org/10.25073/2525-2445/vnufs.4553

Duong, T. M. (2021). Learner autonomy in English language learning: Vietnamese EFL students' perceptions and practices. *Indonesian Journal of Applied Linguistics, 11*(2), 307-317. https://doi.org/10.17509/ijal.v11i2.29605

Elwér, Å. (2014). *Early predictors of reading comprehension difficulties* [Unpublished Doctoral dissertation]. Linköping University Electronic Press. https://doi.org/10.3384/diss.diva-110036

Floyd, C. B. (2011). Critical thinking in a second language. *Higher Education Research & Development, 30*(3), 289-302. https://doi.org/10.1080/07294360.2010.501076

Haristiani, N., Dewanty, V. L., & Rifai, M. M. (2022). Autonomous learning through chatbot-based application utilization to enhance basic Japanese competence of vocational high school students. *Journal of Technical Education and Training, 14*(2), 143-155. https://doi.org/10.30880/jtet.2022.14.02.013

Hu, P., & Zhang, J. (2017). A pathway to learner autonomy: A self-determination theory perspective. *Asia Pacific Education Review, 18*(1), 147-157. https://doi.org/10.1007/s12564-016-9468z

Kim, N. Y. (2018). A study on chatbots for developing Korean college students' English listening and reading skills. *Journal of Digital Convergence, 16*(8), 19-26. https://doi.org/10.14400/JDC.2018.16.8.019

Kim, N. Y. (2019). A study on the use of artificial intelligence chatbots for improving English grammar skills. *Journal of Digital Convergence*, *17*(8), 37-46. https://doi.org/10.14400/JDC.2019.17.8.037

Laufer, B., & Ravenhorst-Kalovski, G. C. (2010). Lexical threshold revisited: Lexical texts coverage, learners' vocabulary size and reading comprehension. *Reading in a Foreign Language, 22*(1), 15-30.

Le, H. T. T., Tran, T., Trinh, T. T. P., Nguyen, T. C., Nguyen, T. T. P., Vuong, T. T., Vu, H. T., Bui, Q. D., Vuong, M. H., Hoang, H. P., Nguyen, H. M., Ho, T. M., & Vuong, H. Q. (2019). Reading habits, socioeconomic conditions, occupational aspiration and academic achievement in Vietnamese junior high school students. *Sustainability, 11*(18), Article 5113. https://doi.org/10.3390/su11185113

Le, V. H., Su Li, C., & Wan, R. (2023). An investigation into the critical reading skills of engineering students at 2 private universities in Malaysia and Vietnam. *KnE Social Sciences, 8*(20), 614-632. https://doi.org/10.18502/kss.v8i20.14628

Lee, J. F., & Musumeci, D. (1988). On hierarchies of reading skills and texts types. *The Modern Language Journal*, *72*(2), 173-187. https://doi.org/10.2307/328240

Li, C. S., & Wan, R. (2023). An investigation into the critical reading skills of engineering students at 2 private universities in Malaysia and Vietnam. *KnE Social Sciences,* 614-632. https://doi.org/10.18502/kss.v8i20.14628

Masrai, A. (2019). Vocabulary and reading comprehension revisited: Evidence for high-, mid-, and low-frequency vocabulary knowledge. *Sage Open*, *9*(2). https://doi.org/10.1177/2158244019845182

Milton, J., & Alexiou, T. (2009). Vocabulary size and the common European framework of reference for languages. In B. Richards, M. H. Daller, D. D. Malvern, P. Meara, J. Milton, & J. Treffers-Daller (Eds.), *Vocabulary studies in first and second language acquisition: The interface between theory and application* (pp. 194-211). Palgrave Macmillan. https://doi.org/1057/9780230242258_12

Mohamed, S. S. A., & Alian, E. M. I. (2023). Students' attitudes toward using Chatbot in EFL learning. *Arab World English Journal (AWEJ)*, *14*(3), 15-27. https://doi.org/10.2139/ssrn.4591887

Nergis, A. (2013). Exploring the factors that affect reading comprehension of EAP learners. *Journal of English for Academic Purposes*, *12*(1), 1-9. https://doi.org/10.1016/j.jeap.2012.09.001

Nguyen, C. T. N., & Nguyen, T. T. (2020). Non-language-major students' autonomy in learning English in Vietnam. *Arab World English Journal, 11*(3), 184-192. https://doi.org/10.24093/awej/vol11no3.11

Nguyen, G. M., Nguyen, D. V., Nguyen, N. T. H., Nguyen, G. T. H., & Ngo, T. T. (2023). Measures to develop the ability to self-study chemistry for high school students with the support of AI Chatbot. *Journal of Education for Sustainable Innovation, 1*(1), 49-60.

Nguyen, L. T. H. (2017). Sử dụng phương pháp "bắc giàn giáo" để khắc phục những khó khăn về kĩ năng đọc hiểu tiếng Anh của sinh viên không chuyên ngữ [Using the "scaffolding" method to recover difficulties in the English reading comprehension to non - language specified students]. *Tạp chí Khoa học Giáo dục Việt Nam, 142*, 73-77.

Nguyen, L. T. H. (2021). Teachers' perception of ICT integration in English language teaching at Vietnamese tertiary level. *European Journal of Contemporary Education*, *10*(3), 697-710.

Nguyen, L. T., & Tran, X. T. T. (2024). Tìm hiểu những khó khăn trong đọc hiểu tiếng Anh của sinh viên năm nhất chuyên ngành tiếng Anh tại một trường đại học ở Việt Nam [An investigation into difficulties in English reading comprehension of english-majored freshmen at a university in Vietnam]. *TNU Journal of Science and Technology*, *229*(3), 34-42. https://doi.org/10.34238/tnu-jst.7975

Nguyen, N. H., & Kim, T. K. (2021). Difficulties in reading comprehension of English majored sophomores at Tay Do University Can Tho, Viet Nam. *European Journal of English Language Teaching*, *6*(3). https://doi.org/10.46827/ejel.v6i3.3590

Nguyen, S. V., & Habók, A. (2020). Non-english-major students' perceptions of learner autonomy and factors influencing learner autonomy in Vietnam. *Relay Journal*, *3*(1), 122-139. https://doi.org/10.37237/relay/030110

Nguyen, T. H. (2021). Reading comprehension difficulties encountered by first-year English-majored students. *International Journal of Education, Learning and Development*, *9*(9), 51-67.

Qasem, F., Ghaleb, M., Mahdi, H. S., Al Khateeb, A., & Al Fadda, H. (2023). Dialog chatbot as an interactive online tool in enhancing ESP vocabulary learning. *Saudi Journal of Language Studies*, *3*(2), 76-86. https://doi.org/10.1108/SJLS-10-2022-0072

The National Assembly. (2005). *Education Law 38/2005/QH11 of June 14, 2005, on Education.* https://thuvienphapluat.vn/van-ban/Giao-duc/Luat-Giao-duc-2005-38-2005-QH11-2636.aspx

Tran, N. T., Tran, P. H., & Nguyen, T. T. (2019). Applying AI chatbots for teaching a foreign language: An empirical research. *International Journal of Scientific and Technology Research*, *8*(12), 897-902.

Vo, L. T. N., & Nguyen, G. M. (2024). Several teaching methods combined with the support of ai chatbot to develop self-learning competency for students. *International Journal of Current Science Research and Review, 7*(3), 1719-1724. https://doi.org/10.47191/ijcsrr/V7-i3-32

Zin, Z. M., Wong, B. E., & Rafik-Galea, S. (2014). Critical reading ability and its relation to L2 proficiency of Malaysian ESL learners. *3L, Language, Linguistics, Literature, 20*(2), 43-54.