THE EFFECTS OF AI-ASSISTED SCAFFOLDING ON VOCABULARY RETENTION AMONG NON-ENGLISH-MAJOR STUDENTS AT TON DUC THANG UNIVERSITY

TÁC ĐỘNG CỦA HỖ TRỢ HỌC TẬP BẰNG TRÍ TUỆ NHÂN TẠO ĐẾN KHẢ NĂNG GHI NHỚ TỪ VỰNG CỦA SINH VIÊN KHÔNG CHUYÊN ANH TẠI TRƯỜNG ĐẠI HỌC TÔN ĐỨC THẮNG

Ho Thi Nhu Uyen*

Creative Language Center, Ton Duc Thang University, Vietnam

*Corresponding author: hothinhuuyen@tdtu.edu.vn

(Received: September 14, 2025; Revised: October 15, 2025; Accepted: October 22, 2025)

DOI: 10.31130/ud-jst.2025.23(10A).525E

Abstract - This study investigates the effects of AI-assisted scaffolding on vocabulary retention among non-English-major students at Ton Duc Thang University. A quasi-experimental design was conducted with two groups of first-year students: an experimental group (N = 32) using AI-assisted scaffolding in vocabulary tasks and a control group (N = 34) receiving traditional instruction. A pre-test and post-test were administered to measure students' vocabulary retention while semi-structured interviews with eight students were conducted to explore their perceptions of AI-assisted scaffolding. Results showed that students in the experimental group achieved a significantly higher rate of vocabulary retention compared to the control group ($p < 0.05$). The qualitative findings further revealed that students perceived AI-assisted scaffolding as engaging, supportive, and effective in reinforcing their vocabulary knowledge. These results highlight the potential of integrating AI-based scaffolding into EFL classrooms to strengthen vocabulary acquisition.

Key words - AI-assisted scaffolding; vocabulary retention; non-English-major students; EFL; students' perceptions.

Tóm tắt - Nghiên cứu này khảo sát tác động của việc hỗ trợ học tập bằng trí tuệ nhân tạo đối với khả năng ghi nhớ từ vựng của sinh viên không chuyên Anh tại Trường Đại học Tôn Đức Thắng. Nghiên cứu bán thực nghiệm được tiến hành với hai nhóm sinh viên năm nhất: nhóm thực nghiệm (N = 32) học từ vựng bằng trí tuệ nhân tạo và nhóm đối chứng (N = 34) học theo phương pháp truyền thống. Bài kiểm tra trước và sau khóa học được dùng để đánh giá khả năng ghi nhớ từ vựng, cùng với phỏng vấn bán cấu trúc với 08 sinh viên nhằm tìm hiểu nhận thức của các em về phương pháp này. Kết quả cho thấy, nhóm thực nghiệm có khả năng ghi nhớ từ vựng tốt hơn đáng kể so với nhóm đối chứng ($p < 0.05$) và đánh giá việc hỗ trợ học tập bằng trí tuệ nhân tạo là hữu ích, hấp dẫn và hiệu quả trong việc củng cố từ vựng. Nghiên cứu khẳng định tích hợp trí tuệ nhân tạo vào giảng dạy tiếng Anh nhằm nâng cao khả năng tiếp thu từ vựng.

Từ khóa - Hỗ trợ học tập bằng trí tuệ nhân tạo; ghi nhớ từ vựng; sinh viên không chuyên Anh; học tiếng Anh như một ngoại ngữ; nhận thức của sinh viên

1. Introduction

Vocabulary is of paramount importance for foreign language learners to comprehend English texts and engage in effective communication [1]. It was found that a limited range of vocabulary significantly hinders successful communication and comprehension, consequently leading to misunderstandings and communication breakdown [2]. Moreover, it is revealed that learners with limited vocabulary often face considerable difficulty with contextual understanding, decoding meaning, expressing ideas articulately and understanding spoken and written discourse [3].

Despite its importance, there are certain significant challenges facing learners in acquiring and retaining English vocabulary [4]. These difficulties are particularly evident among non-English major university students, most of whom are usually minimally exposed to English outside the classroom and lack intrinsic motivation to study the language [5]. Previous research reveals several common obstacles in learning vocabulary, including low confidence, fear of making mistakes, overreliance on translation from their native language, and misuse of vocabulary in contexts [6]. Additionally, there are other institutional factors that contribute to the challenges, namely overcrowded classrooms, varying entry-level proficiency, and exam-oriented curricula [7].

Therefore, scaffolding students in learning vocabulary is absolutely necessary to address these challenges. With the rise of AI and tremendous benefits it offers, teachers have the tendency to integrate intelligent technologies to enhance students' learning experiences [8]. The potential of using AI to scaffold vocabulary learning, therefore, holds potential to boost students' retention of vocabulary.

The present study was conducted to investigate the effects of AI-assisted scaffolding on vocabulary retention among first-year non-English major students at Ton Duc Thang University. This research seeks to contribute to the growing body of literature on AI and vocabulary and innovative instruction on vocabulary at tertiary education level.

To achieve the aims mentioned above, there are two research questions formulated:

1. To what extent do AI-assisted scaffolding affect the vocabulary retention of first-year non-English-major

students at Ton Duc Thang University?

2. What are first-year non-English-major students' perceptions of AI-assisted scaffolding for learning and retaining vocabulary?

2. Literature review

2.1. Vocabulary in language learning

Vocabulary has been defined and interpreted in various ways from different perspectives. From a linguistic and cognitive standpoint, Bloomfield [9] referred to vocabulary as a complete set of morphemes in a language, emphasizing the structural function of vocabulary in a language. Chomsky [10], on the other hand, pointed out two most important aspects of vocabulary knowledge: competence (knowledge of language) and performance (using a language).

Considering pedagogical aspects, Ur [11] defined vocabulary as a set of words that learners must understand and use in order to communicate effectively. Similarly, Schmitt [12] also highlighted the practical importance of words and their meanings in communication. He further elaborated that knowing a word also involves the awareness of its spoken and written forms, meanings, grammar, collocations, and frequency.

Nation [13] proposed a model of vocabulary with two distinct aspects, namely receptive knowledge (the ability to recognize and understand words when listening and reading) and productive knowledge (the use of words accurately when speaking and writing). Furthermore, he proposed that a vocabulary item has three crucial components: form, meaning and use. These components are essential in supporting learners to competently obtain meaning from texts, their own expressions of ideas and meaningful communication.

2.2. Theoretical foundations of scaffolding

Scaffolding is a concept based on Vygotsky's Sociocultural Theory [14], which highlights the necessity of social interaction in learning. The core of this theory is the Zone of Proximal Development (ZPD) which is defined as the gap between what a learner can do independently and what they can achieve with guidance [14]. Wood, et al. [15] referred to scaffolding as temporary support provided by a more knowledgeable other, such as a teacher or a peer that helps learners perform tasks just beyond their current ability. When the learners become more competent, scaffolding is slowly withdrawn to promote the independence of learners and greater learner autonomy [15].

According to Sharma & Hannafin [16], scaffolding has been proven to raise motivation, ease cognitive overload, and improve academic achievement for learners. Moreover, the adaptation of the scaffolding techniques by the instructor, aligning it with the learners' varying levels of proficiency and the complexity of the tasks, would enhance engagement and persistence in the learning process [17].

2.3. Dimensions of scaffolding in EFL contexts

In English as a Foreign Language (EFL) contexts, scaffolding has been widely adapted to respond to language and cognitive demands on learners. First, the Scaffolding Cycle developed by Hammond and Gibbons [18] included four stages: building the field, modeling, joint construction, and independent construction, indicating the degree of support provided to learners as they move from supported interaction to independent use of language. Adding further nuance, Van de Pol et al. [19] identified three essential dimensions of scaffolding: contingency, fading, and transfer of control. Contingency refers to the extent to which teachers adjust supports to the learners' current performance level; fading means reducing support as competence develops, and transfer of control involves transferring responsibility from the teacher to the learners. In addition to introducing an important conceptualization of scaffolding and its fineness, they ended up forming more robust principles upon which scaffolding practices for EFL classrooms can be based. Practicing and validating the eventual transfer of teaching and learning from the teacher to the learner. Instruction in EFL contexts typically transitions from teacher input towards learner output.

2.4. Scaffolding in digital and AI-assisted learning environments

AI-assisted scaffolding has transformed traditional instruction by leveraging technology to provide adaptive and personalized guidance to learners. Umutlu and Gursoy [20] found that the AI features named natural language processing and learner modeling are effective in identifying the learners' struggles and weaknesses so as to provide tailored feedback and proper support. Similarly, Ouyang and Jiao [21] emphasized the role of AI as a learning collaborator. They believed that AI offers features that provide structured guidance to help students engage with the language content while promoting learner autonomy in their learning process.

Zuo et al. [22], on the other hand, highlighted that scaffolding strategies in an e-learning environment exerted positive impacts on students' performance, especially when the scaffolding was adaptive and aligned with learner goals. Wang et al. [23] further showed that AI-based interactive scaffolding improves learners' motivation, self-evaluation, and performance in informal digital English learning environments. These studies highlight the potential of AI-assisted scaffolding to better personalize and boost engagement, thus yielding better learning outcomes.

Collectively, AI-assisted scaffolding is the responsive support offered through AI tools to help students achieve their learning goals as well as promote their motivation and autonomy during their learning process. Built on the concept of instructional scaffolding, AI-assisted scaffolding provides individualized prompts, suggestions and feedback that are responsive to students' needs and performance.

Given the various benefits of AI-assisted scaffolding, there is still a dearth of research examining its potential in enhancing vocabulary, especially among non-English major students at tertiary level. This study, therefore, was conducted to fulfill this research gap.

3. Methodology

3.1. Research site and participants

The study was conducted at the Creative Language Center at Ton Duc Thang University, Ho Chi Minh City, Vietnam during the first semester of the 2024–2025 academic year, from September 2024 to March 2025.

There were 66 first-year non-English major students involved in the study. Aged between 18 and 21 years, approximately 62% of them were males, while around 38% were females. Before enrolling in the Foundation 1 course, all of the students had taken the placement test at the beginning of the semester.

The participants were divided into two separate groups. The experimental group (n = 32) received instruction with AI-assisted scaffolding provided by the teacher. There were 12 instructional sessions over 6 weeks. The control group (n = 34), on the other hand, was taught by the same teacher using traditional methods without the integration of AI-based scaffolding.

3.2. Research design

The study employed a quasi-experimental design with a combination of quantitative and qualitative data collection.

In terms of quantitative data, pre-tests, post-tests and a questionnaire were employed. First, the pre-tests with 40 question items including multiple choice and short-answer questions were administered to both groups at the beginning of the course to measure their baseline level of vocabulary. The post-tests, on the other hand, were conducted at the end of the course with the same format and level of difficulty as the pre-tests to measure the extent of their vocabulary improvement. The two tests were scored by two independent raters, one was the teacher in charge of the classes and the other was another English teacher in the same department. Cohen's kappa ($\kappa = 0.68$) indicated that there was a substantial level of consistency between the two raters.

For the qualitative data set, semi-structured interviews with eight volunteer students from the experimental group were carried out. The interviews were conducted by another faculty member from the center, who was also a teacher of English. This approach was taken to ensure objectivity and to avoid potential bias as the interviewer was not directly involved in the intervention.

3.3. Description of AI-assisted scaffolding in the experimental group

In the experimental group, AI-assisted scaffolding was embedded into vocabulary instruction to support the students at different stages in their learning process.

The scaffolding was organized in a purposeful cycle of modeling, guided practice and independent application with the integration of AI-assisted platforms like Quizlet, Quizizz, Gimkit and Memrise. This AI-assisted scaffolding was intentionally designed to align with the scaffolding model proposed by Van de Pol et al. [19] with the following stages: providing contingency (tailoring support), fading (reducing prompts over time), and transfer of responsibility (allowing students to use the vocabulary independently).

In modeling, the teacher modeled target vocabulary using AI-assisted technologies such as Quizlet flashcards, Quizizz, and Memrise. All these platforms automatically provided explanations in both Vietnamese and English, definitions, phonetic transcription for pronunciation and contextualized examples in sentences to demonstrate the form, meaning and use of new vocabulary items.

In guided practice, the students engaged in interactive activities using AI-assisted technology, such as Quizlet, Quizizz, Blooket, and Gimkit. These platforms provided game-like quizzes and flashcard review with immediate corrective feedback tailored to each student's performance. This support helped students to identify their weaknesses, track their progress, and gradually reinforce retention of vocabulary in an engaging and motivating way.

In the independent stage, the students were asked to use the newly learned vocabulary in both written and oral performances without the support from AI tools. For writing, they are required to write a few short reflections, short writing pieces in which they have to use at least 10 target words from the day's lesson. For the oral performance, the students either presented in class or recorded short videos in the forms of conversations, interviews that involved using the vocabulary in true communicative contexts.

Table 1. *AI-assisted scaffolding activities for vocabulary instruction*

No.	Lesson	Number of vocabulary items	AI-assisted activities (modeling & guided practice)	Independent practice activities
1	**Unit 1: People**	18	Quizlet bilingual flashcards; Quizizz definitions & pronunciation drills; Gimkit and Blooket review games	Write a short self-introduction using 10 target words; record a video describing a friend or classmate
2	**Unit 2: Work and study**	28	Quizlet flashcards; Quizizz matching & sentence practice; Blooket collaborative quizzes	Write a reflection on study habits or part-time jobs; role-play a mock interview or study-related conversation
3	**Unit 3: Daily life**	23	Quizizz sentence completion; Quizlet practice sets; Gimkit review quizzes	Keep a one-day diary using 8–10 target words; record a short video describing a daily routine
4	**Unit 4: Food**	34	Memrise contextualized dialogues; Quizizz food-related quizzes; Blooket team challenges	Write a restaurant review or food diary; create a menu presentation or food-ordering role-play
5	**Unit 5: Places**	26	Quizlet location flashcards; Quizizz multiple-choice quizzes; Gimkit review battles	Design a mini poster or presentation about a favorite place
6	**Unit 6: Family**	32	Quizizz sentence practice; Quizlet bilingual sets; Blooket family-related vocabulary games	Write a paragraph about family traditions; record a short video introducing family members

4. Findings and discussion

4.1. Findings

4.1.1. Findings from the Pre-tests and Post-tests

Using SPSS (version 22), a paired sample t-test was conducted to determine if the AI-assisted scaffolding activities had an effect on students' level of retention of English vocabulary. This was done by measuring the change in participants' performance from the pre-test to the post-test. The mean scores for the pre-tests and post tests were also reported so that the differences between before and after treatment could be seen.

Table 2. *Descriptive statistics for the pre-test and post-test scores of both groups*

		N	Min	Max	Mean	S.D
Control group (CG)	*Pre-test*	34	3.60	6.40	4.95	.521
	Post-test	34	4.80	7.20	6.32	.487
Experimental group (EG)	*Pre-test*	32	3.20	6.80	5.03	.498
	Post-test	32	5.60	8.40	7.21	.536

Table 2 shows that in the control group (n = 34), the mean score increased from M = 4.95 (SD =.521) on the pre-test to M = 6.32 (SD =.487) on the post-test, demonstrating a modest increase of approximately 1.37 points. In the experimental group (n = 32), there was a greater achievement. The mean score increased from M = 5.03 (SD =.498) on the pre-test to M = 7.21 (SD =.536) on the post-test, an increase of about 2.18 points.

In summary, while both groups showed improvement in the scores from the pre-test to the post-test, the experimental group exhibited greater gain overall, indicating that there was a greater impact of the intervention compared to traditional instruction.

Table 3. *Overall results from the paired sample t-test*

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	S.D	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
CG	*Pre-Post*	1.37	.621	.106	1.15	1.59	12.92	33	**.000**
EG	*Pre–Post*	2.18	.684	.120	1.94	2.42	18.17	31	**.000**

A paired-samples t-test was examined in order to compare pre-test scores to post-test scores for each respective group. For the control group (n = 34), results indicated a statistically significant improvement from pre-test to post-test, $t(33) = 12.92$, $p < .001$. The mean difference was 1.37 points (SD = 0.621), with a 95% confidence interval ranging from 1.15 to 1.59. This suggests that even without the experimental treatment, participants in the control group demonstrated measurable progress. In contrast, the experimental group (n = 32) showed a greater improvement in scores, with a mean difference of 2.18 points (SD = 0.684), $t(31) = 18.17$, $p < .001$, and a 95% confidence interval of [1.94, 2.42]. These findings indicate that the intervention had a substantially positive impact on the students' outcomes, with the experimental group outperforming the control group in terms of score gains.

In general, both the control and experimental groups demonstrated significant improvement between the pre-test and post-test, with the experimental group demonstrating a larger gain in vocabulary retention.

4.1.2. Findings from the interviews

Semi-structured interviews with eight participants from the experimental group revealed four major themes with respect to AI-assisted scaffolding.

First, all of the students valued the enjoyment of the game-like features of AI-assisted scaffolding that made the vocabulary practice enjoyable and motivating. As one student recalled, "*The game activities on Quizlet were really fun, like a competition, so I did not feel bored when reviewing words"* (S2). The motivation was also derived from peer interaction and healthy rivalry provided by the games. As S6 reflected, "*I enjoyed competing with my friends on Blooket. I wanted to win, so I concentrated more on choosing the right words*". Another student added, "*We laughed together during the games, which made the review more memorable*" (S4).

The students also noted that AI-assisted scaffolding was particularly useful because it was both supportive and adaptive (S1, S2, S4, S6, S7, S10). From their sharing, the flashcards provided by the teacher had bilingual explanations, pronunciation transcripts and representations of usage in clear examples, facilitating the acquisition of the words. As one participant stated, "*The flashcards on Quizlet were simple and clear, with Vietnamese meaning and example, so I could understand the words easily*" (S8). The game-based activities on the other platforms, furthermore, offered adaptive features that allowed the students to understand their weaknesses and reinforce their retention of vocabulary. One student said, "*When I got the word wrong, the game showed it again and again until I mastered it"* (S4). This repeated exposure was believed to be highly beneficial, as another student explained, "*It reminded me of the words I usually forgot, so I could practice them more carefully*" (S6).

In addition, the students also shared that the AI-assisted scaffolding activities were practical and accessible (S1, S2, S4, S5, S7, S9). Three of the respondents stated that the flashcard function on Quizlet was simple to use, requiring only a simple flip: one side displayed the word and its part of speech while the other side showed the definition, a Vietnamese equivalent, and examples of the words. One student noted, "*I could review the flashcards through the links provided by the teacher anytime at home, so I did not forget the words*" (S2). Similarly, the students highlighted the accessibility of the games on other platforms (S1, S2, S6, S10). In their opinion, the review games could be joined simply through a shared link or QR code, allowing them to join easily as long as they had an Internet connection. This was illustrated by one student: "*The QR code made it fast to join. I didn't need to log in or prepare much, just scan and play*" (S1).

However, the students also indicated some challenges in their learning process. First, technical challenges were experienced at times due to unstable Internet connections

and issues within the platforms themselves. Specifically, some participants stated weak Wi-Fi at school interrupted the flow of learning and playing (S3, S6, S9, S10). As one participant said, "*The connection was slow, so my answers didn't even load, so that meant I lost the game even though I knew the words*" (S6). Three other students (S3, S5, S8) complained about the Gimkit game, describing it as their least favorite platform because they sometimes could not even load the questions due to frequent lagging. Additionally, several students reported problems with their devices such as forgetting to bring their phones or running out of battery, which sometimes forced them to share devices with their friends (S1, S3, S6, S7). This situation, from their sharing, limited their ability to engage fully in the activities and reduced the effectiveness of vocabulary review.

4.2. Discussion

The findings of this study suggest that the intervention of AI-assisted scaffolding was effective in improving the students' vocabulary retention. Quantitative data showed that all students improved from the pre-tests to the post-tests but the experimental group was shown to demonstrate significantly greater improvement in retaining vocabulary. These results are consistent with the finding of Zuo et al. [22], who stated that adaptive scaffolding in e-learning environments has a positive on learner outcomes and with that of Wang et al. [23] who revealed that AI-assisted scaffolding increases motivation and improves performance when aligned with learners' goals.

The qualitative findings also echoed what has been presented within existing literature of scaffolding frameworks. Specifically, Hammond and Gibbons [18] and Van de Pol et al. [19] had described scaffolding as a cycle that moves through modeling, guided practice, and independent use. Relatedly, this study viewed AI-assisted activities as having similar phases: flashcards for modeling, gamified practice for guided practice, and finally independent tasks with vocabulary in writing and speaking.

It was also found that the students perceived the use of AI-assisted scaffolding as enjoyable and motivating. In their opinion, the game-like features turned the vocabulary practice from a repetitive activity to a fun and engaging experience. This finding is in line with the view of Sharma and Hannafin [16] positing that scaffolding lessens cognitive overload while promoting persistence and with Wang et al.'s finding [23] that AI-supported scaffolding enhances motivation for learners in digital spaces.

However, there are some new findings that extend the existing literature. This study highlights the application of AI-assisted scaffolding for non-English-major students at a university in Vietnam. These learners typically have limited exposure to English and low intrinsic motivation, making vocabulary learning particularly difficult. By focusing on this new context and sample, the study broadens the scope of scaffolding research and demonstrates that AI-assisted scaffolding can be effective even for underrepresented groups who face persistent challenges in language learning.

A further insight from this study relates to accessibility, which has not been discussed in previous research on scaffolding. Some of the students commented that AI-assisted platforms were simple and accessible, with either a QR code to scan, shared link, or simple use of flashcards.

The current research also found out practical problems facing the students that are rarely discussed in the literature. Among these problems were some technical issues, such as poor internet connection, lagging platforms, and access to devices, which impacted participation and engagement and made certain activities less effective.

5. Conclusion

The study aimed to examine the effects of AI-assisted scaffolding on vocabulary retention among the non-English major students at Ton Duc Thang University. The quantitative results showed that the participants in the experimental group who received scaffolding with the integration of AI retained vocabulary better compared to the control group. The qualitative findings also indicated that the students found the AI-assisted scaffolding fun, supportive, and accessible and they experienced increased motivation and retention with gamification, bilingual flashcards and adaptive feedback. However, practical difficulties, including unreliable Internet connection, lagging platforms, limited access to devices, etc. were identified as challenges in fully utilizing these types of tools.

Although there were some positive findings, this study has some limitations. First, the sample size was small (N = 66) and limited to one university, which may limit the generalization of the findings. Second, the intervention was rather short; hence, it was not possible to make conclusions about the long-term effects of AI-assisted scaffolding on vocabulary retention. Moreover, the quasi-experimental design without random assignment may limit the ability to control prior differences in the two groups that may have influenced the results.

Based on these limitations, it is recommended that future research involves a larger and more diverse sample across different institutions and contexts so that external validity could be maximized and more generalizable results could be achieved. Moreover, future studies may focus on technical challenges that the students face and consider the roles of teachers and institutions in applying AI-assisted scaffolding. Last but not least, further research might be conducted to examine the effects of AI-assisted scaffolding on other language skills such as listening, speaking, reading, and writing in order to provide a more comprehensive understanding of its potential impact in EFL contexts.

The study offers several pedagogical implications for EFL instruction. First, the findings demonstrate that AI-assisted scaffolding is an effective method to develop students' vocabulary retention. Therefore, it should be integrated as a complement to traditional teaching practices to enhance students' learning outcomes. Moreover, the obstacles facing the students in this study emphasize the importance of teacher training and institution support.

Teachers need sufficient training and digital literacy to use AI effectively while institutions must develop reliable infrastructure and supportive policies that will help students to get the full benefits of AI-assisted scaffolding.

Acknowledgments: The author gratefully appreciates the teacher participants at Creative Language Center, Ton Duc Thang University for their support and contributions to this research.

REFERENCES

[1] H. P. Mukhtar, Z. Ali, and R. A. Font, "The importance of vocabulary in reading among EFL learners", *European Proceedings of Educational Sciences*, 2024. DOI: 10.15405/epes.23097.61

[2] M. Alqahtani, "The importance of vocabulary in language learning and how to be taught", *Int. J. Teach. Educ.*, vol. 3, no. 3, pp. 21–34, 2015. https://doi.org/10.20472/TE.2015.3.3.002

[3] A. Annisa, "Techniques in presenting vocabulary to young EFL learners", *J. English Educ.*, vol. 1, no. 1, pp. 11–20, 2013.

[4] N. Schmitt, "Review article: Instructed second language vocabulary learning", *Lang. Teach. Res.*, vol. 12, no. 3, pp. 329–363, 2008. https://doi.org/10.1177/1362168808089921

[5] N. H. U. Chau, "Factors affecting non-English major students' English proficiency at Hoa Binh University: Current situation and solutions", *Hoa Binh Univ. J. Sci. Technol.*, no. 14, pp. 54–61, 2024.

[6] N. T. Linh and P. T. Hang, "Challenges faced by non-major students in learning English to achieve the outcomes at a Vietnam public university", *VNU J. Sci.: Educ. Res.*, Jul. 2025, Advance online publication. https://doi.org/10.25073/2588-1159/vnuer.4978

[7] N. Afzal, "A study on vocabulary-learning problems encountered by BA English majors at the university level of education", *Arab World English J.*, vol. 10, no. 3, pp. 81–98, 2019. https://doi.org/10.24093/awej/vol10no3.6

[8] Y. Yang, "AI-supported L2 vocabulary acquisition: A systematic review from 2015 to 2023", *Educ. Inf. Technol.*, vol. 30, pp. 17995–18029, 2025. https://doi.org/10.1007/s10639-025-13417-8

[9] L. Bloomfield, *Language*. New York, NY, USA: Holt, Rinehart and Winston, 1933.

[10] N. Chomsky, *Aspects of the Theory of Syntax*. Cambridge, MA, USA: MIT Press, 1965.

[11] P. Ur, *A Course in Language Teaching: Practice and Theory*. Cambridge, U.K.: Cambridge Univ. Press, 1996.

[12] N. Schmitt, *Vocabulary in Language Teaching*. Cambridge, U.K.: Cambridge Univ. Press, 2000.

[13] I. S. P. Nation, *Learning Vocabulary in Another Language*. Cambridge, U.K.: Cambridge Univ. Press, 2001. https://doi.org/10.1017/CBO9781139524759

[14] L. S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA, USA: Harvard Univ. Press, 1978.

[15] D. Wood, J. S. Bruner, and G. Ross, "The role of tutoring in problem solving", *J. Child Psychol. Psychiatry*, vol. 17, no. 2, pp. 89–100, 1976. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

[16] P. Sharma and M. J. Hannafin, "Scaffolding in technology-enhanced learning environments", *Interact. Learn. Environ.*, vol. 15, no. 1, pp. 27–46, 2007. https://doi.org/10.1080/10494820600996972

[17] J. Hammond, *Scaffolding: Teaching and Learning in Language and Literacy Education*. Sydney, Australia: Primary English Teaching Assoc. (PETA), 2001.

[18] J. Hammond and P. Gibbons, "Putting scaffolding to work: The contribution of scaffolding in articulating ESL education", *Prospect*, vol. 20, no. 1, pp. 6–30, 2005.

[19] J. van de Pol, M. Volman, and J. Beishuizen, "Scaffolding in teacher–student interaction: A decade of research", *Educ. Psychol. Rev*., vol. 22, no. 3, pp. 271–296, 2010. https://doi.org/10.1007/s10648-010-9127-6

[20] D. Umutlu and M. E. Gursoy, "Leveraging artificial intelligence techniques for effective scaffolding of personalized learning in workplaces", in *Artificial Intelligence Education in the Context of Work*, M. E. Gursoy and D. Umutlu, Eds. Cham, Switzerland: Springer, 2022, pp. 59–76. https://doi.org/10.1007/978-3-031-14489-9_4

[21] F. Ouyang and P. Jiao, "Artificial intelligence in education: The three paradigms*", Comput. Educ.: Artif. Intell.,* vol. 2, p. 100020, 2021. https://doi.org/10.1016/j.caeai.2021.100020

[22] M. Zuo, S. Kong, Y. Ma, Y. Hu, and M. Xiao, "The effects of using scaffolding in online learning: A meta-analysis", *Educ. Sci.*, vol. 13, no. 7, p. 705, 2023. https://doi.org/10.3390/educsci13070705

[23] X. Wang, C. Xia, Q. Zhao, and L. Chen, "Enhancing second language motivation and facilitating vocabulary acquisition in an EFL classroom through translanguaging practices", *Appl. Linguist. Rev.*, vol. 16, no. 5, 2025. [Online]. Available: https://www.degruyterbrill.com/document/doi/10.1515/applirev-2024-0292/html