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The Use of Mindmap and its Effectiveness in Different Fields of Foreign Language Learning: A Systematic Review (2014-2024)

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Abstract

Mindmap has been verified as an effective learning tool in foreign language education. However, there was a notable lack of updated reviews with foci on the different areas, such as reading, writing and vocabulary etc., and on various learning strategies or technologies used in mindmap assisted foreign language learning. To fill this gap, the present study conducted a systematic and in-depth review of 33 relevant empirical studies published in WOS and Scopus journals from January 1, 2014, to June 30, 2024. The results indicated that mindmap was particularly effective for vocabulary retention, reading comprehension, and the prewriting stages of foreign language learning. Additionally, they also showed potential in enhancing speech and grammar skills. Furthermore, advancements in technology, such as mind mapping software and AI integration, significantly contributed to improved learning outcomes. Based on these findings, practical recommendations for educators on effectively implementing mind mapping techniques were provided. Finally, the review concludes with recommendations for future research, particularly exploring the use of emerging technologies such as artificial intelligence and effective strategies in conjunction with mind mapping.

Keywords: Mindmap, Foreign Language Learning, Pedagogical Strategies, Technology Integration

Introduction

In today's globalized context, language communication is crucial across various fields. However, foreign language learning still presents numerous challenges, such as vocabulary retention, grammar comprehension, oral expression, and writing proficiency. Traditional text-based teaching methods often fail to address these challenges effectively, prompting a shift toward innovative tools like mind mapping. As a visual learning technique, mind mapping helps learners organize information and create structured representations of complex concepts, making it a valuable tool in language education (Buzan, 2010; Luangkrajang, 2022).

Mind mapping is particularly relevant in foreign language education because it aligns with the cognitive processes involved in language learning. Research indicates that mind mapping has a positive impact on multiple aspects of language learning, effectively enhancing vocabulary, grammar, speaking, reading, and writing skills (Jun & Jamaludin, 2022). By visually organizing information, mind maps help learners make connections in vocabulary, grammatical structures or contextual usage, thereby facilitating deeper understanding and retention;Wibowo, 2020; Normawati, 2020). Despite its potential, there is a lack of comprehensive reviews evaluating its effectiveness in multiple areas of foreign language learning, such as reading, writing, and vocabulary. This gap highlights the need for a systematic review to synthesize existing evidence and explore the integration of mind mapping with emerging technologies and teaching strategies.

In foreign language learning, mind mapping has been considered as a tool that can provide distinct advantages to learners in the process of foreign language learning (Baskin, 2024). Studies have shown mind mapping positively influences many aspects of language learning to enhance various skills., such as vocabulary, grammar, speaking ability, reading ability, and writing skills (Jun & Jamaludin, 2022). In aspect of grammar, mind mapping helped students better understand and learn foreign language grammar (Wibowo, 2020; Normawati, 2020). In aspect of vocabulary, it was revealed that mind mapping had positive impacts and improved vocabulary retention (Al-Otaibi, 2019; Shi & Tsai, 2024). Regarding to speaking ability, mind mapping is considered an effective and potential tool in verbal accuracy and complexity in speaking.(Jun & Jamaludin, 2022). In aspect of reading, Many studies found that the use of mind mapping can enhance learners' development in reading comprehension and their reading ability (Gómez Betancur & King, 2014; Mohaidat, 2018). In writing, mind mapping could effectively improve the learner's writing performance in the steps of draft and revision (Karim, 2018; Mustika et al., 2021).

Although several studies have explored the application of mind maps in language learning, and the number of such studies has increased in recent years, there remains a lack of systematic and comprehensive reviews over the past decade. Specifically, there is a need for a thorough evaluation of their effectiveness in different fields of language learning, as well as the integration of mind mapping with various learning strategies and technologies.

The importance of this study lies in its potential to transform foreign language education by providing educators with evidence-based tools to enhance learning outcomes. As language learning becomes increasingly digital, the integration of mind mapping with technologies such as AI and mobile applications offers new opportunities for personalized and interactive learning experiences.

This review aims to address these gaps by providing a systematic analysis of the use of mindmap and the effectiveness of mind mapping in various fields of foreign language learning, offering practical recommendations for educators, and recommendations for identifying areas for future research. The rationale of this study is to provide a clear and systematic analysis of using mind mapping in foreign language learning. This review aims to critically analyze the existing literature on the use of mind mapping in foreign language learning. By synthesizing empirical findings from relevant studies in Web of Science and Scopus in the recent 10 years, the review aims to examine the efficacy of mind mapping in enhancing various aspects of FL learning, including vocabulary acquisition, grammar comprehension, speaking proficiency, reading comprehension, and writing skills. Furthermore, it also aims to explore effective pedagogical strategies and technological tools for integrating mind mapping techniques into FL instruction and provide actionable insights and recommendations, guiding instructors on how to effectively incorporate mind mapping to enhance student learning effect.

The following research questions have been formulated to obtain the results of this study:

RQ1. How Many Studies were Published over the Years and what trends have emerged in research on the use of mind maps in foreign language learning from 2014 to 2024?

RQ2. What is the empirical evidence supporting the effectiveness of mind mapping in different fields of foreign language learning and what pedagogical strategies or technologies can be employed to integrate mind mapping techniques into foreign language instruction effectively in different fields?

Methods

The systematic literature review methodology, as articulated by Safdar et al. (2023), was employed in this study, guided by the quality standards outlined in the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Tian et al., 2015). The review process was structured into two distinct phases: planning and execution. The planning phase involved the formulation of research questions, defining inclusion and exclusion criteria, and the identification of descriptors and databases. Subsequently, the execution phase encompassed reference retrieval from the designated databases, data refinement through filtering, information extraction, and the synthesis of results for representation. The inclusion and exclusion criteria were developed in accordance with the study's objectives and research questions, according to the PRISMA statement's recommendations (Tian et al., 2015).

Strategy

The search strategy was centered on the Web of Science (WOS) and Scopus databases, chosen for their international prestige and adherence to high quality standards for article indexing. Following the selection of these databases, descriptors were defined, and search equations were subsequently developed, as outlined in Table 1.

Table 1
Inclusion and Exclusion Criteria

Inclusion Criteria (IC)	Exclusion Criteria (EX)
IC1: Journal articles.	EX1: Book chapters, books, or other types of non-peer-reviewed publications.
IC2: Empirical research.	EX2: Theoretical studies or revisions.
IC3: Articles written in English	EX3: Articles are not written in English
FIC4: Research discusses learning foreign language using mind mapping	EX4: Research does not discuss learning foreign language using mind mapping

Table 2
Search topics

Database	**Search Descriptors （WOS & Scopus）**
WOS	TS=((mindmap) OR (mind map*) AND (language) AND (learning))
Scopus	TITLE-ABS-KEY=mindmap OR (mind map*) AND language AND learning

Document type = article Time period = 2014.01.01-2024.06.30
Note: the asterisk (*) was employed to broaden the search scope and capture all keywords sharing the same word root.

The selection of articles was conducted by two independent researchers, adhering strictly to the guidelines outlined in the search protocol. This approach minimized the risk of selection bias, as noted by Hinojo-Lucena et al. (2019). Notably, the researchers achieved full agreement (100%) in their selection of studies.

Data Collection and Analysis

Data collection followed the PRISMA protocol, dividing the screening process into four phases (Figure 1). The process began with the identification phase, which encompassed all articles found after using the search equations outlined in Table 2 in the WOS and Scopus databases. In the subsequent screening phase, duplicate records were removed, and the inclusion and exclusion criteria were applied, leading to a reduced number of articles. Next, during the suitability phase, the texts of the remaining articles were thoroughly analyzed to extract key information listed in the research questions (RQs). At this stage, the inclusion criteria (IC1, IC2, IC3, and IC4) and exclusion criteria (EX1, EX2, EX3, and EX4) were rigorously executed, resulting in the elimination of articles that failed to meet the inclusion standards or met the exclusion criteria. Finally, in the inclusion phase, the articles constituting the study sample were collected. The search was conducted on 1 January 2024, encompassing all articles published in the past 10 years.

The search strategy focused on the Web of Science (WOS) and Scopus. The flow diagram was formed (Figure 1).

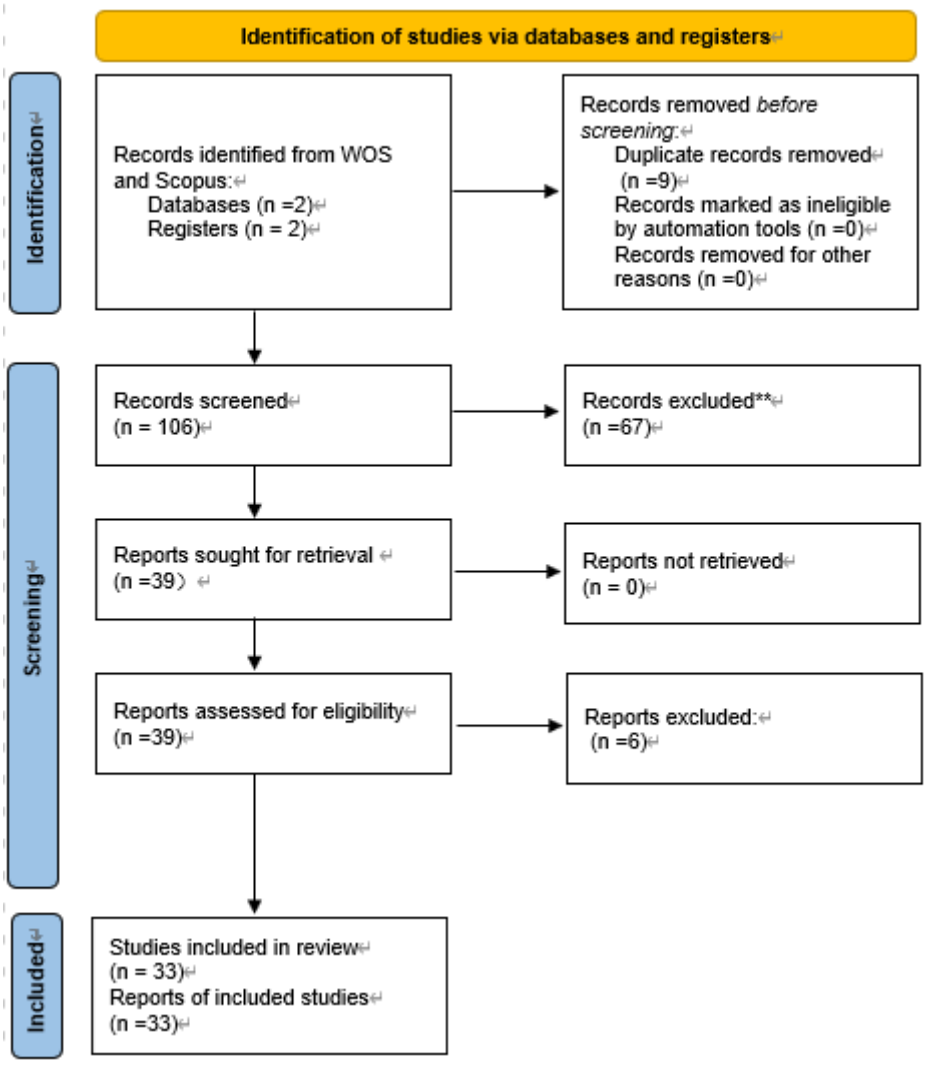

Figure 1. Flow diagram

The inclusion (IC1, IC2, IC3and IC4) and exclusion (EX1, EX2, EX3 and EX4) criteria were applied in this phase. The result is shown in Figure 2. After selection, 33 articles are in the field of using mind mapping in foreign language learning. Among the 33 articles reviewed, 12 focus on the role of mind mapping in vocabulary acquisition within foreign language learning. Additionally, 11 articles explore its impact on writing, while 7 are related to reading. Only 3 articles address the application of mind mapping in speaking, and 1 article examines its relevance to grammar instruction. 4 articles provide a general overview of mind mapping across multiple aspects of language learning.

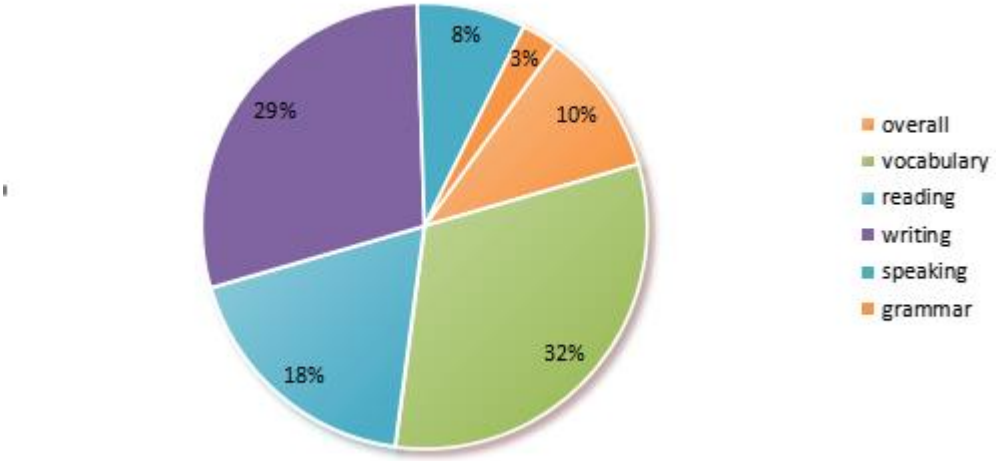

Figure 2: Distribution of using mindmap in different fields of foreign language learning

Results

RQ1. How many studies were published over the Years?

A total of 33 articles satisfied the study's objectives and adhered to the established inclusion and exclusion criteria. These data are from January 1, 2014, to June 30, 2024. Most of these articles were published in the last five years (72.72%). This trend reflects a growing academic interest in the role of mind maps in foreign language learning, particularly as educational technologies continue to advance (Figure 3).

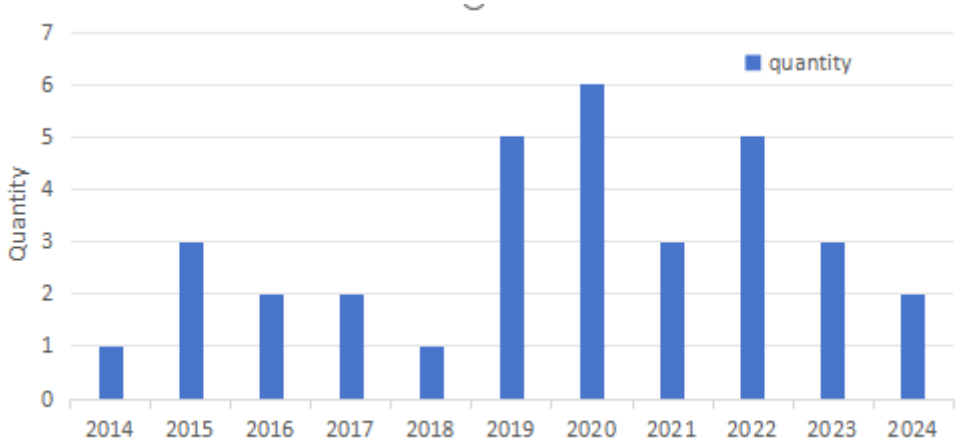

Figure 3: Grouping of articles by year

RQ2. What is the empirical evidence supporting the effectiveness of mind mapping in different fields of foreign language learning and what pedagogical strategies or technologies can be employed to integrate mind mapping techniques into foreign language instruction effectively in different fields?

This part introduced the application and development of mindmap in assisting language learning. The table shows the literature of the use of mindmap and its effectiveness in different fields of foreign language learning in the past 10 years.

Table 3
Literature of the Use of Mindmap and its Effectiveness in Different Fields of Foreign Language Learning

Author	Year	Field	Objective	Findings
Wu & Chen	2018	Reading	To investigate the effectiveness of integrating e-books, reciprocal teaching, and mind mapping in teaching classical Chinese to tenth-grade students in a vocational school.	The findings indicate that integrating e-books into language learning, along with reciprocal teaching and mind mapping strategies, positively impacts reading comprehension, knowledge sharing, and cognitive skills development among students.
Van der Wilt et al.	2019	Reading	To investigate the impact of three interactive reading strategies—traditional interactive reading, interactive reading with focused attention, and interactive reading incorporating mind maps—on children's language ability.	All 3 types of interactive reading strategies (traditional interactive reading, interactive reading with focused attention, and interactive reading with the use of mind maps) are beneficial for enhancing children's language abilities.
Almanea	2021	Reading	To explore the correlation between brain hemispheric dominance and reading comprehension among adult Saudi EFL learners.	Right-brained learners and whole-brained learners with a preference for the right mode benefited most from the visual tool of mind mapping. This suggests that learners with varying hemispheric dominance should adopt different learning strategies tailored to their cognitive preferences.
Pannim et al.	2022	Reading	To explore the innovative method of combining multimedia storytelling with mind maps to improve reading comprehension among students with learning disabilities (LD).	This approach using multimedia storytelling with mind maps significantly improved their reading while addressing the learners' weaknesses.

Yan & Kim	2023	Reading	To investigate the effect of schema strategy instruction through digital mind mapping on enhancing the reading comprehension of Chinese university students studying English as a Foreign Language.	Schema strategy instruction using digital mind mapping effectively enhanced participants' awareness of schema strategies in reading, though it did not lead to a significant improvement in their reading comprehension scores.
Chen et al.	2023	Reading& Speaking	To investigate the potential synergy between ChatGPT and mind mapping in enhancing children's storytelling and comprehension skills.	ChatGPT has shown potential in improving storytelling and comprehension skills in children, particularly when integrated with mind mapping techniques.
Araújo &Correia	2020	Speaking	To investigate the effectiveness of mind mapping as a pedagogical technique in teaching consecutive interpreting to students in the Bachelor's degree in Applied Languages program.	Mind maps helped in structuring ideas, showing connections between different concepts, and circumscribing important information, which enhanced their thought process and speech delivery.
Permatasari & Andriyanti	2021	Speaking	To develop students' intercultural communicative competence (ICC) and their ability to function appropriately in multicultural situations	The systematic and explicit teaching of cultural texts, supported by mind maps and other visual aids, effectively enhanced students' intercultural competencies and language skills
Werbińska	2014	Vocabulary	To examine the stability and variability of beliefs held by two pre-service language teachers over a nearly three-year period. .	The mind-mapping technique was utilized by pre-service teachers as part of their vocabulary learning strategy. It helps organize and retain vocabulary more effectively than traditional methods like rote memorization.
AlJarf	2015	Vocabulary	To develop and evaluate a model that enhances vocabulary	Students who utilized vocabulary mind-maps demonstrated greater

			acquisition in English as a Foreign Language	improvements in vocabulary acquisition and achieved higher accuracy in vocabulary knowledge.
Bahadori & Gorjian	2017	Vocabulary	To explore the effect of mind mapping on English vocabulary attainment among pre-university learners.	Various types of mind mapping software may be helpful in learning vocabulary since the learners' visual memory could be reinforced through the mind mapping charts.
Aiotaibi	2019	Vocabulary	To investigate the efficacy of a cognitive method, particularly Rudzka-Ostyn's Model, in teaching phrasal verbs to learners of English as a Foreign Language (EFL).	The experimental group demonstrated notable improvement in retaining the meanings of phrasal verbs and applying particles' literal senses to new contexts. However, their post-test performance was not significantly superior to that of the control group. The lack of significant improvement was attributed to difficulties in including all verbs or senses in a single map, particularly for polysemous phrasal verbs.
Prabha & Aziz	2020	Vocabulary	To evaluate the effectiveness of employing Poly-Category Mind Maps for vocabulary enhancement.	Employing Poly Category Mind Maps is beneficial for vocabulary enhancement in English language such as Improving Vocabulary Knowledge and Integration and Deep Processing
Shah	2020	Vocabulary	To investigate the impact of using the Poly Category Mind Map strategy on undergraduate students' achievement in developing English vocabulary	The findings highlight the significant positive impact of the Poly Category Mind Map strategy on vocabulary acquisition and support its adoption in educational settings to improve language learning outcomes.

Alhajaji et al.	2020	Vocabulary	Examining the effectiveness of the GMT technique—Games, Mind-Mapping, and Twitter Hashtags—in teaching vocabulary within an EFL higher education context.	The GMT (Games, mind-mapping, and twitter hashtags) technique is effective in promoting active engagement and improving vocabulary learning among EFL students. In this process, Mind-Mapping serves as Cognitive tools to help students organize and retain vocabulary.
Luangkrajang	2022	Vocabulary	To evaluate mind-mapping techniques in language learning	Mind mapping is an effective teaching tool that not only enhances language learning but also promotes broader cognitive and collaborative skills, fostering a more engaging and interactive learning environment.
Alba	2022	Vocabulary	To evaluate the effectiveness of mind mapping software in developing vocabulary skills among English as Foreign Language learners	Mind mapping software was found to significantly enhance vocabulary acquisition, demonstrating better retention and understanding of new words compared to traditional methods.
Shi &Tsai	2024	Vocabulary	To evaluate the effectiveness of a mind mapping Mobile Assisted Language Learning (MALL) app in assisting Taiwan learners to learn vocabulary.	Mind mapping MALL app is an effective method for learning foreign vocabulary, providing both immediate and long-term benefits in vocabulary acquisition and retention.
Yen	2024	Vocabulary&reading	To evaluate the effect of mind walker program standing by Under Design Model (UbD) for remote upper-grade elementary students on enhancing English Comprehension.	The use of mind maps improved Vocabulary Acquisition and helps participants make connections between words and concepts, facilitating better understanding of texts
Lin	2019	Writing	To evaluate the effectiveness of integrating mind	Using mind mapping in combination with online peer assessment can

			mapping with an online peer assessment approach in a flipped classroom setting for English writing education.	improve Organizational Thinking and Paraphrasing Skills,enhance Learner Autonomy and Critical Thinking and positive Learning Reflections
Adamson et al.	2019	Writing	To explore the academic supervisory practices and experiences of supervisors in guiding Japanese Master's students in their L2 thesis writing.	Mind maps may be used as a part of pre-writing planning planning in the writing process. However, specific effects or detailed discussions on their use are not provided in the document.
Naghme & Rastgoo	2020	Writing	To assess the effectiveness of mind maps on enhancing EFL writing skills among intermediate-level Iranian students.	Mind maps significantly enhance the development of organizing skills in intermediate-level EFL writing. However, they do not have a notable effect on improving mid-stage EFL writing style.
Bui & Vu	2020	Writing	To investigate the impact of integrating traditional teaching methods with various technological tools and modern classroom practices in a writing class, utilizing a range of interactive and independent learning activities and channels.	Mind map presentations garnered substantial positive feedback.They were found to be beneficial in several ways, such as enlarging the range of vocabulary, helping to remember ideas better, improving communicative skills, enhancing collaboration and confidence, and promoting creative and logical thinking.
Tay & Li Phang	2022	Writing	To investigate the effectiveness of mind mapping software, specifically i-Think maps, in aiding pre-service teachers with their academic writing.	The use of mind mapping software can effectively enhance academic writing abilities among pre-service teachers.
Sitawati, et al.	2022	Writing	The objective of the study is to develop a TBLT (Task-Based Language Teaching)-blended learning model for teaching English for	The impact of utilizing mind maps included improved clarity in students' writing and better understanding of the relationships

			international correspondence.	between different concepts in business correspondence.
Lan et al.	2015	Writing	To investigate the impact on various computer-assisted cooperative prewriting strategies on elementary-level EFL (English as a Foreign Language) learners' writing performance in Taiwan, including mind mapping, text-based brainstorming, and drawing.	The mind mapping strategy had strongest impact on elementary-level EFL writers, with the drawing strategy and text-based brainstorming strategy following in effectiveness.
Synekop	2015	Writing	To resolve the problem of writing of students in technical specialties	Different tools such as brainstorming, freewriting and mindmap can be used in Information organization of the text writing.
Abrams & Byrd	2016	Writing	To investigate the influence of pre-task planning on L2 writing, focusing on the use of mind mapping and chronological sequencing activities to enhance the writing performance of first-year German learners.	No significant differences were found between the mind-mapping pre-task and the chronological sequencing pre-task in terms of their effects on the writing tasks.
Vijayavalsalan	2016	Writing	To examine the effectiveness of mind mapping as a technique for improving essay writing skills among undergraduates in the context of learning foreign languages.	The findings revealed that using the mind mapping technique for pre-writing planning significantly enhanced the effectiveness of essay writing in coursework, making the process more enjoyable and engaging.
Archer	2017	Writing	To explore the affordances of multimodal pedagogies in writing center environments to improve student writing.	Mind mapping is identified as one of the tools used within multimodal pedagogies to enhance student writing.
Smagulova et al.	2019	Overall language skills	To explore the implementation and effectiveness of the	The article highlights that using the CLIL approach, including activities like

			Content and Language Integrated Learning (CLIL) approach in overcoming language acquisition barriers for students of non-linguistic specialties in higher education institutions in Kazakhstan.	mind mapping, significantly aids in language acquisition. Mind maps help students organize and visualize information, making it easier to understand and remember.
Kashiwa	2021	Overall language skills	The objective of using mind maps in the context of language learning was to enhance students' self-reflection on their learning experiences beyond the classroom and to support the creation of a more effective learning environment.	An English major student created a mind map as a tool to reflect on her learning experiences beyond the classroom, both before and after participating in various reflective activities.
Norah	2023	Overall language skills	To evaluate nursing students' self-motivation, attitude toward communicative Language teaching, and learning style preferences Concerning	More than 70% preferred learning medical terminologies using visual aids, mind maps.

Vocabulary

Vocabulary learning is perhaps the most extensively studied area in mind mapping research, with 12 out of the 33 studies reviewed specifically addressing this area. This indicates that mind maps have significant potential to enhance vocabulary learning and promote language acquisition. Mind mapping has proven to be effective to enhance vocabulary acquisition and retention in language learning (Rahayu et al., 2024). Multiple studies consistently report positive outcomes, demonstrating that the visual and associative elements of mind maps significantly improve learners' ability to recall and understand new vocabulary. For instance, Bui and Vu (2020) reported that mind maps help expand the range of vocabulary learners acquire, confirming their effectiveness in vocabulary learning. Among various types of mind maps, the Poly Category Mind Map is one of the most frequently used and studied formats. Prabha and Aziz (2020) highlighted the practicality of Poly Category Mind Maps in improving participants' vocabulary learning performance. The features of this mind map type, such as the use of pictures, keywords, and word groupings, make it especially useful for learning and retaining vocabulary, including complex forms like phrasal verbs (A. H. Shah, 2020).

Mind maps, when integrated with pedagogical strategies and models, enhance their effectiveness in educational contexts (Al-Jarf, n.d.; A/P Prabha & Abdul Aziz, 2020; A. Shah,

2020). For instance, Al-Otaibi (Al-Otaibi, 2019) explored the application of mind maps alongside Rudzka-Ostyn's Model, a cognitive framework designed for teaching phrasal verbs to EFL learners. This combination was shown to promote a deeper understanding of the semantic roles of particles in phrasal verbs, thereby enriching the overall learning experience (Shah, 2020).

Mind mapping is also effectively combined with technologies. Shi and Tsai (2024) demonstrated that mind mapping MALL apps are an effective method for learning foreign vocabulary, providing both immediate and long-term benefits in vocabulary acquisition and retention. This integration allows learners to engage with vocabulary in a dynamic, interactive format that enhances visual memory and recall. Mind mapping software was found to significantly enhance vocabulary acquisition, demonstrating better retention and understanding of new words compared to traditional methods. The effectiveness of mind mapping software was found in developing vocabulary skills among Foreign Language learners. Mind mapping software was found to significantly enhance vocabulary acquisition, demonstrating better retention and understanding of new words compared to traditional methods (Alba, 2022) since the learners' visual memory could be reinforced through the mind mapping charts implications (Bahadori & Gorjian, 2017).

Reading

Mind mapping has been shown to significantly enhance reading comprehension by aiding learners in visually organizing and summarizing information from texts. Studies by Keles (Keleş, 2012) and Buzan (2010) demonstrate that students using mind maps for reading tasks exhibit better comprehension and recall compared to traditional note-taking methods. Among the reviewed 7 studies related to reading, 6 articles (85%) focused on the impact of mind mapping on reading comprehension, highlighting consistent positive outcomes (Almanea,M, 2021; (Pannim et al., 2022; van der Wilt et al., 2019; Wu & Chen, 2018; Yen, 2024). However, there was a review study that indicated no significant improvement in reading comprehension scores. This might be attributed to the short duration of interventions (Yan & Kim, 2023).

Mind mapping, as an effective teaching tool, is often combined with other instructional strategies to enhance students' reading comprehension. Integrating e-books into language learning, along with reciprocal teaching and mind mapping strategies, positively impacts reading comprehension, knowledge sharing, and cognitive skills development (Wu & Chen, 2018). The use of multimedia storytelling with mind maps significantly improves students' reading comprehension skills (Pannim et al. 2022). Additionally, interactive reading using mind maps has been shown to be beneficial for enhancing children's language abilities (van der Wilt et al., 2019).

Mind mapping combined with technology also demonstrates unique advantages and significant effectiveness in enhancing reading comprehension. Mindmap APP (Pannim et al.) and mindmap combining Chat GPT (Chen et al., 2023) have shown significant improvements in reading comprehension skills. Additionally, Schema strategy instruction using digital mind mapping has been found to effectively promote participants' awareness of schema strategy in reading, though it did not significantly improve reading comprehension scores (Yan, XF; Kim, J, 2023).

Writing

Mind mapping has proven to be effective in enhancing writing skills by assisting learners in organizing their ideas and developing coherent text structures. Among the 11 articles reviewed that focused on writing, most studies utilized mind mapping during the prewriting phase (Adamson et al., 2019; (Lan et al., 2015). Notably, improvements in foreign language learners' writing performance were found when using mind map (Abrams & Byrd, 2016; Archer, 2017; Naghmeh-Abbaspour & Rastgoo, 2020; Sitawati et al., 2022; Synekop, 2015; Vijayavalsalan, 2016). However, it is important to note that mind maps did not have a significant impact on the development of mid-stage EFL writing styles (Naghmeh-Abbaspour & Rastgoo, 2020).

Mind mapping has proven to be an effective instructional tool, particularly when combined with other instructional strategies to enhance students' writing skills (Archer, 2017; Bui & Vu, 2020; Lin, 2019). For example, integrating mind mapping with peer assessment improves writing skills, increases student engagement, and enhances learner autonomy and critical thinking (Lin, 2019). Besides, mindmap used in a (Task-Based Language Teaching)-blended learning model improved clarity in students' writing and better understanding of the relationships between different concepts (Sitawati et al., 2022). Additionally, mind mapping has been identified as one of the tools used within multimodal pedagogies to enhance student writing (Archer, 2017).

Mind mapping combined with technology also demonstrates unique advantages and significant effectiveness in developing writing skills. For instance, the use of mind mapping software can effectively enhance academic writing abilities (Tay & Phang, 2022). Lan et al. (2015) examined the effect of various computer-supported cooperative prewriting strategies—such as text-based brainstorming, drawing, and mind mapping—on the writing performance of elementary EFL learners. The results indicated that mind mapping, as a computer-supported tool, had the most significant effect on improving learners' writing skills.

Speaking

In terms of speaking, 2 reviewed studies have highlighted the effectiveness of mind mapping in improving speech organization and delivery (Araújo & Correia, 2020); Chen et al. , 2023). Araújo and Correia (2020) found that mind maps aid in structuring ideas, illustrating connections between concepts, and emphasizing key information, thereby enhancing both thought processes and speech performance. Similarly, Chen et al. (2023) investigated the synergistic potential of combining ChatGPT with mind mapping to bolster children's storytelling and comprehension skills. Their findings indicate that children who utilized mind maps during storytelling were able to retell stories more effectively. The visual representation of information facilitated deeper engagement, allowing readers to generate their own interpretations and ideas related to the narrative. This suggests that integrating mind mapping with interactive tools like ChatGPT can significantly enhance educational outcomes in storytelling.

Grammar

The role of mind maps in grammar instruction has been the least explored, with only one study focusing specifically on this area (Luangkrajang, 2022). The findings suggest that mind maps can be useful in helping learners visualize complex grammatical structures, such as

sentence patterns and verb conjugations. Luangkrajang (2022) reported that students who used mind maps to learn grammar rules demonstrated improved understanding and application of grammatical concepts compared to those who learned through traditional exercises.

Implication for Educators

First, teachers should select proper method and field to apply mindmap method. This review found that mind maps are overall effective in vocabulary learning, grammar learning, speaking ability, reading ability, and writing skills (Jun & Jamaludin, 2022), the subject matter, courses, and methods of applying mind maps differ in their effects. Therefore, when teachers should select proper method to apply mind maps in learning or teaching at the beginning, they should select the appropriate fields that have been widely validated, such as writing, reading, and vocabulary. Moreover, the method of using mind maps should be carefully chosen (Loc & Loc, 2020) whether students create mindmap or teachers generate mindmap as instructional aids. During this process, the user-friendliness of the tool should be considered, as it is closely related to students' perceptions of the learning process and the learning outcomes (Lun et al., 2022).

Second, based on these analyses, teachers should assess students' ability to accept this teaching method or use mind maps as a learning tool. According to the results of the assessment, if students show difficulty in accepting or using mind maps, teachers should provide them with technical guidance and training before implementing mind maps (AlSaleem, 2019). The guidance should include an introduction to the functions and usage of mind maps. This instruction should include a clear explanation of how mind maps can enhance learning in language skills (Jamaluddin, 2023), such as organizing ideas for writing, structuring speech, or visualizing vocabulary connections. If mind maps are combined with other teaching strategies or technologies, it should also include an introduction to the strategies or technological functions used in combination with mind maps (Wong & Jamaluddin, 2023), explanations of the usefulness of these strategies and functions in teaching or learning. Teachers should demonstrate specific techniques for creating and utilizing mind maps effectively, along with examples.

In addition, Practicing the use of these strategies and technologies is also necessary to prepare students to use mind maps for learning (Idris & Kamaruddin, 2022) and offering this guidance, students can better understand the benefits of mind maps and incorporate them more successfully into their language learning process.

Further Use of Mindmap in Foreign Language Learning

The potential for further applications of mind mapping in foreign language learning remains vast and underexplored. While existing research has established its effectiveness in enhancing reading, writing, and vocabulary acquisition, opportunities exist to expand its use in developing speaking, listening, and grammar skills. Furthermore, integrating mind mapping with emerging technologies such as AI-driven tools, mobile applications, and multimodal learning platforms can provide personalized, interactive, and collaborative learning experiences. These advancements not only enhance learners' academic performance but also foster deeper engagement and more effective retention of knowledge, paving the way for innovative approaches to foreign language education.

Fields in Foreign Language Learning

There has been extensive research in the areas of reading, writing, and vocabulary related to the use of mind maps in foreign language learning (Alba, 2022; Bui & Vu, 2020; Chew et al., 2019). However, the use of mind maps for speaking skills, such as outlining or creating frameworks for presentations, remains underexplored (Baskin, 2024). Additionally, fields such as grammar and listening have not been studied in depth, which entailed the value of further investigation of them in these fields.

Integration with Pedagogical Strategies or New Technologies

In recent foreign language learning studies, various types of technologies have been frequently utilized in mindmap assisted foreign language learning, however previous research on mind maps rarely explored emergent technologies such as web-based or mobile app-based mind maps or AI technology. Empirical evidence suggests that web-based or mobile app-based mind maps are effective in enhancing students' academic performance and improving their interest or perception of learning (e.g. Chen et al., 2023; Shi & Tsai, 2024)). This highlights the need for further research and application of these aspects in mindmap assisted foreign language learning.

Integration of Artificial Intelligence and Smart Tools

Personalized Learning Paths: AI tools can generate personalized mind maps based on learners' progress and proficiency levels (Chen et al., 2020; Jaiswal & Arun, n.d.). For example, if a student struggles with verb conjugations in Spanish, the AI can generate a personalized mind map focusing on verb tenses, showing related vocabulary and grammar rules. This tailored approach helps learners visualize complex language structures and reinforces areas where they need improvement, thus enhancing their overall language proficiency.

Automated Content Generation: In foreign language learning, automated content generation tools can create customized mind maps based on specific topics (Chen et al., 2023) or grammar rules. For instance, a student learning English might input the topic "The Past Tense" into a mind mapping tool. The AI would automatically generate a mind map with key points such as "The Past Tense," "Past perfect tense, past perfect continuous tense," and "Expressions of Time," along with example sentences, conjugation rules, and common usage tips. This visual representation helps students understand the relationship between different past tense forms, improving their comprehension and retention of the language.

Mobile Mind Mapping Tools Supporting Foreign Language Learning

Based on mobile device applications, mind mapping tools allow students to engage in language learning anytime and anywhere, making full use of fragmented time to update learning content (Shi & Tsai, 2024). With more diverse and in-depth development, the combination of mobile learning and mind mapping leverages the portability of these tools, supporting interactive, fragmented, and collaborative learning. By using mobile mind mapping tools, language learning becomes more interactive and flexible, helping students effectively organize, connect, and apply the knowledge they acquire, thus improving learning efficiency and engagement. For example, when learning English vocabulary, students can use a mobile mind mapping tool to create a vocabulary map on the topic of "environmental protection." During fragmented time, they can open their phones to update new words such as "recycling" and "sustainability," and link these words to related phrases or sentences. With

the tool's interactive features, students can add images, audio pronunciations, or share the mind map with others for collaborative learning, expanding the vocabulary network together. This approach is both convenient and enhances students' understanding and retention of vocabulary, promoting effective language learning.

Integration with Learning Strategies

Mindmap can be combined with various learning strategies to promote learning effect (Alba, 2022; Shah, 2020). However， research in this area remains limited. Exploring such combinations could yield valuable insights for improving teaching and learning outcomes. For instance, it can be combined with cooperative learning strategy (Lan et al., 2015). Specifically, Teacher Guidance and Peer Feedback strategy can be used combining mindmap. Teachers can guide students to collaboratively create mind maps on specific topics, and through group presentations, students can receive peer feedback, helping them reflect and improve their learning strategies.

Integration with Multimodal Learning

Integration of Audio, Video, and Text: Future mind mapping tools could support multimodal input, allowing students to learn language through the combination of audio, video, text, and images(Archer, 2017). For example, nodes in the mind map could include audio pronunciation samples, video explanations, and images to aid memory, enhancing language learning.

Limitations

This review study has two key limitations. First, the articles included were limited to those published in WOS and Scopus-indexed journals. Future research could broaden the scope by incorporating studies from additional sources, such as book chapters, conference papers, and articles indexed by other databases, to provide a more comprehensive overview of the field. Second, this study concentrated on the areas and methods of using mind mapping in foreign language learning, without exploring other aspects of the reviewed articles, such as participants' ages, language proficiency levels, group sizes, and research methodologies. Future studies could address this gap by considering these diverse factors in their reviews.

Conclusion

This systematic review highlights the effectiveness of mind mapping as a powerful tool in foreign language learning, especially in improving vocabulary retention, reading comprehension, and writing skills. The review, which analyzed 33 empirical studies published from 2014 to 2024, consistently demonstrated the positive impact of mind mapping across these domains. While the majority of studies focused on vocabulary, reading, and writing, mind mapping also showed potential to support speaking and grammar skills. Importantly, integrating emerging technologies, particularly AI and mind mapping software, has played a significant role in enhancing learning outcomes.

These findings contribute significantly to both theory and practice, reaffirming the value of visual learning tools in language education. On a practical level, the study offers educators actionable insights on how to implement mind mapping techniques more effectively, particularly when integrated with modern technologies. These tools can provide personalized learning experiences, better catering to diverse learner needs.

However, the review also identified gaps in research, especially the limited exploration of mind mapping's application in speaking and grammar, and its integration with emerging technologies. Future research should focus on expanding these areas, exploring how AI-driven tools can further enhance foreign language learning. Additionally, the review calls for longitudinal studies to assess the long-term impact of mind mapping on language retention and fluency.

In conclusion, despite certain limitations, such as the exclusion of non-English studies and book chapters, this review provides suggestions for future pedagogical innovations. By advancing the understanding of mind mapping in foreign language education, this study paves the way for its broader application, ensuring it remains a relevant and powerful tool in language acquisition.

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