

Spaced repetition for vocabulary retention in EFL and ESL learning: A systematic literature review

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ABSTRACT

Vocabulary retention remains a persistent challenge among EFL and ESL learners because newly learned words are often forgotten without systematic, repeated exposure. Although spaced repetition (SR) is widely recognized as an effective strategy for long-term memory, there is still limited understanding of how SR can be optimally implemented across diverse EFL and ESL learners' contexts, particularly regarding spacing schedules, instructional design, and technology integration. As a result, evidence on SR implementation in EFL and ESL learners' vocabulary learning remains fragmented. EFL and ESL learners' systematic literature review aims to synthesize the opportunities and challenges associated with the use of SR for vocabulary learning among EFL and ESL learners. Following the PRISMA guidelines, 25 studies published between 2010 and 2025 were selected from Scopus, Google Scholar, ScienceDirect, and ResearchGate based on predetermined inclusion and exclusion criteria. The reviewed studies examined various SR approaches, including digital flashcards, retrieval-based activities, mobile-assisted language learning applications, cumulative testing, and multimodal learning tools. The findings indicate that SR provides substantial opportunities, particularly for improving vocabulary retention and enhancing long-term memory, while also increasing learner motivation, learner autonomy, retrieval practice, and technology-enhanced language learning. However, several challenges were identified, including instructional design issues, uncertainty regarding optimal spacing schedules, technology and digital literacy constraints, learner-related differences, and limited empirical evidence across diverse educational settings. Overall, the reviewed evidence consistently points to the positive potential of SR as a cognitively efficient approach for supporting vocabulary development, particularly when implemented through well-designed instructional practices.

Keywords: EFL and ESL learners; English vocabulary; spaced repetition; systematic literature review; vocabulary retention

First Received:	Revised:	Accepted:	Published:
June 1 st , 2026	August 21 st , 2026	August 21 st , 2026	August 31 st , 2026

How to cite (in APA style):

Shalehah, H. N., Baehaqi, L., & Miftah, M. Z. (2026). Spaced repetition for vocabulary retention in EFL and ESL learning: A systematic literature review. *Journal of Research on English and Language Learning (J-REaLL)*, 7(2), 428–451. <https://doi.org/10.33474/j-reall.v7i2.25562>

INTRODUCTION

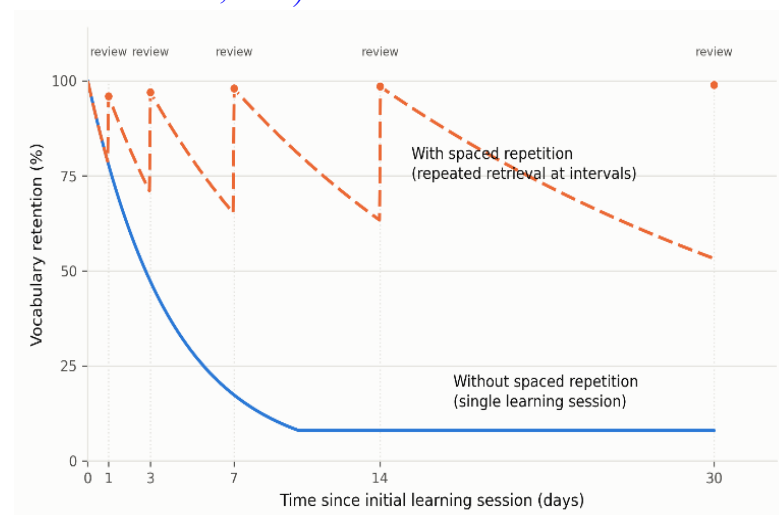
Vocabulary is widely regarded as a foundation of language proficiency. Vocabulary knowledge significantly predicts learners' reading comprehension and their productive performance in writing and speaking (Alqahtani, 2015; Hu et al., 2022; Kiliç, 2019). However, acquiring vocabulary is only the first stage of language learning; retaining newly learned words over time remains a persistent challenge for many EFL and ESL learners. This difficulty is particularly evident in instructional contexts that emphasize rote memorization and translation rather than meaningful and repeated use of words (Ameen, 2026). When learners have limited opportunities to revisit and retrieve previously learned vocabulary, their knowledge may gradually decline because of limitations in memory consolidation and the natural tendency to forget information over time (Bayliss & Jarrold, 2015). Consequently, identifying instructional strategies that can promote long-term vocabulary retention has become an important concern in language education.

In this review, several key constructs require clarification. Vocabulary learning refers broadly to the process through which learners acquire new lexical knowledge, whereas vocabulary acquisition commonly refers to the gradual, and often incidental, development of word knowledge through exposure and use. Vocabulary recall concerns a learner's ability to retrieve a word or its meaning at a particular moment. Vocabulary retention, in contrast, refers to the durability of vocabulary knowledge over time, whether words remain accessible after a delay rather than being forgotten. In the studies reviewed, retention was generally operationalized through delayed post-tests administered after a specified interval and measured as either receptive knowledge, such as recognizing a word's meaning, or productive knowledge, such as recalling or producing the word. This distinction is important because the effects of instructional interventions may differ across receptive and productive vocabulary measures.

One instructional approach that has received considerable attention is spaced repetition (SR). Rooted in Ebbinghaus's forgetting curve and the spacing effect, SR refers to the systematic distribution of learning and review sessions over time rather than concentrating them in a single learning period (Hanson & Brown, 2020). Research in cognitive psychology indicates that information reviewed at strategically spaced intervals is retained more effectively than information learned through massed practice or cramming (Kang, 2016; Kim & Webb, 2022; Roediger & Karpicke, 2006). By promoting repeated retrieval and reducing cognitive overload, SR may strengthen memory traces and support long-term retention (Tabibian et al., 2019). These characteristics make SR particularly relevant to vocabulary learning in EFL and ESL contexts, where learners are expected to retain a large number of lexical items despite limited instructional time.

Figure 1

Conceptual Illustration of Ebbinghaus's Forgetting Curve and the Spacing Effect (Adapted conceptually from Hanson and Brown, 2020)



Previous research has documented the effectiveness of SR across diverse educational and language-learning contexts (Lotfolahi & Salehi, 2016; Namaziandost et al., 2020; Al-Okiedy, 2022). In vocabulary learning, SR has been associated with improved long-term retention, memory enhancement, learner engagement, and both receptive and productive vocabulary knowledge (Kim & Webb, 2022; Nakata, 2017). Beyond vocabulary, spaced practice has also been linked to more stable learning gains in grammar, although its effects may be smaller and more dependent on task complexity than in vocabulary learning (Kim & Webb, 2022; Miles, 2014). Similarly, spaced exposure and repeated retrieval may improve pronunciation accuracy, automaticity, and lexical collocation learning, although the evidence base in these areas remains more limited (Farvardin, 2019; Kim & Webb, 2022). These domain-specific patterns suggest that SR is generally beneficial, but the magnitude and consistency of its effects depend on the linguistic target and the design of the learning task.

The growing integration of digital technologies has further expanded the application of SR in language education. Mobile-assisted language-learning applications, such as Duolingo, Memrise, and Quizlet, as well as digital flashcards, gamified platforms, and computer-assisted language-learning environments, increasingly incorporate automated review schedules and retrieval-based practice (Dhiya et al., 2025; Zhang et al., 2022). These technologies can provide immediate feedback, personalize review intervals, and enable learners to engage in self-paced vocabulary practice beyond the classroom. Nevertheless, the use of digital SR also raises practical concerns related to instructional design, learner motivation, technology access, teacher preparedness, and the appropriateness of automated review schedules for different learner profiles.

Although the body of research on SR is growing, the literature remains fragmented across learner populations, educational settings, instructional tools, and implementation procedures. Individual studies generally confirm that SR can support vocabulary retention; however, findings remain inconsistent regarding optimal spacing intervals, the number of repetitions required, and the comparative effectiveness of expanding and equal spacing schedules. The benefits of SR may also vary according to learner characteristics, including age, proficiency level, and prior vocabulary knowledge, as well as contextual factors such as task type, instructional setting, and the availability of feedback. Bibliometric studies have mapped dominant themes, influential publications, and emerging directions in the field (Miftah et al., 2022; Pek et al., 2025), but they do not provide an in-depth synthesis of pedagogical opportunities and implementation challenges. Existing systematic reviews have also tended to focus on particular tools, such as digital flashcards (Annisah et al., 2025) or online vocabulary-learning applications (Dhiya et al., 2025; Mijan & Hashim, 2023), rather than examining SR implementation across a broader range of instructional approaches.

Therefore, this systematic literature review (SLR) aims to synthesize the opportunities and challenges associated with the use of spaced repetition for vocabulary learning in EFL and ESL contexts. Although the review primarily focuses on EFL contexts, studies conducted in ESL settings are also included when they examine structurally comparable second-language vocabulary-learning processes, given the substantial theoretical and methodological overlap between EFL and ESL vocabulary acquisition research. Following PRISMA guidelines, this review analyzes studies published between 2010 and 2025 to address two research questions: (1) How does spaced repetition support vocabulary retention among EFL and ESL learners in terms of learning processes and outcomes? (2) What pedagogical opportunities and practical challenges are associated with implementing spaced repetition in EFL and ESL learning contexts? By synthesizing previous findings, this review seeks to provide practical insights for teachers, curriculum developers, educational technology designers, and researchers interested in implementing SR effectively.

LITERATURE REVIEW

Spaced repetition for vocabulary retention

Spaced repetition (SR) is a learning technique grounded in the spacing effect, a cognitive principle initially associated with Ebbinghaus's work on memory and forgetting (Ebbinghaus, 1885/1913). This principle suggests that memory traces gradually weaken over time unless they are reinforced through

repeated exposure and retrieval. Subsequent research has consistently shown that information is retained more effectively when learning episodes are distributed across multiple intervals rather than concentrated in a single session (Cepeda et al., 2006). In vocabulary learning, SR therefore involves revisiting lexical items at planned intervals to reduce forgetting and strengthen long-term memory. By distributing review sessions over time, SR enables learners to encounter previously learned words before they become inaccessible, thereby supporting the transition of vocabulary knowledge from short-term to long-term memory.

The effectiveness of SR can also be explained through the encoding variability hypothesis. This hypothesis proposes that repeated encounters with information across different times or contexts create richer memory representations and provide multiple cues for later retrieval (Zawadzka et al., 2021). From a neurocognitive perspective, spaced encounters facilitate memory consolidation and reconsolidation because each successful retrieval reactivates and strengthens existing memory traces (Smith & Scarf, 2017). SR is also related to the principle of desirable difficulty, which suggests that learning is strengthened when retrieval requires moderate but manageable cognitive effort (Kim et al., 2019). Contemporary SR systems often apply adaptive algorithms to determine review intervals based on learner performance: successfully recalled items are presented less frequently, whereas forgotten items are reviewed sooner (Mettler et al., 2016; Zhang et al., 2022). This scheduling process may improve learning efficiency while maintaining vocabulary accessibility.

Retrieval practice theory and vocabulary learning

The effectiveness of SR can further be understood through retrieval practice theory. According to Karpicke and Roediger (2008), actively retrieving information from memory strengthens learning more effectively than passive exposure, such as rereading a word list or repeatedly viewing the same material. Retrieval practice requires learners to reconstruct previously learned information, which reinforces the pathways needed to access that information in the future. In vocabulary learning, this process may involve recalling a target word from its meaning, producing its translation, identifying its form from a definition, or using it in an appropriate context. Because retrieval requires active cognitive effort, it promotes deeper processing and supports more durable memory formation than learning activities that merely expose learners to vocabulary items.

SR incorporates retrieval practice by requiring learners to recall vocabulary repeatedly at strategically distributed intervals. Flashcards, cumulative quizzes, recall exercises, matching tasks, and digital vocabulary-review systems can all create opportunities for learners to retrieve previously studied items. When retrieval is successful, learners reinforce the association between a word's form, meaning, pronunciation, and use; when it is unsuccessful, corrective feedback can direct attention to the item that requires additional practice. Thus, the benefits of SR do not arise solely from repeated exposure to vocabulary but from the combination of distributed learning and active recall. This combination is especially relevant in EFL and ESL settings, where learners often need systematic opportunities to revisit lexical items that may not be encountered frequently outside instructional activities.

Dual coding theory and multimodal vocabulary learning

Another theoretical perspective relevant to SR is dual coding theory. This theory proposes that information may be retained more effectively when it is processed through both verbal and nonverbal representational systems, such as words and images (Clark & Paivio, 1991). Unlike the spacing effect, dual coding theory does not explain why review should occur over time. Instead, it helps explain why certain SR implementations may produce additional benefits when spaced review is combined with visual, auditory, or interactive materials. When learners encode a vocabulary item through more than one representational channel, they may develop multiple retrieval routes. As a result, a word may be easier to remember because learners can access it through its written form, spoken form, image, contextual meaning, or another associated cue.

In vocabulary learning, multimodal materials may include written words, pictures, audio recordings, videos, gestures, example sentences, and interactive digital activities. These representations

can strengthen semantic associations and make abstract or unfamiliar vocabulary more meaningful for learners. For example, a digital flashcard that combines a word, its pronunciation, an image, and a contextual sentence may support richer encoding than a translation-only flashcard. When such materials are used through spaced review, learners repeatedly retrieve vocabulary while receiving support from multiple representational channels. Consequently, SR activities that employ multimedia flashcards, audiovisual resources, gamified platforms, and other technology-enhanced materials may promote vocabulary retention through the combined influence of spacing, retrieval, and multimodal encoding.

Spaced repetition in EFL learning context

Within EFL contexts, SR has been implemented through a range of instructional approaches. These include physical and digital flashcards (Annisah et al., 2025; Darsana, 2025; Lexi et al., 2025; Zarrati et al., 2024), retrieval-based vocabulary activities (Nakata, 2015; Nakata et al., 2021), cumulative testing (Nakata et al., 2021), mobile-assisted language-learning applications (Janebi et al., 2025; Permatasari et al., 2025; Zhang et al., 2022), and computer-assisted language-learning environments (Çakmak et al., 2021; Hirschel & Fritz, 2013). Despite their different formats, these approaches share a common principle: learners revisit vocabulary items over time rather than studying them only once. Such repeated encounters may reduce cognitive overload, provide opportunities for retrieval, and help learners retain vocabulary beyond the immediate learning session.

Recent technological developments have expanded the use of SR by integrating it into platforms such as Quizlet, Duolingo, and Memrise (Dhiya et al., 2025; Permatasari et al., 2025). These tools can automate review schedules, provide immediate feedback, and enable learners to engage in self-paced vocabulary practice (Zhang et al., 2022). Technology-assisted SR has also been associated with greater learner engagement because gamification, progress tracking, and instant feedback can make vocabulary review more interactive (Janebi et al., 2025; Permatasari et al., 2025). In addition, mobile and computer-based systems may support learner autonomy by allowing users to monitor and direct their own review processes (Çakmak et al., 2021; Zhang et al., 2022). Because these tools are accessible through personal devices, they can extend vocabulary practice beyond scheduled classroom sessions and support continuous learning across different environments (Hirschel & Fritz, 2013; Zarrati et al., 2024).

Previous reviews on spaced repetition in vocabulary learning

Previous systematic reviews have examined the role of SR in vocabulary learning, although many have focused on instructional tools or digital technologies. For example, Annisah et al. (2025) reviewed the use of digital flashcards and reported that flashcards incorporating SR can enhance vocabulary retention and learner engagement. Dhiya et al. (2025) reviewed vocabulary-learning applications, including Quizlet, Duolingo, Wordwall, and Memrise, and concluded that technology-supported vocabulary learning can improve vocabulary acquisition. Similarly, Mijan and Hashim (2023) highlighted the potential advantages of technology-assisted vocabulary learning and reported that digital tools incorporating SR often produce more favorable outcomes than traditional learning methods. These reviews provide valuable evidence for specific platforms and tools, but they do not fully synthesize SR implementation across diverse instructional approaches and learning conditions.

Meta-analytic and theoretical evidence also supports the value of distributed learning. Kim and Webb (2022) found that spaced practice significantly improves second-language vocabulary learning and long-term retention, particularly when it includes retrieval opportunities and corrective feedback. Kang (2016) likewise emphasized that SR can support durable learning by strengthening memory consolidation and reducing forgetting. Nevertheless, the effects of SR may vary according to learning objectives, instructional conditions, and the interval used to measure retention. Uchihara et al. (2019), for instance, found that massed practice may occasionally produce stronger results in incidental vocabulary-learning contexts, particularly for short-term outcomes. However, the reported advantage of massed practice was limited, while SR remained more beneficial for longer-term retention. These

findings indicate that SR should be evaluated not only by immediate performance but also by the durability of vocabulary learning over time.

Research gap and conceptual positioning

Although previous reviews generally demonstrate that SR supports vocabulary retention, most focus primarily on outcome-oriented questions, such as whether a particular tool improves vocabulary knowledge or learner engagement. Comparatively less attention has been given to how SR can be implemented effectively across diverse EFL and ESL settings. As a result, evidence concerning the broader pedagogical opportunities and practical challenges of SR remains fragmented. Important considerations including instructional design, the selection of spacing intervals, learner engagement, technology integration, feedback, learner autonomy, and access to digital resources are often addressed separately across individual studies. This fragmentation limits the ability of teachers, curriculum developers, and educational technology designers to understand which conditions may facilitate or hinder successful SR implementation.

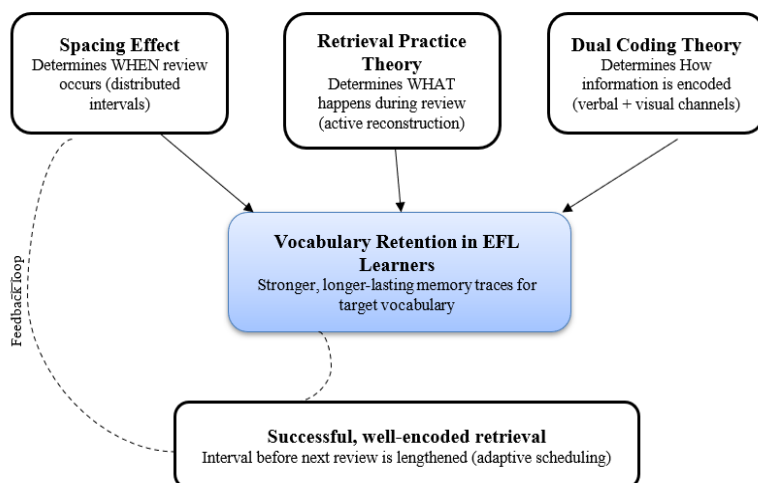
To address this gap, the present systematic literature review synthesizes both the opportunities and challenges associated with SR for vocabulary learning in EFL and ESL contexts. The review examines studies published between 2010 and 2025 and integrates findings across instructional settings, digital and non-digital tools, learner populations, and learning activities. Rather than focusing only on whether SR improves vocabulary retention, this review also considers the pedagogical conditions under which SR is implemented and the factors that may influence its effectiveness. In doing so, the review aims to provide a broader understanding of the pedagogical potential, practical limitations, and future directions of SR-based vocabulary learning. This conceptual positioning distinguishes the present review from earlier studies that concentrated mainly on individual technologies or specific vocabulary-learning tools.

Conceptual framework

The present review integrates the spacing effect, retrieval practice theory, and dual coding theory as complementary explanations of vocabulary retention through SR. The spacing effect explains the timing of review by emphasizing that learning episodes should be distributed over time rather than massed in a single session. Distributed review interrupts the gradual decline of memory traces described by the forgetting curve and creates opportunities for learners to retrieve vocabulary after a manageable degree of forgetting has occurred. Retrieval practice theory explains the cognitive process that should take place during these spaced encounters. Rather than simply seeing a word again, learners are expected to actively reconstruct its form, meaning, or use from memory, which strengthens the memory trace more effectively than passive rereading (Karpicke & Roediger, 2008).

Dual coding theory complements these mechanisms by explaining how vocabulary representations can become richer when learners encode information through verbal and nonverbal channels, such as text, images, sound, and contextual examples (Clark & Paivio, 1991). Together, the three perspectives form an integrated SR cycle: spacing determines when vocabulary should be reviewed, retrieval practice determines the depth of processing during review, and dual coding strengthens the richness of the representation being retrieved. When learners successfully retrieve a multimodally encoded vocabulary item, adaptive SR systems may schedule a longer interval before the next review (Zhang et al., 2022). This framework is used to interpret the 25 included studies. Opportunities are understood as conditions in which spacing, retrieval, and multimodal encoding work together effectively, whereas challenges are understood as conditions in which one or more of these mechanisms are disrupted.

Figure 2
Conceptual Framework



The conceptual framework illustrates the relationship among the timing of review (spacing), the depth of cognitive processing (retrieval practice), and the richness of vocabulary representation (dual coding) in an SR cycle. It also guides the interpretation of opportunities and challenges identified in the reviewed studies. For instance, appropriately distributed review intervals, active-recall tasks, corrective feedback, and multimodal materials may facilitate effective SR implementation. In contrast, overly short or overly long intervals, recognition-based tasks that require limited recall, inadequate feedback, or reliance on a single representational modality may weaken the potential benefits of SR. The following section describes the methodological procedures used to identify, select, and synthesize the studies analyzed through this framework.

METHOD

Research selection

The review aimed to investigate the use of spaced repetition in supporting vocabulary retention among EFL learners and the opportunities and challenges associated with the implementation of spaced repetition in EFL learning contexts. This study applied a systematic literature review (SLR) to synthesize and analyze previous studies examining the use of spaced repetition (SR) for vocabulary learning in the English as a foreign language (EFL) context. To ensure methodological rigor, transparency, and reproducibility, the review followed the preferred reporting items for systematic reviews and meta-analyses (PRISMA 2020) guidelines.

A comprehensive literature search was conducted on September 10, 2025, using two primary bibliographic databases, Scopus and ScienceDirect, supplemented by Google Scholar. Scopus and ScienceDirect were selected as the primary sources because they provide curated, peer-reviewed coverage of applied linguistics, language education, and cognitive/educational psychology research and because they have been widely used in prior systematic reviews within this field (Annisah et al., 2025; Mijan & Hashim, 2023; Dhiya et al., 2025). Google Scholar was included to broaden coverage across multidisciplinary and practice-oriented outlets not indexed in Scopus or ScienceDirect, given that SR research also intersects with educational technology and cognitive psychology. Web of Science was not included because it could not be fully accessed through our institutional license at the time the study was conducted; we acknowledge this as a limitation, as its inclusion might have identified additional eligible studies.

ResearchGate was not treated as an equivalent bibliographic database but was retained as a supplementary discovery source, used only to identify author-uploaded manuscripts and grey literature not indexed elsewhere. Records identified through ResearchGate were still required to meet the same peer-review and publication-type criteria specified in Table 1; records that could not be verified as

peer-reviewed journal publications were excluded during eligibility screening. This distinction between primary databases and the supplementary source is reflected in the PRISMA flow diagram. We nonetheless acknowledge that this search strategy, together with the exclusion of specialist multidisciplinary databases (e.g., ERIC, PsycINFO), the restriction to English-language publications, and the exclusion of non-peer-reviewed grey literature, may limit the comprehensiveness of the evidence base; these limitations are discussed further below.

The search employed combinations of the following keywords: ("spaced repetition" OR "spaced practice" OR "distributed practice") AND ("vocabulary learning" OR "vocabulary retention" OR "vocabulary acquisition") AND ("EFL" OR "ESL" OR "language learning"). This core search string was adapted to the specific syntax and field-search capabilities of each database, as summarized in Table 1. The search was limited to studies published between 2010 and 2025 to capture a substantial, up-to-date body of literature and ensure the review reflects the most current and relevant evidence available on spaced repetition for vocabulary learning up to the time this study was conducted (September 2025). Both empirical and review studies were considered to provide a comprehensive overview of the opportunities and challenges associated with SR implementation.

Table 1

Database-Specific Search Strings and Filters

Database	Search string	Field searched	Filter applied
Scopus	TITLE-ABS-KEY(("spaced repetition" OR "spaced practice" OR "distributed practice") AND ("vocabulary learning" OR "vocabulary retention" OR "vocabulary acquisition") AND ("EFL" OR "ESL" OR "language learning"))	Title, abstract, keywords	PUBYEAR > 2009 AND PUBYEAR < 2026; Document type: Article; Language: English
ScienceDirect	("spaced repetition" OR "spaced practice" OR "distributed practice") AND ("vocabulary learning" OR "vocabulary retention" OR "vocabulary acquisition") AND ("EFL" OR "ESL" OR "language learning")	Title, abstract, keywords	Years: 2010–2025; Article type: Research articles
Google Scholar	"spaced repetition" OR "spaced practice" OR "distributed practice" OR "vocabulary learning" OR "vocabulary retention" OR "vocabulary acquisition" "EFL" OR "ESL" OR "language learning"	Full text (no field restriction available)	Custom range: 2010-2025
ResearchGate (supplementary)	spaced repetition vocabulary EFL	Full-text/keyword search (no Boolean field search available)	Manually screened for 2010–2025

Exclusion and inclusion criteria

The dataset comprises journal articles focusing on the spaced repetition method, vocabulary retention or learning, and EFL learners. Study selection followed predefined inclusion and exclusion criteria to ensure the relevance and quality of the studies included. Table 2 provides a detailed overview of the criteria applied in the selection process.

Table 2*Article Selection of Inclusion and Exclusion Criteria*

Criteria	Inclusion	Exclusion
Population	EFL/ESL learners across different educational levels and age groups.	Studies unrelated to language learners.
Intervention	Studies implementing spaced repetition, spaced practice, distributed practice, retrieval-based review, Spaced Repetition System (SRS), digital flashcards, or interval learning techniques.	Studies examining unrelated instructional approaches.
Outcome	Vocabulary learning, vocabulary retention, vocabulary acquisition, vocabulary recall, and related-language-learning outcomes (e.g., grammar, pronunciation, reading comprehension, or higher-order cognitive skills) alongside a primary vocabulary outcome were also included.	Outcomes unrelated to language learning (e.g., mathematics or science learning outcomes, general cognitive training unrelated to language, or non-linguistic memory tasks).
Study type	Empirical studies and review studies.	Opinion papers, editorials, books, theses, conference abstracts, and dissertations.
Language	Articles published in English	Articles published in languages other than English
Publication year	Published within 2010-2025	Articles published before 2010

Two criteria in [Table 2](#) warrant further clarification. First, regarding study type, both empirical and review studies (including systematic reviews and meta-analyses) were eligible for inclusion because this review synthesizes the opportunities and challenges associated with SR implementation through a thematic, narrative synthesis rather than a quantitative pooling of effect sizes. Empirical studies provided direct, context-specific evidence of SR implementation, whereas review and meta-analytic studies (e.g., [Kang, 2016](#); [Kim & Webb, 2022](#); [Uchihara et al., 2019](#)) provided synthesized evidence across multiple primary studies, which is valuable for identifying broader patterns of consensus or inconsistency. To minimize the risk of double counting overlapping evidence, each included study was treated as a single, independent unit of analysis based on its own reported objectives, methods, and conclusions, rather than decomposed into its underlying primary sources; we nonetheless acknowledge that some overlap in the underlying evidence base may exist between these two study types, which is discussed further as a limitation. Second, regarding publication year, the 15-year search window (2010–2025) was selected to capture a substantial and up-to-date body of literature on spaced repetition and vocabulary learning up to the date the search was conducted (September 2025).

To enhance the reliability of the review, each selected study was assessed based on its methodological quality using a set of informal, criteria-based indicators rather than a standardized appraisal checklist. These indicators considered the clarity of the research design, description of participant characteristics, transparency of procedures, adequacy of data collection methods, and relevance to the review objectives. Studies that lacked sufficient methodological information or demonstrated limited relevance to spaced repetition and vocabulary learning were excluded during the eligibility stage. We acknowledge that this quality appraisal was not guided by a validated instrument such as the mixed methods appraisal tool (MMAT) or Joanna Briggs Institute (JBI) critical appraisal checklists, which are commonly used in reviews incorporating diverse study designs; the absence of a standardized appraisal tool is noted as a limitation of this review.

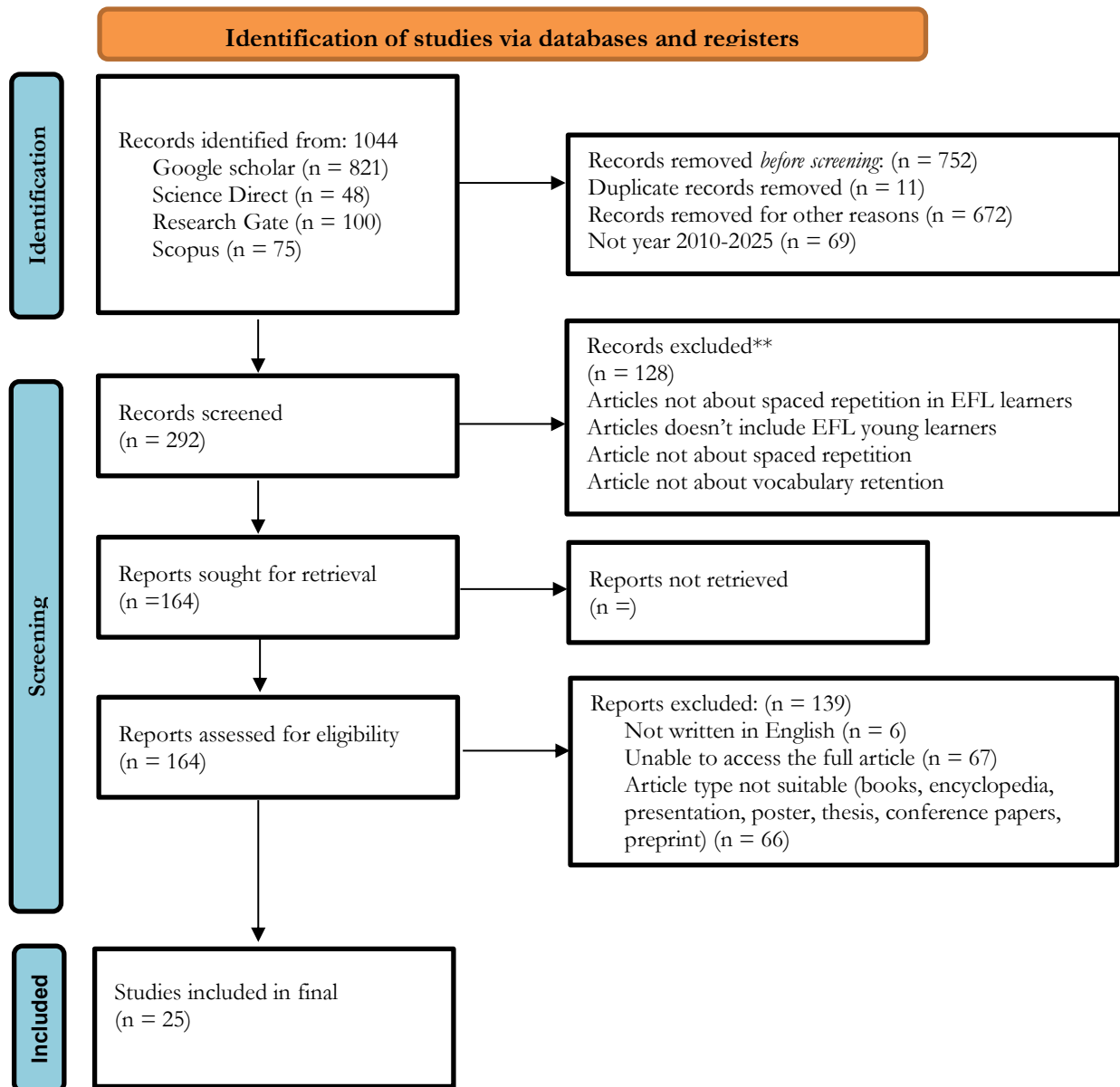
Data extraction

Relevant information was extracted from each selected study using a structured data extraction form. The extracted data included authors, publication year, research objectives, research design, participant characteristics, instructional intervention, key findings, opportunities, and challenges associated with SR implementation. The initial search identified 1,044 records from four databases, consisting of Scopus ($n = 75$), Google Scholar ($n = 821$), ScienceDirect ($n = 48$), and ResearchGate ($n = 100$). Following the removal of duplicates and the application of inclusion and exclusion criteria, studies underwent title and abstract screening, followed by full-text eligibility assessment. The final dataset

consisted of 25 studies that met all selection criteria. The overall review process is presented in the PRISMA 2020 flow diagram (Figure 3).

Figure 3

PRISMA Diagram for Systematic Literature Review adapted from Page et al. (2020)



The study selection process followed the PRISMA 2020 framework. The initial database search identified 1,044 records from Scopus, Google Scholar, ScienceDirect, and ResearchGate. After the removal of duplicate records and preliminary screening based on titles and abstracts, 292 potentially relevant studies remained. These studies were subsequently assessed against the predefined inclusion and exclusion criteria, resulting in 164 studies for full-text evaluation. During the eligibility stage, studies were excluded because they were published in languages other than English (n = 6), lacked accessible full-text versions (n = 67), or did not meet the required publication type criteria (n = 66). Following this screening process, 25 studies satisfied all eligibility requirements and were included in the final review.

Data analysis

The extracted data from the 25 included studies were analyzed using a manual narrative and thematic synthesis approach. The reported opportunities and challenges associated with SR implementation in each study were read repeatedly and grouped inductively based on similarity of content, without the use of qualitative data analysis software. Related codes were then organized into broader thematic categories (e.g., instructional design, spacing schedules, technology and digital literacy, learner-related differences, and limited empirical evidence), consistent with the two research questions guiding this review. The frequency with which each thematic category appeared across the 25 studies was tallied to identify the most commonly reported opportunities and challenges, as presented in Table 4 and elaborated narratively in the Findings and Discussion sections. It should be noted that these frequency counts represent a simple tally of how many studies reported each theme and are not intended as a measure of effect size, statistical significance, or the relative importance of a given theme, a theme reported by fewer studies is not necessarily less significant or less impactful than one reported more frequently, as this review does not employ meta-analytic weighting or quantitative effect-size synthesis. This analytical process was distinct from the PRISMA-guided selection process described above, which determined study eligibility but did not itself constitute the method of data analysis.

FINDINGS

Spaced repetition support for vocabulary retention among EFL learners

The analysis results revealed a synthesized overview of the 25 studies included in this systematic literature review. Table 3 summarizes each study's objective, research design, reported vocabulary retention support, other opportunities, and identified challenges related to the implementation of spaced repetition in EFL vocabulary learning. The opportunities and challenges presented in Table 3 are grounded in the explicit findings, results, and discussion reported in each original study, consistent with the structured data extraction process described in the Method section; however, the specific wording and thematic groupings reflect the reviewers' synthesis and interpretation of this content during the manual thematic coding process described in the data analysis section, rather than verbatim extracts from the original articles.

Table 3

The Result of Literature Review

No.	Articles	Objective	Method	Vocabulary Retention Support (RQ1)	Other Opportunities (RQ2)	Challenges
1.	Annisah et al. (2025)	To analyze the effectiveness of flashcards in English Language Teaching through a systematic review.	SLR	Flashcards improve vocabulary retention.	Improve learner motivation, engagement, and classroom interaction.	Digital literacy gaps, overreliance on rote memorization, and dependence on instructional design quality.
2.	Çakmak et al. (2021)	To investigate the effects of CALL-enhanced vocabulary learning software with spaced exposure on EFL learners' vocabulary development.	Experimental (Quantitative)	CALL-enhanced flashcard software improved vocabulary retention and long-term vocabulary acquisition through spaced repetition.	Improved learner autonomy, repeated vocabulary exposure, and flexible learning.	Learners often struggle to retain vocabulary for long periods, technology integration may confuse unguided learners, and software implementation depends on appropriate

No.	Articles	Objective	Method	Vocabulary Retention Support (RQ1)	Other Opportunities (RQ2)	Challenges
						instructional design and learner needs.
3.	Darsana (2025)	To analyze the implementation of bilingual flashcards in kindergarten vocabulary teaching and explore teachers' perceptions.	Qualitative	Bilingual flashcards increased vocabulary retention.	Increased motivation and made learning more interactive and enjoyable.	Flashcard size limitations, noisy classrooms, the need for teacher creativity, less effectiveness for non-visual learners, and student dependency on flashcards.
4.	Dhiya (2025)	To review the influence of online platforms such as Quizlet, Duolingo, Memrise, and Wordwall on students' vocabulary acquisition.	SLR	Online platforms (Quizlet, Duolingo, Memrise, Wordwall) improve vocabulary acquisition.	Provide flexible and interactive learning; promote student-centered and self-directed learning.	The effectiveness of each platform depends on the learning context and implementation, and there is still limited research focusing specifically on web-based vocabulary learning in Indonesia.
5.	Farvardin (2019)	To investigate the effects of spacing techniques on EFL learners' recognition and production of lexical collocations.	Quasi-experimental (Quantitative)	ESR and USR improve long-term retention of lexical collocations better than massed repetition.	Improve recognition and production of lexical collocations.	ESR and USR do not always show significant differences, and effectiveness depends on spacing intervals, material difficulty, and learning context.
6.	Hirschel & Fritz (2013)	To examine the short-term and long-term effectiveness of vocabulary notebooks and CALL programs with spaced repetition for vocabulary learning.	Quantitative	CALL programs with spaced repetition supported long-term vocabulary acquisition.	Supported learner independence, instant feedback, repetition, and flexible self-paced learning.	Empirical evidence on CALL effectiveness remains limited, vocabulary notebooks may not always promote long-term retention, and learners may struggle to select useful vocabulary independently.
7.	Janebi et al. (2025)	To compare the effects of two mobile-assisted language learning (MALL)	Mixed-method	SRS and multimedia integration enhanced receptive vocabulary learning.	Gamification and interactive exercises enhanced learner engagement.	No significant differences were found in productive vocabulary learning, and the effectiveness of

No.	Articles	Objective	Method	Vocabulary Retention Support (RQ1)	Other Opportunities (RQ2)	Challenges
		applications on receptive and productive vocabulary knowledge.				app features for vocabulary acquisition remains underexplored.
8.	Kang (2016)	To explain the effectiveness of spaced repetition and its implications for instruction.	Literature review	Spaced repetition enhances memory and durable long-term learning.	Enhances problem-solving and transfer learning.	Massed practice is still widely used because it appears effective in the short term, and implementing spaced practice requires careful scheduling.
9.	Lexi et al. (2025)	To investigate the effectiveness of flashcards in improving English vocabulary mastery among fifth-grade elementary students in rural schools.	Pre-experimental design (Quantitative)	Flashcards supported vocabulary retention through visualization and repetition.	Active engagement, low-cost learning, and suitability for low-resource schools.	Lack of qualified English teachers, teacher-centered learning, limited interactive media, and low student vocabulary mastery.
10.	Lo (2024)	To examine the effects of immediate repetition and spaced repetition through dual-subtitled video viewing on EFL learners' vocabulary learning and retention.	Quasi-experimental (Quantitative)	Repeated viewing with dual subtitles enhanced vocabulary gains, meaning recognition, and vocabulary retention.	Enhanced audiovisual learning and autonomous learning opportunities outside the classroom.	Research on repeated viewing and spacing intervals in audiovisual vocabulary learning remains limited, and the effectiveness of spaced repetition may vary depending on learner proficiency and repetition timing.
11.	Lotfolahi & Salehi (2016)	To investigate learners' perceptions of the effectiveness of spaced learning schedules in L2 vocabulary learning.	Quantitative	Spaced learning improves vocabulary retention and long-term recall.	Improves attention and learner motivation.	There is no standardized classroom implementation for spaced practice, and some learners initially perceive massed learning as more effective.
12.	Lotfolahi & Salehi (2017)	To investigate the effects of spaced practice and retrieval practice on vocabulary learning among	Quantitative	Spaced practice improved long-term vocabulary retention.	Enhanced retrieval practice and provided a pedagogically effective strategy for EFL	Vocabulary acquisition requires repeated review over intervals, and there is still limited evidence regarding

No.	Articles	Objective	Method	Vocabulary Retention Support (RQ1)	Other Opportunities (RQ2)	Challenges
		young EFL learners.			vocabulary learning.	how spacing techniques should be implemented effectively in EFL classrooms.
13.	Miles (2014)	To investigate the effects of spaced versus massed distribution instruction on second language grammar learning.	Quasi-experimental (Quantitative)	Spaced distribution instruction improved long-term retention and produced more stable learning gains compared to massed instruction.	-	Inconsistent findings, and the complexity of grammar learning may reduce the effectiveness of spacing techniques compared to vocabulary learning.
14.	Murphy (2024)	To examine the impact of spaced learning strategies on vocabulary retention in primary school English classes.	Narrative review	Spaced learning enhances long-term retention and retrieval memory.	Enhances student attention without increasing learning time.	Teachers often face curriculum pressure, lack training in spaced practice, and still rely on massed practice.
15.	Al-Okiedy (2022)	To investigate the effect of the spaced learning repetition (SLR) method on EFL Islamic school students' achievement in English reading comprehension .	Quasi-experimental (Quantitative)	SLR improved reading comprehension achievement and vocabulary understanding.	Increased learner motivation, participation, collaboration, critical thinking, immediate feedback, and social interaction.	Small sample size (n=20), short intervention duration (4 weeks), and implementation requires teacher familiarity with SLR procedures and classroom management.
16.	Nakata et al. (2021)	To compare the effects of cumulative and noncumulative quizzes on L2 vocabulary learning over a semester.	Quantitative	Cumulative testing enhanced receptive and productive vocabulary retention.	Promoted distributed retrieval practice.	The effectiveness of cumulative testing may depend on spacing intervals, repeated retrieval, and students' study habits.
17.	Nakata (2015)	To examine the effects of within-session repeated retrieval on second language (L2) vocabulary learning.	Quantitative	Repeated retrieval improved vocabulary retention, especially with five and seven retrievals, and supported long-term vocabulary learning.	-	Benefits of repeated retrieval may diminish over time; excessive retrieval practice can reduce efficiency when time-on-task is controlled.
18.	Nakata (2017)	To investigate whether expanding	Quantitative	Expanding spacing facilitated vocabulary	Introducing spacing itself produced strong	Previous studies showed inconsistent

No.	Articles	Objective	Method	Vocabulary Retention Support (RQ1)	Other Opportunities (RQ2)	Challenges
		spacing improves second language vocabulary learning more effectively than equal spacing.		learning and long-term retention.	general learning benefits.	findings regarding expanding versus equal spacing; effectiveness depends on spacing amount and retention interval.
19.	Namaziandost et al. (2020)	To investigate the effects of spaced versus massed instruction on EFL learners' vocabulary recall and retention.	Quantitative	Spaced instruction significantly improved vocabulary recall and long-term retention compared to massed instruction.	-	Few classroom-based studies have explored spacing effects in authentic EFL contexts, and long-term vocabulary retention remains challenging.
20.	Permatasari et al. (2025)	To improve EFL students' English vocabulary mastery through the integration of Quizlet as a digital learning tool.	Classroom Action Research (Mixed-method)	Quizlet enhanced vocabulary mastery through flashcards, spaced repetition, and active recall.	Supported gamification, collaborative learning, learner autonomy, and increased student engagement and motivation.	Difficulties using the platform, and implementation depended on internet access, device availability, and students' technological literacy.
21.	Peterson et al., (2014)	To examine the effectiveness of Incremental Rehearsal (IR) in improving letter-sound acquisition and fluency among English Language Learners (ELLs).	Single-subject intervention design (Quantitative)	IR significantly improved letter-sound acquisition, fluency, and retention.	Reduced working memory demands and increased exposure to target language forms through structured, repetitive intervention.	Small sample size, limiting generalizability, lack of information about learners' first-language literacy backgrounds and uncertainty regarding implementation fidelity across different instructors.
22.	Kim & Webb (2022)	To investigate the effects of spaced practice on second language learning through meta-analysis	Meta-analysis	Spaced practice improves vocabulary learning and long-term retention.	Also benefits grammar and pronunciation learning.	Effectiveness varies depending on feedback timing, activity type, retention interval, and task complexity.
23.	Uchihara, et al. (2019)	To clarify the relationship between repetition and incidental vocabulary learning in second	Meta-analysis	Repetition supports vocabulary retention, form recognition, and meaning recall	-	The required number of encounters varies depending on proficiency, engagement, and spacing conditions.

No.	Articles	Objective	Method	Vocabulary Retention Support (RQ1)	Other Opportunities (RQ2)	Challenges
		language acquisition.				
24.	Zarrati et al. (2024)	To compare the effectiveness of digital flashcards on smartphones, laptops, and paper-based flashcards for academic vocabulary learning.	Quantitative	Smartphone-based flashcards enhanced vocabulary learning through spaced repetition.	Supported self-directed learning, mobile-assisted learning, and flexible vocabulary practice.	EFL learners face challenges in acquiring academic vocabulary, and teachers need effective technology integration and instructional support for digital vocabulary learning.
25.	Zhang et al. (2022)	To investigate the nature of spaced repetition in mobile-assisted word learning apps and explore learners' perceptions of spaced repetition strategies.	Mixed-methods	Mobile-assisted spaced repetition supported vocabulary retention and retrieval practice.	Supported multimedia learning, gamification, learner autonomy, and flexible self-paced vocabulary learning.	Many learners dislike repetitive learning activities, authentic mobile-assisted spaced repetition remains underexplored, and effective repetition patterns vary depending on learner preferences and knowledge levels.

The findings presented in [Table 3](#) reveal a striking degree of consistency across otherwise highly diverse studies: despite differences in educational level (from kindergarten to university), instructional format (classroom-based, mobile-assisted, or computer-assisted), and research design, the majority of the reviewed studies (23 of 25) converged on the same core conclusion that spaced repetition enhances learners' ability to retain vocabulary over extended periods through repeated exposure to target words at strategically distributed intervals ([Çakmak et al., 2021](#); [Lotfolahi & Salehi, 2017](#); [Nakata, 2015](#); [Namaziandost et al., 2020](#)). This convergence across such heterogeneous contexts suggests that SR's retention benefit is not confined to a particular learner population or instructional setting but reflects a comparatively robust and generalizable mechanism. Notably, however, two studies introduced important nuances to this otherwise consistent pattern. [Janebi et al. \(2025\)](#) found that SR-based MALL applications enhanced receptive vocabulary knowledge but produced no significant gains in productive vocabulary knowledge, suggesting that SR's retention benefit may not extend uniformly across all dimensions of word knowledge. Similarly, [Uchihara et al.'s \(2019\)](#) meta-analysis indicated that massed practice can occasionally outperform spaced repetition in incidental vocabulary learning, particularly for short-term outcomes, implying that SR's advantage may be most pronounced for long-term rather than immediate retention. These exceptions suggest that the magnitude of SR's retention benefit may depend on the specific dimension of vocabulary knowledge being measured (receptive vs productive) and the retention interval assessed (immediate vs delayed), rather than being uniform across all conditions.

Another prominent finding is the role of retrieval practice within spaced repetition. Several studies highlighted that repeated retrieval opportunities contributed to stronger vocabulary retention and recall accuracy ([Lotfolahi & Salehi, 2017](#); [Nakata, 2015](#); [Nakata et al., 2021](#); [Zhang et al., 2022](#)). For example, [Nakata \(2015\)](#) found that multiple retrieval attempts improved long-term vocabulary learning, while [Nakata et al. \(2021\)](#), in a semester long quasi-experimental comparison of cumulative and noncumulative quizzes—in which previously taught vocabulary items were retested alongside

newly introduced items across multiple testing sessions distributed over the semester—promoted distributed retrieval practice by requiring learners to repeatedly retrieve earlier-learned words at spaced intervals, thereby enhancing both receptive and productive vocabulary retention compared to noncumulative quizzes that tested only the most recently taught material. Similarly, [Zhang et al. \(2022\)](#) and [Lotfolahi and Salehi \(2017\)](#) emphasized that the combination of spaced review and retrieval practice facilitated deeper processing of lexical items, leading to more durable learning outcomes.

Beyond these core cognitive mechanisms, several studies also linked SR to broader pedagogical benefits, such as technology-enhanced delivery, increased learner motivation, and greater learner autonomy that extend beyond the retention mechanism itself. Because these benefits relate more directly to the opportunities and challenges of implementing SR, they are addressed in detail in the following section, together with the corresponding implementation challenges (see [Table 4](#) and [Table 5](#)).

Overall, the evidence synthesized in [Table 3](#) demonstrates that spaced repetition supports vocabulary retention primarily through two core cognitive mechanisms: (1) repeated exposure to vocabulary items over time, (2) retrieval practice that strengthens memory traces through active recall. These findings collectively indicate that spaced repetition is an effective instructional approach for promoting long-term vocabulary retention among EFL learners, with its broader implementation opportunities and associated challenges examined in the following section.

Opportunities and challenges associated with the implementation of spaced repetition in EFL learning context

The selected studies were further analyzed using thematic content analysis to identify recurring patterns across the reported findings. Similar findings were grouped into broader thematic categories representing opportunities and challenges associated with the implementation of spaced repetition. [Table 4](#) and [Table 5](#) present the resulting thematic classifications and their frequencies of both the opportunities and challenges associated with the implementation of spaced repetition.

Table 4

The Opportunities associated with the implementation of spaced repetition

No	Opportunities	Articles (no.)	Frequency
1.	Improving vocabulary retention	1, 2, 3, 6, 7, 9, 10, 11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25	20
2.	Long-term retention and memory enhancement	2, 5, 6, 8, 9, 12, 13, 14, 15, 17, 18, 19, 20, 22, 23	15
3.	Increasing learner motivation and engagement	1, 3, 7, 10, 12, 16, 21, 25	8
4.	Learner autonomy and self-directed learning	2, 4, 6, 11, 21, 24, 25	7
5.	Retrieval practice enhancement	13, 15, 17, 19, 21, 25	6
6.	Technology-enhanced language learning	2, 4, 6, 7, 11, 21, 24, 25	8
7.	Reading comprehension development	16	1
8.	Grammar learning and retention	9,14	2
9.	Pronunciation learning	9	1
10.	Lexical collocation learning	5	1
11.	Letter-sound acquisition and fluency	22	1
12.	Higher-order cognitive skills	8,16	2

Before turning to these results, it is important to note that the frequencies reported in [Table 4](#) and [Table 5](#) reflect how often a theme appeared across the 25 reviewed studies, not the magnitude of its effect on vocabulary learning, a higher frequency indicates broader attention or consensus across the reviewed literature rather than a stronger empirical effect. [Table 4](#) indicates that the most

frequently reported opportunity associated with spaced repetition is improving vocabulary retention, representing 27.8% of all identified opportunities (20 occurrences). This finding is followed by long-term retention and memory enhancement, which accounts for 20.8% (15 occurrences). Other prominent opportunities include increasing learner motivation and engagement and technology-enhanced language learning, each representing 11.1% (8 occurrences), followed by learner autonomy and self-directed learning (9.7%) and retrieval practice enhancement (8.3%). Less frequently reported opportunities include grammar learning and retention, higher-order cognitive skills, reading comprehension development, pronunciation learning, lexical collocation learning, and letter–sound acquisition and fluency. These findings suggest that the primary pedagogical value of spaced repetition lies in its ability to strengthen vocabulary retention while simultaneously promoting learner engagement and technology-supported learning. Furthermore, the challenges associated with the implementation of spaced repetition are shown in Table 5.

Table 5

The Challenges associated with the implementation of spaced repetition

No	Challenges	Articles (no.)	Frequency
1.	Implementation and instructional design challenges	1, 2, 4, 8, 9, 12, 13, 15, 16, 19, 24	11
2.	Technology and digital literacy constraints	1, 2, 4, 6, 7, 21, 24, 25	8
3.	Limited research evidence and need for further investigation	4, 6, 7, 11, 13, 14, 16, 20, 22, 25	10
4.	Spacing schedule and retrieval conditions	5, 9, 11, 13, 17, 18, 19, 23, 25	9
5.	Learner differences and individual factors	3, 7, 11, 12, 22, 23, 25	7
6.	Teacher and classroom management issues	3, 10, 15, 16, 24	5
7.	Vocabulary learning remains difficult	2, 6, 20, 24	4
8.	Resistance to spaced learning and preference for massed learning	8, 12, 15	3
9.	Resource and infrastructure limitations	3, 10, 21	3
10.	Skill-specific limitations	5, 7, 14	3

As shown in Table 5, implementation and instructional design challenges constitute the most frequently reported challenge, accounting for 17.5% of all identified challenges (11 occurrences). This category is followed by limited research evidence and the need for further investigation (15.9%; 10 occurrences) and spacing schedule and retrieval conditions (14.3%; 9 occurrences). Technology and digital literacy constraints also represent a substantial challenge (12.7%; 8 occurrences), while learner differences and individual factors account for 11.1% (7 occurrences). Additional challenges include teacher and classroom management issues, persistent difficulties in vocabulary learning, resistance to spaced learning and preference for massed practice, resource and infrastructure limitations, and skill-specific limitations. Collectively, these findings indicate that although spaced repetition offers considerable benefits for vocabulary learning, its effectiveness depends heavily on appropriate instructional design, technological support, learner characteristics, and contextual implementation factors.

Overall, the findings demonstrate that spaced repetition provides multiple pedagogical benefits beyond vocabulary retention, including enhanced learner motivation, autonomy, retrieval practice, and technology-supported learning. However, the reviewed studies also reveal several implementation challenges, particularly concerning instructional design, optimal spacing schedules, technological readiness, and contextual factors. These findings form the basis for the discussion of the theoretical and practical implications of spaced repetition in EFL vocabulary learning presented in the following section.

DISCUSSION

Rather than reflecting isolated or coincidental findings, the consistency with which spaced repetition supported vocabulary retention across heterogeneous studies can be interpreted through the integrated mechanism proposed in the Conceptual Framework. Specifically, the reviewed studies suggest that SR may support durable vocabulary learning through three interdependent conditions. First, review sessions are distributed over time, allowing a manageable degree of forgetting to occur before learners revisit target items, as proposed by the spacing effect and Ebbinghaus's forgetting curve (Kang, 2016). Second, SR encourages learners to actively retrieve vocabulary from memory rather than merely re-encounter it through passive review, consistent with retrieval practice theory (Karpicke & Roediger, 2008). This retrieval mechanism was reported in six reviewed studies (Lotfolahi & Salehi, 2017; Murphy, 2024; Nakata, 2015; Nakata et al., 2021; Permatasari et al., 2025; Zhang et al., 2022). Third, several technology-assisted implementations supported retrieval through multimodal materials, such as text, images, and audio, which may enrich vocabulary representations in line with dual coding theory (Clark & Paivio, 1991). The finding that improved vocabulary retention was reported in 20 of the 25 reviewed studies is therefore consistent with the proposition that spacing, active retrieval, and multimodal encoding may operate as complementary mechanisms supporting durable vocabulary retention.

This integrated interpretation also helps explain the two exceptions identified in the review. Janebi et al.'s (2025) null finding for productive vocabulary may indicate a retrieval-practice mismatch. Recognition-based MALL tasks may satisfy the spacing condition but may not require the deeper, production-oriented retrieval needed to develop productive vocabulary knowledge. Similarly, Uchiyama et al.'s (2019) finding that massed practice can rival SR in short-term incidental vocabulary learning is consistent with the importance of delayed retrieval. The benefits of spacing are expected to become more evident when learners are required to retrieve vocabulary after a delay, whereas this advantage may be less apparent when learning is assessed immediately. Rather than undermining the value of SR, these findings suggest that its effects may depend on the alignment among spacing intervals, retrieval demands, learning objectives, and the timing of retention assessment.

Beyond vocabulary retention, the review identified several additional opportunities associated with SR implementation. Increasing learner motivation and engagement and supporting technology-enhanced language learning were each reported in eight studies (Annisah et al., 2025; Darsana, 2025; Janebi et al., 2025; Lexi et al., 2025; Lotfolahi & Salehi, 2016; Al-Okiedy, 2022; Permatasari et al., 2025; Zhang et al., 2022), while learner autonomy and self-directed learning appeared in seven studies (Çakmak et al., 2021; Dhiya, 2025; Hirschel & Fritz, 2013; Lo, 2024; Permatasari et al., 2025; Zarrati et al., 2024; Zhang et al., 2022). Digital platforms such as Quizlet, Duolingo, Memrise, and other mobile-assisted learning applications provide flexible opportunities for repeated review beyond classroom settings (Dhiya, 2025; Hirschel & Fritz, 2013; Permatasari et al., 2025; Zarrati et al., 2024; Zhang et al., 2022).

Although vocabulary retention was the central focus of this review, several included and supporting studies suggest that the principles underlying SR may also contribute to related language-learning outcomes. These outcomes include reading comprehension (Al-Okiedy, 2022), grammar retention (Kim & Webb, 2022; Miles, 2014), pronunciation learning (Kim & Webb, 2022), lexical collocation acquisition (Farvardin, 2019), and letter-sound fluency (Peterson et al., 2014). These findings indicate that distributed practice and repeated retrieval may have wider pedagogical relevance beyond vocabulary learning. However, these broader applications should be interpreted cautiously because they were not investigated consistently across all included studies and were not the primary focus of the present review. Future research should therefore examine whether and under what conditions SR can support these additional language-learning outcomes in EFL and ESL contexts.

Despite these opportunities, several challenges remain. The most frequently reported challenges were implementation and instructional design, appearing in 11 studies, followed by limited research evidence and the need for further investigation (10 studies) and uncertainty regarding spacing schedules and retrieval conditions (9 studies). These findings are consistent with previous research

suggesting that the effectiveness of spaced repetition is highly dependent on the design of review schedules and instructional procedures. For example, Kang (2016) argued that although spaced repetition is a powerful learning strategy, its success relies on carefully planned spacing intervals and systematic implementation. Similarly, Cepeda et al. (2006) emphasized that learning outcomes vary substantially depending on the timing and distribution of review sessions. However, the findings of the present review also reveal a continuing lack of consensus regarding the optimal spacing intervals, number of repetitions, and retrieval frequency required for different learning contexts. This contrasts with the common assumption that a single-spacing schedule can be universally applied across learners and educational settings (Cepeda et al., 2006). Instead, the reviewed studies suggest that spacing effectiveness is influenced by contextual factors such as learner characteristics, task complexity, instructional goals, and learning environments (Farvardin, 2019; Kim & Webb, 2022; Miles, 2014; Zhang et al., 2022).

Technology and digital literacy constraints emerged as significant challenges, particularly in studies using mobile applications and digital learning platforms. Although digital SR tools can provide flexibility, accessibility, feedback, and opportunities for autonomous learning, these benefits may not be equally available to all learners because of unequal internet access, device availability, and digital literacy (Hirschel & Fritz, 2013; Zhang et al., 2022). The effectiveness of technology-supported SR therefore depends not only on the quality of the platform but also on learners' readiness and ability to use digital tools. Importantly, the retention benefits associated with digital SR are likely to result primarily from the spacing and retrieval processes that platforms automate, rather than from technology alone. Technology may contribute by delivering these processes consistently, supporting multimedia materials, and enabling learners to review vocabulary beyond class time. However, few reviewed studies isolated the effect of technological delivery from that of the underlying SR mechanism. This issue should be addressed in future research.

In addition, learner differences, classroom management issues, resource limitations, and resistance to spaced learning were identified as recurring barriers. This finding supports previous studies suggesting that individual learner characteristics influence the effectiveness of spaced repetition (Lotfolahi & Salehi, 2016; Zhang et al., 2022). However, whereas many experimental studies have primarily focused on the cognitive benefits of spaced repetition, the current review highlights the importance of affective and contextual factors in determining successful implementation. Some learners benefit substantially from repeated retrieval opportunities, whereas others perceive repetitive learning activities as monotonous or less engaging. These findings suggest that the effectiveness of SR is shaped not only by cognitive mechanisms but also by learner motivation, preferences, and educational contexts. Several evidence-based strategies may help teachers address these barriers. To accommodate learner differences, teachers can adopt adaptive spacing approaches similar to the individualized scheduling algorithms used in digital SR tools (Zhang et al., 2022) that adjust review frequency to individual learners' recall performance rather than applying a single fixed schedule to an entire class. Classroom management challenges may be mitigated by embedding brief, structured retrieval activities (short cumulative quizzes; Nakata et al., 2021) directly into existing lesson routines, rather than treating spaced review as a separate, additional task that competes with limited instructional time. Where resource and infrastructure limitations restrict access to digital tools, low-cost alternatives such as paper-based flashcards have themselves been shown to produce meaningful retention gains (Lexi et al., 2025), suggesting that the benefits of SR do not strictly depend on technology. Finally, to address learner resistance and the perception of spaced review as repetitive or monotonous, teachers can vary retrieval formats (alternating between written recall, oral production, and multimedia-based tasks) to sustain engagement while preserving the underlying spacing and retrieval mechanisms that drive SR's effectiveness. Therefore, adapting spaced repetition practices to learners' characteristics and classroom conditions is essential for maximizing its pedagogical benefits.

This review should be interpreted in light of several methodological limitations. The search was limited to Scopus, ScienceDirect, Google Scholar, and ResearchGate, and did not include Web of Science or specialist databases such as ERIC and PsycINFO. In addition, the inclusion of English-

language, peer-reviewed publications may have excluded relevant studies published in other languages or grey literature. The review did not employ a standardized quality-appraisal instrument or independent second-coder procedures; therefore, the thematic categorization of opportunities and challenges may involve some degree of subjectivity. Finally, because empirical studies and review or meta-analytic studies were analyzed together, some overlap in the underlying primary evidence may be present. These limitations should be considered when interpreting the findings and indicate the need for future reviews using broader search strategies, formal quality assessment, and more rigorous coding procedures.

The findings of this review are generally consistent with previous reviews and meta-analyses showing that spaced practice can produce stronger long-term learning outcomes than massed practice (Kang, 2016; Kim & Webb, 2022). The present review extends this evidence by synthesizing not only the effects of SR on vocabulary retention but also its pedagogical opportunities and implementation challenges in EFL and ESL contexts. The findings indicate that SR can support durable vocabulary learning through planned spacing and active retrieval while also promoting learner engagement, autonomy, and technology-supported practice. However, successful implementation depends on context-sensitive instructional design, appropriate spacing conditions, learner characteristics, technological readiness, and available classroom resources. Teachers may therefore integrate planned review schedules, active-recall activities, cumulative assessment, and appropriate digital or paper-based tools into vocabulary instruction. Curriculum developers and educational institutions should provide guidance, training, and accessible resources to support this implementation.

CONCLUSION

This systematic literature review synthesized the opportunities and challenges associated with implementing spaced repetition (SR) for vocabulary learning in EFL contexts. Based on the analysis of 25 studies published between 2010 and 2025, the review found that SR generally supports long-term vocabulary retention through distributed review and active retrieval practice, while technology-assisted and multimodal SR may further promote learner motivation, autonomy, and engagement. However, the effectiveness of SR depends on context-sensitive factors, including the design of review schedules, the quality of retrieval activities and feedback, learner characteristics, technological readiness, and classroom conditions. These findings extend previous outcome-focused research by demonstrating that SR should be understood not only as a memory-support technique but also as a pedagogical approach whose success depends on the alignment of spacing, retrieval, and appropriate instructional design. The review therefore offers practical guidance for teachers, curriculum developers, and educational technology designers to integrate planned review cycles, active-recall activities, and suitable digital tools into vocabulary instruction. Future research should employ longitudinal and methodologically rigorous designs involving more diverse learner populations, particularly adult and university-level EFL learners, to identify effective spacing schedules and examine whether the benefits of SR extend to broader language skills.

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CONFLICT OF INTEREST STATEMENT:

No potential conflict of interest was reported by the authors.

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