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Effects of self-regulated vocabulary learning with chatbots on incidental and collocational vocabulary learning and foreign language learning boredom

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Abstract

Recent advances in artificial intelligence have introduced generative AI chatbots as a mediating tool for vocabulary learning. While self-regulated vocabulary learning strategies help to promote learner autonomy, maintaining motivation and reducing boredom remain challenges. This study investigated the effects of integrating generative AI chatbots into self-regulated vocabulary learning and on incidental vocabulary knowledge, receptive knowledge of collocations, and foreign language learning boredom. It also examines EFL learners' attitudes toward using AI chatbots. Using a quasi-experimental design, 187 EFL learners were randomly grouped into a control group (CG) of 93 learners and an experimental group (EG) of 94 learners. Both groups completed pretests and posttests on vocabulary, collocations, and boredom. Over 18 sessions, the EG practiced self-regulated learning with AI chatbots, while the CG received traditional instruction without AI tools. Interviews were conducted with 16 EG participants. Results showed that the EG outperformed the CG in vocabulary and collocation knowledge and reported lower levels of boredom. Interview data supported these findings, revealing increased learner autonomy, motivation, and reduced anxiety. Participants reported satisfaction with the chatbots' interactive and personalized features, which encouraged learning beyond the classroom. These findings suggest that generative AI chatbots create engaging, personalized learning environments that promote self-regulated learning and improve vocabulary outcomes in EFL settings.

Keywords Generative AI chatbots, Self-Regulated learning, Incidental vocabulary learning, Foreign language boredom, Receptive knowledge of collocations

1 Introduction

The integration of artificial intelligence (AI) into education has emerged as a radical shift, providing more personalized and adaptive learning opportunities [4]. This era has been marked by emerging trends toward digital resources, gamified learning experiences, and customized learning assets [76]. Among AI tools, generative chatbots receive attention



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due to their ability to simulate human-like interaction through natural language processing [62]. Accessed through affordances on websites and instant messaging applications, they afford adaptive educational content. For foreign language learners, they can particularly provide continuous input, dynamic feedback, and review opportunities, providing for more manageable study sessions [6].

AI chatbots are defined as “smart bots, interactive agents, digital assistants, or artificial conversation entities” that can fulfill the requisite tasks [2], p. 373). Research highlights their potential use for vocabulary learning, comprehension, and conversational practice through immediate and personalized responses [10, 34, 35]. This potential has evolved from existing chatbot designs working on rule-based or task-oriented systems, which lacked the personalization [18] necessary to pedagogically effective AI chatbots that fill the role of automated personalized tutors [58]. These AI chatbots are tasked with fostering active and emotional engagement in knowledge building rather than just passive reception of information [15, 71] when learning a foreign language. Such designs have been found to be effective for long-term retention and incidental vocabulary learning [76].

Recent research on vocabulary learning has acknowledged multi-word entities (hereby, collocations) as a *sine qua non* for fluency and proficiency in a second language [51, 64]. Examples such as *make a phone call* or *weak point* show both grammatical collocations and lexical collocations [9, 38]. Despite their importance in language learning, collocations remain behind single-word learning [60] due to limited opportunities for practice and context-specific usage difficulties, which make collocations less noticeable to learners [56, 65].

While cognitive aspects of vocabulary acquisition are well-researched [37, 48], emotional dimensions, especially boredom, have received less attention, though they are vital to teach vocabulary in an EFL context [5]. Boredom, framed as a multi-layered concept entailing affective, cognitive, and situational factors [25, 55, 75], can affect motivation, engagement, and performance in a current activity [46]. In foreign language learning, the causes of boredom can be teacher-, student-, or activity-induced [42]. All of which can be mitigated to an extent through engaging and relevant instruction [59]. Recent studies, especially after the Covid-19 pandemic, have further emphasized the dynamic interplay between boredom and other affective or cognitive factors such as enjoyment and learning achievement [20, 69].

Innovative technologies such as AI chatbots have been applied to language learning, specifically targeting incidental vocabulary learning. Collocations can also be taught effectively through the adaptive, dynamic, and immediate responses of AI chatbots, which are highly likely to reduce boredom and stimulate long-term vocabulary retention [1]. However, to our knowledge, few studies have examined how integrating self-regulated vocabulary learning strategies with generative AI chatbots affects incidental vocabulary knowledge, receptive collocation knowledge, and boredom among EFL learners [61]. Therefore, the current study addresses the gap by investigating these effects and exploring learners' psychological states and attitudes toward chatbot-assisted vocabulary learning.

2 Theoretical framework and literature review

This study is grounded in a multi-dimensional theoretical framework to explain how chatbots impact vocabulary learning in an EFL setting, can foster collocational knowledge, and connect emotional factors such as boredom with learning outcomes. With an interconnected understanding of self-regulated, constructivist, and incidental learning theories, frequency and sociocultural perspectives, flow theory, and emotional regulation strategies, using generative artificial intelligence (GenAI) in foreign language education can be a relevant influencing factor on cognitive, behavioral, and affective processes in foreign language learning. This intersection is grounded in marking the dimensions of learning that chatbots can influence, such as learners' own planning and self-monitoring, making meaning through contextualized interaction, unintentional taking away through repeated exposure to input, collaboration, and emotional engagement.

As emphasized by Self-Regulated Learning Theory [77], autonomy and learners' self-monitoring of their performance or knowledge are key to learning. Interacting with chatbots independently affords learners opportunities for individualized learning paths, real-time, dynamic feedback, and adaptive prompts. Chatbots have been found to be supportive of learner's learning processes. With interaction, learners can autonomously identify learning assets, plan strategies, and observe their learning journey [33]. In GenAI-assisted contexts, such personalization is natural since there is no agency other than AI-assisted systems like chatbots and the learner during the interaction. In vocabulary learning with chatbot intervention, learner autonomy and self-paced instruction can indirectly facilitate incidental vocabulary learning [32, 67].

Constructivist Learning Theory with Vygotsky's sociocultural perspective [66, 72] addresses the social-interactive dimension of chatbot learning. Chatbots can co-create language input along with peer or tutor interaction and scaffold learners to progress in their learning. This could be counted as adaptive support, as chatbots can dynamically adjust linguistic complexity, request further input, and provide authentic contexts with examples thereby reinforcing collocation usage and understanding the contextual meaning of words [71].

Incidental Learning Theory [39, 63] aligns with SRL and Constructivist Learning theory by highlighting unintentional learning through meaningful and repeated exposure. In chatbot-assisted tasks, learners might encounter vocabulary and collocations in authentic dialogues, which provide for lexical expansion or refinement [23].

Frequency Theory [23] and Sociocultural Theory [66] strengthen the collocation dimension. Chatbots can scaffold learners' target vocabulary, providing high-frequency exposure to them [43]. Such high-frequency exposure and repetition in authentic contexts help increase retention and foster vocabulary learning [9, 51].

Emotional Regulation [28] addresses learners' potential to identify and manage emotional responses which affect entire learning processes, while Flow Theory [19] emphasizes that focused engagement and enjoyment lead to an increase in motivation to learn. Such flow in time and content while learning can avoid boredom and strengthen learning outcomes. In a foreign-language learning context, boredom, frustration, and anxiety can pose challenges to emotional regulation [68]. Chatbots can fight off such challenges and enhance emotional regulation by providing real-time responses, interactive dialogue, and personalized content, all while improving vocabulary retention [68, 76],

The interplay between these theories and perspectives is shown in Fig. 1 below.

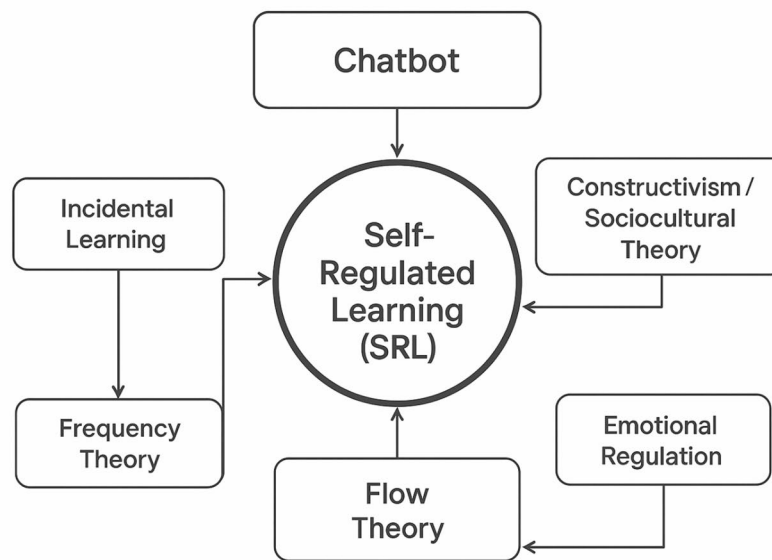


Fig. 1 Integrated Theoretical Framework for AI Chatbot-Assisted Vocabulary Learning

As illustrated, SRL is the core mechanism that relates learner-chatbot interaction with social, emotional, and cognitive dimensions of language learning. Drawing on this interconnected theoretical framework, several studies aim to investigate how such a theoretically framed conceptualization of the SRL model can be developed in a learning context with a focus on metacognitive support by GenAI [73, 74] and self-efficacy [11]. Specifically, these studies have zoomed in on how chatbots interplay with SRL processes and facilitate cognitive skills, especially with students with higher proficiency [73]. Different than English as a subject, Ng et al. [57] examined whether SRL could be effective in improving science learning. They found that due to chatbots' adaptability and potential for personalization of the instruction, they can alleviate anxiety and facilitate motivation, leading to tangible improvement in learning outcomes. Likewise, Chen et al. [11] found that when engaged in dialogic interaction with GenAI tools such as ChatGPT and SRL strategy implementation, programming education students increase their self-efficacy and subject-related knowledge. In general, the extensive systematic review by Guan et al. [29] noted that SRL processes, along with learning outcomes, are enhanced using chatbots across diverse domains.

Within this line of thinking, empirical studies have been conducted to validate the effect of chatbots on vocabulary learning. To exemplify, Wang and Akhter [68] found that chatbots significantly contribute to emotional regulation and vocabulary retention. With an experiment of an eight-week study in an EFL context, Hao et al. [32] noted that chatbot-assisted self-regulated vocabulary learning increased students' performance, metacognitive strategy use, and perceived autonomy. Likewise, Jeon [36] indicated that chatbot-assisted vocabulary interventions can create a diagnostic report on vocabulary learning progression and help learners monitor their own learning based on evidence, which could imply effectiveness for increasing learner autonomy and metacognitive strategy use. In a similar vein, Kim [40] noted that an eight-week vocabulary learning intervention with a chatbot increased learners' word knowledge and, as a side effect, their motivation and self-confidence. He also noted a positive effect on their use of

emotional regulation strategies while learning vocabulary, with students reporting less anxiety and boredom. Focusing on receptive and productive vocabulary gains, Zhang and Huang [76] researched how chatbots could facilitate incidental vocabulary learning and found that chatbots, when designed pedagogically, could facilitate incidental vocabulary learning. Ait Baha et al. [3] emphasized that chatbots can create enhanced learning experiences, encouraging students to self-regulate their pace and motivate themselves to learn.

Although existing research has highlighted improvements in linguistic, cognitive, and affective factors when using chatbots in foreign language education contexts, there remains a gap in integrating self-regulated vocabulary learning strategies, especially for collocation teaching with chatbots, and in understanding their affective benefits, such as reducing boredom. Therefore, this research aims to contribute to the field by investigating the effects of integrating chatbots into self-regulated vocabulary learning, specifically on incidental vocabulary knowledge, receptive knowledge of collocations, and foreign language learning boredom. The following research questions were formed:

1. What is the effect of practicing self-regulated vocabulary learning strategies with a chatbot on incidental vocabulary learning knowledge among EFL learners?
2. What is the impact of practicing self-regulated vocabulary learning strategies with a chatbot on learners' receptive knowledge of collocations?
3. To what extent does the use of self-regulated vocabulary learning strategies with a chatbot influence foreign language learning boredom?
4. What are EFL learners' attitudes toward using chatbots in learning English?

3 Method

3.1 Participants

The study involved 187 EFL learners aged 17 to 22, recruited from three English language institutes in Türkiye. Participants were selected using convenience sampling. Of the 187 learners, ninety-four were randomly assigned to the EG, and ninety-three to the CG. The EG engaged with generative AI chatbots for self-regulated vocabulary learning strategies, while the CG followed traditional vocabulary instruction without AI integration. All participants had a B2 level of English at the time of treatment. To ensure ethical standards, participants were informed about the study's objectives and their rights to confidentiality. Consent forms were obtained from each participant before the treatment.

In addition, detailed data privacy measures were implemented, including anonymization of all participant data and chatbot interaction records. No personally identifiable information was stored alongside the chatbot data, and all digital records were securely stored with restricted access.

3.2 Instruments

3.2.1 Vocabulary test

The vocabulary test consisted of forty multiple-choice items designed to assess learners' incidental vocabulary knowledge. It was administered as both a pretest and a posttest to measure vocabulary gains over the course of the study. Test items were adapted from authoritative and widely recognized EFL proficiency materials, including sections of the *Oxford Placement Test* and the *Cambridge English Vocabulary Profile*. This approach

enhanced the credibility and authenticity of the assessment. Items were selected to match the vocabulary taught during the eighteen treatment sessions. To ensure content validity, three language assessment experts reviewed the items for appropriateness, clarity, and alignment with the study's objectives. Reliability was confirmed with a Cronbach's alpha value of 0.87. Each correct answer on the test was scored as one, and a wrong answer as zero.

4 Collocation test

The collocation test, also consisting of forty items, was used to assess the participants' receptive knowledge of English collocations. Like the vocabulary test, it was administered as both a pretest and a posttest to measure any improvements in collocation knowledge. The test included a variety of collocation types, such as verb-noun, adjective-noun, and prepositional phrases covered during the intervention. To ensure validity, the collocation items were selected based on established corpora (COCA) and reviewed by a linguist. Each correct answer on the test was scored one, and each wrong answer was score zero. The reliability of the test was confirmed with a Cronbach's alpha of 0.89.

4.1 Foreign Language learning boredom scale (FLLBS)

To collect data on foreign language learning boredom, the researchers adapted the FLLBS, originally developed by Li et al. [47]. The FLLBS is a five-point Likert scale with items ranging from 1 (totally disagree) to 5 (totally agree) and it was originally designed to assess boredom in foreign language classrooms. The scale consists of thirty-two items entailing seven factors: (1) Foreign language class boredom (2) Under-challenging task boredom (3) PowerPoint presentation boredom (4) Homework boredom (5) Teacher-dislike boredom (6) General learning trait boredom (7) Over-challenging or meaningless task boredom. For the current study, the FLLBS was adapted to include the chatbots. The scale was therefore reduced from thirty-two items to twenty-one, with each factor comprising three items. The adapted version maintained the aim of the original instrument but was adapted to the generative AI-assisted language learning environment used in this research. The reduction was justified because nine original items were relevant to rituals of a traditional classroom setting (e.g., PowerPoint presentation boredom) and were not specifically relevant in the AI-assisted self-regulated language learning context. To ensure the validity of the modified FLLBS, two expert reviewers from psychology and educational science checked it. They confirmed that the scale accurately reflected the experience of boredom within this AI-assisted self-regulated learning context. A pilot study was conducted with a sample of eighteen learners who were not part of the main study. Based on the feedback, further minor adjustments were made. The reliability of the adapted FLLBS was checked, and Cronbach's Alpha coefficient was found to be 0.92.

4.2 Interview

The interviews employed a semi-structured format with open-ended questions focused on several areas, such as participants' learning experiences with chatbots during vocabulary learning, any changes in their feelings of boredom or deep engagement during interactions with the chatbot, and their understanding and retention of collocations through interactions with the chatbot. Sixteen students were interviewed for 40-minute sessions. After the interviews, the data was transcribed and identified for initial coding. After

that, codes were grouped into themes: learning impact of chatbot interaction, boredom, and increasing motivation and autonomy.

4.3 Data collection procedures and treatment

In this study, ChatGPT was implemented as a chatbot to facilitate vocabulary and collocation learning for the EG. Over eighteen sessions, both the EG and the CG engaged with the same set of 10 carefully selected reading texts, which collectively introduced 180 target collocations and new vocabulary items. To assess the effectiveness of the interventions, participants completed pretests and posttests measuring incidental vocabulary acquisition, receptive knowledge of collocations, and levels of foreign language learning boredom.

The EG followed SRL strategies within the chatbot-assisted sessions as follows:

- Self-monitoring: Learners were encouraged to monitor their understanding and progress during the interactions with the chatbot by reflecting on their responses.
- Mnemonic techniques: The chatbot introduced learning assets in alignment with learner preferences, such as associations or infographics, to enhance vocabulary retention.
- Use of technology: ChatGPT embodies adaptive systems by providing real-time and personalized feedback.
- Peer learning element with chatbot: The chatbot mimicked dialogic flow in interaction, such as turn-taking and clarification requests, facilitating active engagement.

The EG also engaged in targeted vocabulary exercises with a definition and contextualized examples and were prompted with hints when learners had difficulties in understanding the target word or collocations. Conversely, the CG received traditional classroom instruction without a chatbot application. Instruction involved teacher-led activities such as looking up words, completing vocabulary exercises, and repetition drills based on the same texts and vocabulary targets. The CG was also guided to practice SRL strategies, including self-monitoring, mnemonic use, and peer learning; however, these were implemented under teacher supervision. To maintain consistency, both groups had equivalent access to the coursebook, the standardized lesson plan, and class time.

Additionally, for the EG learner, progress in SRL strategies was monitored through learners' reflections and prompts used within the chatbot sessions. In the CG, teachers facilitated similar reflective activities during class discussions and assignments.

To sum up, both groups completed pre- and post-tests to measure any variation in incidental vocabulary knowledge, collocational understanding, and levels of foreign language learning boredom. To have a broader understanding of the AI-assisted experience, 16 participants from the EG were interviewed for further insights.

4.4 Data analyses

For the analysis of quantitative data, independent samples t-tests were used to compare the performance of the EG and CG groups on the pretests across the three dependent variables. Additionally, ANCOVA was used to assess the impact of the chatbot intervention on posttest scores.

Table 1 Descriptive statistics for pretest scores

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Vocabulary	EG	94	17.46	4.45	0.45
	CG	93	18.23	4.39	0.45
Collocation	EG	94	19.41	4.17	0.43
	CG	93	18.40	3.94	0.40
Boredom	EG	94	74.91	6.29	0.64
	CG	93	73.59	6.87	0.71

Table 2 Independent samples t-test for pretest scores

	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
Vocabulary	0.00	0.97	1.18	185	0.23	−0.76	0.64
			1.18	184.99	0.23	−0.76	0.64
Collocation	0.11	0.73	1.69	185	0.09	1.00	0.59
			1.69	184.58	0.09	1.00	0.59
Boredom	0.94	0.33	1.37	185	0.17	1.32	0.96
			1.37	183.22	0.17	1.32	0.96

Table 3 Descriptive statistics for vocabulary posttest scores

Groups	Mean	Std. Deviation	N
EG	29.80	6.32	94
CG	22.75	7.81	93
Total	26.29	7.92	187

4.5 Quantitative results

To answer three research questions, pre-test and post-test analyses for vocabulary learning, collocation, and boredom are presented separately in the following tables, numbered 1–8. Tables present descriptive statistics and inferential tests (ANCOVA) that compare both groups' performance before and after the intervention.

In Table 1, the pretest statistics for vocabulary, collocation, and boredom show similar value for both the EG and CG. The mean vocabulary score for the EG is 17.46, while the CG scored slightly higher at 18.23, with low standard deviations in both groups. For collocation, the EG had a mean score of 19.41, and the CG had 18.40, showing minimal difference. In terms of boredom, the EG reported a slightly higher mean score (74.91) than the CG (73.59), with both groups showing similar variability.

Table 2 presents the results of independent samples t-tests conducted on pretest scores for vocabulary, collocation, and boredom. Levene's test confirmed the assumption of equal variances across groups for all variables ($p > .05$). The t-test results revealed no statistically significant differences between the EG and CG on vocabulary ($t(185) = 1.18$, $p = .23$), collocation ($t(185) = 1.69$, $p = .09$), or boredom ($t(185) = 1.37$, $p = .17$). These findings indicate that the two groups were equivalent in terms of vocabulary knowledge, receptive collocation knowledge, and level of boredom.

In Table 3, the posttest results show that the EG outperformed the CG in vocabulary knowledge. The mean vocabulary score for the EG was 29.80 compared to 22.75 for the CG, indicating improvement in the EG's vocabulary knowledge. The standard deviations

Table 4 ANCOVA results for vocabulary posttest scores

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2858.18 ^a	2	1429.09	29.84	0.00	0.24
Intercept	4045.92	1	4045.92	84.49	0.00	0.31
Pretest	530.82	1	530.82	11.08	0.00	0.05
Groups	2506.47	1	2506.47	52.34	0.00	0.22
Error	8811.04	184	47.88			
Total	141010.00	187				
Corrected Total	11669.23	186				

Table 5 Descriptive statistics for collocation posttest scores

Groups	Mean	Std. Deviation	N
EG	27.92	8.14	94
CG	23.24	7.77	93
Total	25.59	8.28	187

Table 6 ANCOVA results for collocation posttest scores

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1795.84 ^a	2	897.92	15.07	0.00	0.14
Intercept	2106.91	1	2106.91	35.36	0.00	0.16
pretest	772.71	1	772.71	12.97	0.00	0.06
groups	801.18	1	801.18	13.44	0.00	0.06
Error	10961.07	184	59.57			
Total	135299.00	187				
Corrected Total	12756.92	186				

Table 7 Descriptive statistics for boredom posttest scores

Groups	Mean	Std. Deviation	N
EG	62.36	10.39	94
CG	69.81	9.91	93
Total	66.06	10.80	187

for both groups suggest that individual performance varied more within the CG than the EG. These findings highlight the positive impact of chatbots on vocabulary learning.

The ANCOVA analysis in Table 4 displays a significant effect of the group on vocabulary posttest scores ($p < .001$), with the experimental treatment accounting for 22% of the variance in vocabulary outcomes (Partial Eta Squared = 0.22).

Table 5 displays descriptive statistics for the collocation posttest scores and indicates that the EG had a higher mean score (27.92) than the CG (23.24). This suggests that the EG benefited from the chatbot intervention in terms of collocation learning.

Results in Table 6 show a significant group effect on collocation posttest scores ($p < .001$), with the chatbot accounting for 6% of the variance in outcomes (Partial Eta Squared = 0.06). This result indicates that the EG outperformed the CG in receptive collocation knowledge. Also, the model explained about 14% of the variance in posttest scores (Partial Eta Squared = 0.14) and found that the chatbot intervention had a statistically significant effect on improving students' collocational knowledge.

As shown in Table 7, the posttest results for boredom indicate that the EG reported lower boredom levels (Mean = 62.36) than the CG (Mean = 69.81), suggesting that learners felt less bored during learning.

Table 8 ANCOVA results for boredom posttest scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4452.18 ^a	2	2226.09	23.74	0.00	0.20
Intercept	1341.00	1	1341.00	14.30	0.00	0.07
Pretest	1853.68	1	1853.68	19.77	0.00	0.09
Groups	3029.46	1	3029.46	32.31	0.00	0.14
Error	17249.91	184	93.75			
Total	837991.00	187				
Corrected Total	21702.09	186				

The ANCOVA analysis in Table 8 shows a significant group effect on posttest boredom scores ($p < .001$), with the intervention accounting for 14% of the variance (Partial Eta Squared = 0.14), suggesting that chatbot use alleviated learner boredom.

4.6 Qualitative results

The qualitative data consisted of 45 statements from participants' reflections and feedback about their experiences with chatbot-assisted vocabulary and collocation learning. These statements were thematically categorized using a content analysis approach. The themes identified were the learning impact of chatbot use, alleviated boredom, increased motivation, and autonomy. Some exemplary statements are listed below.

4.6.1 Effectiveness of AI in vocabulary and collocation learning (15 Statements)

1. I found that using AI chatbots helped me remember new vocabulary more effectively.
2. The chatbot provided personalized feedback that improved my vocabulary retention.
3. Interacting with the chatbot made learning unfamiliar words more engaging.
4. I learned collocations more quickly using the chatbot than our classroom methods.
5. The chatbot's explanations of vocabulary and collocations were clear and it provided me with some extra context when needed.
6. I noticed a significant improvement in my vocabulary knowledge after using AI tools.
7. The chatbot offered numerous examples that helped me understand how a word is used.
8. When using the chatbot, I noticed extra words in context.
9. I liked the rapid feedback from the chatbot.
10. The chatbot helped me find the collocations easily in examples.
11. I felt more confident in working on words assigned with the chatbot.
12. The activities with the chatbot were beneficial for my vocabulary learning.
13. I could work with a chatbot as I wanted to. I felt no stress in finishing the task and did the tasks within the time limit I set.
14. The chatbot was enjoyable, and I learned some unfamiliar words with fun.
15. I could still remember the words the chatbot explained with the extra information. I asked it some questions, and it replied immediately.

4.6.2 Reducing boredom (12 Statements)

1. Using the chatbot made my vocabulary learning more enjoyable.
2. I did not get bored during vocabulary exercises when using the AI.
3. Explanation and different activities were engaging.
4. Chatting with the chatbot was more interesting than our classroom activities.

5. The AI's gamified approach helped reduce feelings of boredom.
6. I would like to use the chatbot for more vocabulary practice.
7. The chatbot had fun replies, and they made learning feel less boring.
8. The chatbot kept my attention.
9. I asked to have more examples, and some of them were difficult for me, and I felt challenged.
10. I enjoyed the interaction with the chatbot compared to writing unfamiliar words ten times.
11. When interacting with the chatbot, I focused on new things, which helped to reduce my boredom.
12. The responses from the chatbot kept me interested when interacting.

4.6.3 Increasing motivation and autonomy (17 Statements)

1. Using chatbots motivated me to practice vocabulary.
2. The chatbot encouraged me to follow my conversations and find out word meanings through past chats.
3. I felt more motivated to learn unfamiliar words based on the chatbot's suggestions.
4. The chatbot created a work schedule for me and I followed it to learn unfamiliar words.
5. I liked having freedom to choose my vocabulary learning activities with the chatbot.
6. The chatbot motivated me to keep on learning.
7. I felt more flexible learning with the chatbot's suggestions.
8. The response or corrections I received helped me to focus on my mistakes.
9. I was more willing to study with the chatbot.
10. The chatbot summarized the target words when I asked, and it motivated me to follow up on my work. It was like a live speaking vocabulary notebook for me.
11. I had a feeling of success when I completed vocabulary exercises with it.
12. The chatbot's appraising words increased my self-confidence.
13. The chatbot's learning plan, tailored to my demands, increased my motivation to learn.
14. I enjoyed my freedom to ask questions when studying with chatbot.
15. That chatbot had an interesting response to my questions when doing vocabulary exercises.
16. I was interested in using the chatbot for vocabulary exercises.
17. I felt that the chatbot was a peer with which I could work. I liked learning unfamiliar words with it.

5 Discussion

This study investigated the effect of integrating generative AI chatbots into self-regulated vocabulary learning and its effects on incidental vocabulary knowledge, receptive knowledge of collocations and foreign language learning boredom. Based on the statistical analyses of quantitative data, it was found that the integration of the chatbot significantly improved learners' vocabulary acquisition. Qualitative data analysis further supported this finding, indicating positive benefits for learners in the EG. Identified themes from interviews included user impressions of chatbot-assisted language learning and its effects on boredom, motivation, and autonomy. Quantitative results showed

that EFL learners in the EG demonstrated increased learner autonomy, greater motivation and engagement, and reduced boredom during vocabulary tasks with the chatbot. A key explanation for these improvements could be attributed to the interactive nature of the chatbots, which could foster a more self-regulated approach to vocabulary learning. Learners enjoyed the chatbots' responses, work plans, and feedback, and reported an increased enjoyment in learning activities outside the classroom. These findings reveal the benefits of chatbot-assisted vocabulary learning for both vocabulary learning (general and collocations) and learners' emotional state.

The findings of the current study align with the research by Kim [36, 40, 76] in confirming the effectiveness of generative AI chatbots in supporting self-regulated vocabulary learning and enhancing vocabulary acquisition. Likewise, this study also corroborates with the studies by Adamopoulou and Moussiades [2, 16, 49] and reiterates the key point that the use of chatbots in educational settings can increase exposure to the target language, which positively influences learners' engagement and language development. In this study, the EG showed significant gains in incidental vocabulary knowledge and receptive knowledge of collocations due to chatbots' affordances such as contextualized language input and automated feedback [12].

Additionally, the reduction in boredom observed during language learning in the EG is supported by Han's [31] study. This can confirm that the use of AI chatbots can positively impact affective dimensions of language learning. Han's findings revealed an impact on emotional variables, which was also in line with the current study's qualitative results. The results affirm that AI chatbot use increased learner motivation and reduced anxiety and boredom during vocabulary tasks. These improvements can be attributed to the adaptive, contextualized, and personalized nature of dialogic interaction with the chatbot [50, 73]. The positive learner attitudes toward AI chatbots in this study align with Belda-Medina and Calvo-Ferrer's [7] investigation, which found that EFL learners appreciated the interaction with the chatbot. Similarly, [33, 50] noted positive perceptions toward the interaction with the chatbot, implying that it can foster positive language learning outcomes. In the current study, researchers observed increased motivation among learners to use and engage in vocabulary activities.

Memarian and Doleck [52] noted chatbots' unstructured use may inhibit learners' autonomy and create boredom due to the gap between the student's expectations and the chatbot's response. However, this assumes that the user has low AI literacy or limited knowledge of effective prompting [70]. Another possibility is that learners might experience decreased autonomy yet increased boredom due to diminished cognitive challenge or sense of personal agency. This perspective is consistent with cognitive offloading research [24], which indicates that overreliance on AI tools can undermine intrinsic motivation and active engagement.

Integrated Theoretical Framework for AI Chatbot-Assisted Vocabulary Learning also emphasized that when language learners interact with the chatbot, they take control of their own learning and engage at their own pace and preference. The dynamic interaction viewed from this perspective might have increased learners' curiosity and interest, which can both directly and indirectly affect their state of mind. Feeling interested and engaged may have enhanced motivation and reduced boredom. In contrast, the CG may not have been on the same level of engagement since they were not exposed

to this dynamic interaction, and this might have resulted in less effective vocabulary acquisition.

In the local context of the current research, most of the language learning activities are conducted in a classroom setting where technology integration is not a usual part of the curriculum. This novel intervention could have led students to feel more interested and engaged in learning with a chatbot compared to a more familiar human instructor. Another interpretation from the local context could be that when students were engaged with chatbot instruction, they could have taken comfort from human instructors supervising them and so felt less reliance on other alternative resources and more self-confidence in themselves to continue to fully engage with the chatbot interaction [11]. Engaging activities can enhance motivation and facilitate learning. Qualitative data further supported that those in the EG experienced a different degree of autonomy and engagement than their peers in the CG. When language learners feel a sense of autonomy over their learning process, in contrast to teacher-led processes, they are more likely to be motivated and engaged. The presence of assistive chatbots might have contributed to increasing learners' motivation and reduced anxiety.

Also, the superior performance of the EG over the CG can be attributed to the individualized approach. The chatbot was responsive to the diversity of the language learners' needs and styles, which could have contributed to the superior outcomes experienced by the EG in incidental vocabulary learning and receptive collocation knowledge compared to their counterparts in the CG.

To summarize, the combination of interactive, dynamic, and personalized learning experiences enhanced motivation and a sense of autonomy and alleviated boredom, which could explain the EG's significantly improved vocabulary learning outcomes and positive learning experience. Moreover, based on the results of this study, chatbot interaction can manifest learners' interpersonal emotional regulation. When learners interacted with the chatbot, the practice of people skills in such a dialogic context might have helped them to overcome negative feelings and remain motivated. This might have contributed to a sense of tranquility, thereby reducing anxiety and boredom. The result of the study aligns with Wang and Akter's (2025) study, which noted that the chatbot interaction resulted in both reductions in negative states of mind, improved regulation of emotions, and a significant increase in language learning outcomes. Another interpretation relevant to reduced boredom and emotional balance could be that the constantly and rapidly revised assistance provided by the chatbot might have provided a safe learning experience where learners feel supported.

6 Conclusions and implications

The current study investigated the effect of integrating generative AI chatbots into self-regulated vocabulary learning and their effect on incidental vocabulary knowledge, receptive knowledge of collocations, and foreign language learning boredom. It found a significant difference in incidental vocabulary learning and receptive collocation knowledge, as well as a markedly reduced report of boredom between the EG and the CG, which is attributable to the chatbot-assisted interventions. Furthermore, the findings from the qualitative data supported the enhancement as learners in the EG reported experiencing enhanced learner autonomy and motivation compared to their peers in the CG.

Moreover, the alleviated boredom among the EG participants when interacting with the chatbot indicates that chatbot interactions can create a supportive, motivating, and safe learning environment. By promoting cognitive and affective dimensions in chatbot-assisted vocabulary learning, chatbots can enable learners to develop their language knowledge and interpersonal skills outside classroom settings. Overall, the findings underscore the potential of chatbot-based learning tools to enhance vocabulary acquisition and support the emotional aspects of learning, such as motivation and reduced boredom.

The findings of this study present pedagogical insights for EFL teachers. While chatbot use is found to enhance linguistic and affective factors, it is essential to be alert to the challenges of the current implementation. One notable challenge is the limited effectiveness of chatbot interventions, as well as potential difficulties learners may face when interacting with chatbots via voice [30, 34]. As indicated by El Shazly [10, 22], some students may experience high anxiety levels when using chatbots due to issues such as communication difficulties and frustration with the technology. To mitigate these issues, teachers should focus on engaging, interactive designs for the delivery of learning assets to maintain learners' motivation over a longer exposure [21]. Another challenge could be the learner's language level. Learners with a low level of English may not effectively benefit from the chatbot interaction, therefore the intervention of chatbot-assisted vocabulary learning exercises may be more appropriate for intermediate level students [36, 73].

Moreover, to fully benefit from the educational potential of AI chatbots, teachers are encouraged to opt for chatbots specifically designed for language education with gamified elements. Gamified features in chatbot design, such as quizzes, vocabulary drills, storytelling, and instant feedback, could increase student engagement and enjoyment [30]. Incorporating gamified features can enhance motivation and the feeling of challenge, which can reduce boredom.

The novelty effect of chatbots should also be considered. Initial motivation and interest could fade when learners become more familiar with the intervention [13, 26]. To maintain engagement and support positive affective gains, it is crucial to integrate chatbots deliberately into lessons where they can be most effective. Additionally, to support positive affective gains, it is important to provide emotionally safe, tranquil learning experiences through vocabulary activities with chatbots. Research highlights the key role of chatbots in delivering real-time feedback, which can encourage learners by making them feel supported and confident when they encounter their knowledge gaps [41, 44]. By fostering such a positive environment, language learning can become more effective and less boring or anxiety-provoking, which undoubtedly enhances academic performance and emotional tranquility.

6.1 Limitations and suggestions

One limitation of this study is the employment of a convenience sampling method to select participants, which may limit the generalizability of the findings to a broader context. Future research should consider a more diverse sample. Additionally, there was no delayed test for vocabulary assessment due to the limited accessibility to the participants. Designing longitudinal studies could more effectively show the long-term effects of chatbot-assisted vocabulary learning. Future studies could also involve delayed tests in their research design.

Future research should also investigate the effectiveness of the chatbots on internalizing other language skills along with the vocabulary gains. This exploration could help identify the effect of chatbots in a complementary sense.

Author contributions

Mahmoud Omar Jalambo: Investigation, Data Curation, Formal Analysis, Writing – Review & Editing. Fidel Çakmak: Conceptualization, Methodology, Writing – Original Draft, Writing – Review & Editing. Shamim Akhter: Literature Review, Data Analysis, Visualization, Writing – Review & Editing.

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Data availability

The data that support the findings of this study are not publicly available due to the need to protect personal data and maintain confidentiality among the participants. Data may be made available from the corresponding author upon reasonable request, subject to approval by the institution's ethics committee and any necessary data-sharing agreements.

Declarations

Ethics approval and consent to participate

This study involving human participants was conducted in accordance with the ethical standards mentioned in the 1964 Helsinki Declaration and its later amendments, or comparable ethical standards. ChatGPT (OpenAI) was used for language editing (ensuring grammar correction and clarity) and structuring the sections. The author reviewed and verified the content and accepts responsibility for the accuracy, originality, and integrity of the manuscript. All participants in this study provided informed consent prior to their involvement. They were fully briefed on the study's purpose, procedures, and their right to withdraw at any time without consequence.

Consent for publication

Not applicable.

Informed consent

Informed consent was obtained from all participants before the intervention.

Competing interests

The authors declare no competing interests.

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