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Neuroeducation and Cognitive Processes in English as a Foreign Language (EFL) Learning: The Role of Working Memory, Auditory Processing, and Cognitive Load in Intensive Language Environments

Neuroeducación y procesos cognitivos en el aprendizaje del inglés como lengua extranjera (EFL): el rol de la memoria de trabajo, el procesamiento auditivo y la carga cognitiva en entornos intensivos de aprendizaje

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ABSTRACT

This study analyzes the relationship between neuroeducation, and the cognitive processes involved in English as a Foreign Language (EFL) learning, focusing on working memory, auditory processing, sustained attention, and cognitive load in Intensive Language Environments (ILEs). A qualitative systematic literature review was conducted following PRISMA guidelines. Academic sources were searched in Google Scholar, Scopus, ERIC, ScienceDirect, and SpringerLink. From 45 initially identified studies, 10 met the inclusion criteria and were selected for final analysis. The findings indicate that working memory supports listening comprehension, vocabulary retention, and grammatical processing, while auditory processing contributes to speech perception and oral understanding. Sustained attention allows learners to focus on relevant linguistic input, and cognitive load influences how effectively students process new information. Excessive cognitive demands may limit performance; however, multimodal input, scaffolding, repetition, and guided listening activities can reduce overload and improve learning outcomes. The study concludes that neuroeducation offers a useful framework for designing EFL teaching practices aligned with cognitive functioning. Its integration in intensive language contexts may strengthen comprehension, retention, and communicative performance.

Keywords: neuroeducation, working memory, auditory processing, cognitive load, EFL learning.

RESUMEN

Este estudio analiza la relación entre la neuroeducación y los procesos cognitivos involucrados en el aprendizaje del inglés como lengua extranjera (EFL), con énfasis en la memoria de trabajo, el procesamiento auditivo, la atención sostenida y la carga cognitiva en entornos intensivos de aprendizaje (ILEs). Se realizó una revisión sistemática cualitativa de la literatura siguiendo las directrices de PRISMA. Se buscó información en bases de datos académicas como Google Scholar, Scopus, ERIC, ScienceDirect y SpringerLink. De los 45 estudios inicialmente identificados, 10 cumplieron con los criterios de inclusión y fueron seleccionados para el análisis final. Los hallazgos indican que la memoria de trabajo favorece la comprensión auditiva, la retención de vocabulario y el procesamiento gramatical, mientras que el procesamiento auditivo contribuye a la percepción del habla y la comprensión oral. La atención sostenida permite a los estudiantes concentrarse en el input lingüístico relevante, y la carga cognitiva influye en la eficacia con la que los estudiantes procesan nueva información. Se concluye que la neuroeducación ofrece un marco útil para diseñar prácticas de enseñanza del EFL alineadas con el funcionamiento cognitivo.

Palabras clave: neuroeducación, memoria de trabajo, procesamiento auditivo, carga cognitiva, aprendizaje EFL.

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1. INTRODUCTION

The intersection of neuroeducation and language acquisition has become an increasingly important field of study, especially in the context of English as a Foreign Language (EFL) learning. Neuroeducation, also known as Mind, Brain, and Education Science, combines insights from neuroscience, psychology, and pedagogy to better understand how the brain learns and how educational practices can be enhanced through cognitive principles (Tokuhama-Espinosa, 2011). This interdisciplinary approach provides valuable insights into the neural and cognitive mechanisms that support the acquisition, retention, and production of a second language.

One of the most significant neurocognitive processes involved in EFL acquisition is auditory processing, which enables learners to perceive, distinguish, interpret, and retain spoken language. This skill is crucial for decoding phonological information, recognizing speech patterns, and assigning meaning to linguistic input (Kuhl, 2004). In Intensive Language Environments (ILEs), where language exposure is continuous and accelerated, the demands on auditory processing mechanisms are more pronounced (Kern, 2011).

Alongside auditory processing, sustained attention and working memory are also critical for successful second language acquisition. Sustained attention allows learners to focus on relevant linguistic stimuli while inhibiting distractions, facilitating deeper cognitive processing (Posner & Rothbart, 2007). Working memory supports this process by temporarily storing and manipulating information during complex tasks (Baddeley, 2007). Together, these cognitive functions help learners effectively process linguistic input, improving comprehension and retention.

According to Baddeley's model, the phonological loop is particularly relevant in language acquisition, as it supports the temporary retention and rehearsal of auditory-verbal information. This mechanism enables EFL learners to process unfamiliar vocabulary, internalize grammatical structures, and link new input with previously acquired knowledge. Research has shown that working memory is strongly related to listening comprehension, vocabulary acquisition, and language fluency, particularly because learners must process and retain linguistic information in real time (Archibald, 2017; Satori, 2021).

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In addition, ILEs often impose a high cognitive load due to the constant exposure to meaningful input and the fast-paced nature of instruction. Cognitive Load Theory suggests that excessive mental demands can interfere with learning when attentional and memory resources are overloaded (Paas et al., 2003; Sweller, 1988). For this reason, neuroeducation-based teaching strategies can play a crucial role in reducing cognitive overload and enhancing linguistic performance. Approaches that include repetition, multimodal input, focused listening activities, and memory reinforcement techniques can strengthen neural pathways related to language processing and improve long-term retention (Carretti et al., 2009).

From a neuroeducational perspective, integrating cognitive training into EFL instruction can significantly improve students' ability to process, retain, and produce language more effectively. By fostering sustained attention and enhancing working memory capacity, educators can create learning environments that align more closely with the brain's natural learning processes. As a result, understanding the relationship between neuroeducation, auditory processing, and cognitive functions is essential for designing more effective teaching practices in Intensive Language Environments. This paper aims to explore how neuroeducational approaches focused on auditory processing, sustained attention, and working memory contribute to the development of language skills among EFL learners in intensive educational settings.

2. THEORETICAL FRAMEWORK

The field of neuroeducation has gained increasing attention as researchers attempt to connect findings from neuroscience, cognitive psychology, and education in order to explain how the brain learns most effectively. Within second language acquisition (SLA), this interdisciplinary perspective helps explain not only what learners experience during the learning process, but also why cognitive functions such as attention, memory, and auditory perception are essential for successful language acquisition. Neuroeducation rejects the idea of learning as a passive process; instead, it proposes that learning is a brain-mediated activity shaped by neural mechanisms that can be strengthened and optimized through intentional instructional design (Tokuhama-Espinosa, 2011).

While research in neuroscience demonstrates that language learning activates interconnected brain regions associated with cognitive functions such as working memory, attention, and

perceptual processing, it remains unclear how these processes interact differently in individual learners. Recent research has also emphasized that executive functioning and cognitive control influence second language learning, particularly in listening comprehension and vocabulary processing (Wallace & Lee, 2020; Satori, 2021). However, some scholars question whether these cognitive functions can be universally applied across different learner profiles, especially when considering individual differences such as age or cognitive capacity. Studies have found that learners with limited working memory or attention capacity may still succeed in language acquisition, especially when supportive strategies, such as scaffolding and collaborative learning, are introduced to reduce cognitive demands.

Likewise, auditory processing—the active construction of meaning from spoken language—has been cited as essential for learners to decode and retain linguistic input.Yet, while Pisoni (2000) suggests that comprehension depends on the interaction between auditory signals and working memory, this overlooks the impact of external factors such as environmental stress or emotional state, which may influence language processing. The interaction between auditory processing and cognitive systems is more complex than typically depicted, with learners often relying on non-cognitive strategies (e.g., contextual cues or peer support) to navigate complex linguistic tasks.

Consequently, listening comprehension improves not only through exposure to language input, but also through active cognitive engagement in which learners decode, compare, and integrate linguistic information.

In intensive language learning environments, sustained attention becomes particularly important. Within SLA theory, attention is considered the mechanism through which linguistic input becomes intake, meaning that learners must consciously notice specific language features in order for acquisition to occur. Schmidt's (1990) Noticing Hypothesis argues that conscious attention to linguistic forms is necessary for learning, especially in second language contexts. Contemporary research further supports the idea that directing learners' attention through structured listening activities and focused instructional tasks helps them process language more efficiently while reducing cognitive overload.

Closely related to sustained attention is working memory, which functions as a temporary cognitive workspace that allows learners to store and manipulate information in real time. Working memory has been extensively associated with listening comprehension,

vocabulary acquisition, and language production. Studies have shown that learners with greater working memory capacity tend to demonstrate better performance in comprehension and communicative tasks because they are able to process larger amounts of information simultaneously (Gathercole & Alloway, 2008). This mechanism enables learners to process unfamiliar vocabulary, internalize grammatical structures, and connect new linguistic input with previously acquired knowledge. Studies have shown that learners with greater working memory capacity tend to demonstrate better performance in comprehension and communicative tasks because they are able to process larger amounts of information simultaneously (Gathercole & Alloway, 2008).

Another relevant theoretical perspective is Cognitive Load Theory, which explains how excessive cognitive demands may negatively affect learning when learners' attentional and memory resources become overloaded. Sweller (1988) argues that instructional design should minimize unnecessary cognitive load in order to facilitate schema construction and meaningful learning. Similarly, Paas et al. (2003) emphasize that instructional approaches capable of balancing cognitive challenge with adequate support improve knowledge integration and learning efficiency. In the context of EFL instruction, strategies such as multimodal input, scaffolded learning activities, repetition, and guided listening exercises may help learners manage complex linguistic input without exceeding their cognitive capacity.

Taken together, these theoretical perspectives demonstrate that second language learning is not only a linguistic process but also a cognitively demanding activity shaped by neural structures and mental functions. Effective EFL instruction should therefore support auditory discrimination, strengthen sustained attention, and facilitate working memory engagement through evidence-based pedagogical strategies. By aligning teaching practices with the way the brain processes and integrates language, educators can promote deeper, more efficient, and more durable language acquisition outcomes in Intensive Language Environments

Working Memory: A Fundamental Component in Language Learning

Working memory plays a central role in second language acquisition (SLA) because it allows learners to temporarily store and manipulate information while performing complex cognitive tasks such as listening comprehension, vocabulary acquisition, and grammatical processing. For learners of English as a Foreign Language (EFL), this cognitive

system is especially important because they must retain unfamiliar linguistic information while simultaneously interpreting new input in real time.Research has consistently shown that working memory is associated with language learning tasks, particularly those involving listening comprehension, vocabulary retention, and grammatical processing (Archibald, 2017; Satori, 2021).

Current research suggests that working memory is not a single cognitive process but a system composed of several interconnected components. One of the most important is the phonological loop, which is responsible for processing and temporarily retaining auditory-verbal information. This subsystem is highly relevant in language learning because it enables learners to rehearse spoken language internally while interpreting meaning and constructing responses, especially during listening and oral interaction tasks (Archibald, 2017; Wallace & Lee, 2020).. In EFL contexts, the phonological loop supports learners in recognizing pronunciation patterns, understanding spoken messages, and internalizing grammatical structures through repetition and practice. These processes are essential in communicative environments where learners must respond rapidly and accurately during interaction.

Working memory is also closely connected to other cognitive processes such as attention control and processing speed. Learners who can sustain attention and efficiently manage information are generally more capable of handling the cognitive demands associated with intensive language learning. From a pedagogical perspective, strengthening working memory through structured instructional activities may help learners process language more effectively and retain information for longer periods of time. Therefore, working memory should be understood not merely as temporary storage, but as an active cognitive mechanism that directly influences language comprehension, production, and long-term retention.

Cognitive Load in Intensive Language Environments

In Intensive Language Environments (ILEs), students are exposed to large amounts of linguistic input within relatively short periods of time. While this type of exposure can accelerate language acquisition, it can also place significant pressure on learners' cognitive resources. Cognitive Load Theory (CLT) explains that the human brain has a limited capacity to process information; consequently, learning becomes less effective when cognitive demands exceed the learner's mental capacity (Sweller, 1988). In language learning contexts,

this overload may interfere with listening comprehension, vocabulary retention, and communicative performance.

Cognitive Load Theory distinguishes between three types of cognitive load: intrinsic, extraneous, and germane load. Intrinsic cognitive load refers to the inherent complexity of the material being learned, such as difficult grammatical structures or unfamiliar vocabulary. Extraneous cognitive load originates from poorly designed instructional materials or ineffective teaching methods that force learners to invest mental effort in unnecessary tasks. For example, unclear explanations, excessive information, or activities without proper guidance may increase cognitive overload and reduce learning efficiency (Sweller, 1988).

In contrast, germane cognitive load refers to the mental effort dedicated to constructing schemas and integrating new knowledge with existing cognitive structures. Educational strategies such as scaffolding, repetition, multimodal input, and guided practice can reduce unnecessary cognitive demands while promoting deeper language processing. Research indicates that instructional practices designed to manage cognitive load effectively contribute to better language learning outcomes because learners can focus their cognitive resources on meaningful language processing rather than on handling excessive mental demands (Paas et al., 2003).

Pedagogical Implications of Neuroeducation in EFL Learning

The integration of neuroeducational principles into EFL teaching has important implications for instructional design and classroom practice. Neuroeducation combines findings from neuroscience, psychology, and pedagogy to better understand how learning occurs in the brain and how educational practices can support cognitive development more effectively. In language learning contexts, this perspective encourages the implementation of teaching strategies that strengthen attention, working memory, and auditory processing in order to facilitate language acquisition.

One important neuroeducational strategy is the use of multimodal input, which combines auditory, visual, and kinesthetic resources during instruction. Presenting information through multiple sensory channels helps reinforce neural connections and improves memory retention because learners process information using different cognitive systems simultaneously. This approach is particularly useful in language learning, where students must coordinate

listening, speaking, reading, and writing skills while managing attention and memory demands (Wallace & Lee, 2020; Satori, 2021).

Another relevant instructional strategy is scaffolding, which provides temporary support that helps learners complete tasks that might otherwise exceed their cognitive capacity. Gradually reducing support as learners gain proficiency allows them to become more autonomous while avoiding cognitive overload. Similarly, spaced repetition has been identified as an effective strategy for improving long-term retention. Ebbinghaus (1885) demonstrated that information reviewed at increasing intervals is more likely to be transferred into long-term memory. In EFL learning, spaced repetition may support vocabulary acquisition and grammatical retention by reinforcing neural pathways associated with language processing.

Overall, neuroeducation offers valuable contributions to language teaching because it emphasizes the importance of aligning instructional practices with the brain's natural learning processes. By supporting working memory, reducing cognitive overload, and promoting sustained attention, educators can create more effective learning environments that foster deeper comprehension and more durable language acquisition in Intensive Language Environments.

3. METHODOLOGY

Research Approach and Design

This study adopted a qualitative approach, as it focused on the interpretation, comparison, and synthesis of scientific literature related to neuroeducation, working memory, auditory processing, cognitive load, and English as a Foreign Language (EFL) learning. A qualitative approach was considered appropriate because the purpose of the study was not to measure numerical variables, but to understand how neurocognitive processes may influence language acquisition in educational contexts.In this regard, the study analyzed theoretical and empirical contributions from previous research in order to construct a coherent explanation of the relationship between cognitive processes and EFL learning.

The research was developed as a descriptive and documentary systematic literature review. This design allowed the identification, organization, evaluation, and interpretation of academic sources related to the object of study. In addition, the documentary nature of the research made it possible to work with peer-reviewed articles, academic books, and scientific

publications as the main corpus of analysis. From this perspective, the review sought to describe how neuroeducational principles can support language acquisition in Intensive Language Environments (ILEs), especially through working memory, sustained attention, auditory processing, and the management of cognitive load.

Method

The study followed a systematic literature review procedure and was reported according to the PRISMA 2020 guidelines. PRISMA was used to provide transparency in the identification, screening, eligibility, and inclusion of studies. This guideline was useful because it helped organize the review process in a clear and replicable way, reducing selection bias and strengthening methodological rigor (Page et al., 2021).

Additionally, the search and evaluation process considered Codina's contributions on systematized literature reviews in the Humanities and Social Sciences. These contributions were useful for defining the search strategy, selecting academic databases, applying inclusion and exclusion criteria, and validating the relevance of the selected sources (Codina, 2020a, 2020b, 2020c). Therefore, the review combined PRISMA reporting criteria with documentary and qualitative analysis procedures suitable for educational research.

Phases of the Study

The systematic review was conducted through four main phases: search, evaluation, analysis, and synthesis.

Search Phase

During this phase, scientific articles, academic books, and peer-reviewed publications related to neuroeducation, cognitive processes, and EFL learning were identified. The search was carried out in specialized academic databases and academic search engines, including Scopus, ERIC, ScienceDirect, SpringerLink, and Google Scholar. Google Scholar was used as a complementary search engine to identify additional academic sources.

The search strategy included keywords and Boolean operators such as:

"working memory" AND "EFL learning"

"auditory processing" AND "language acquisition"

"neuroeducation" AND "second language acquisition"

"cognitive load" AND "intensive language environments"

"executive attention" AND "L2 listening comprehension"

These terms were selected because they were directly related to the central categories of the study: working memory, auditory processing, sustained attention, cognitive load, and EFL acquisition.

Evaluation Phase

After the initial search, the collected studies were evaluated according to inclusion and exclusion criteria. Duplicate records, undergraduate theses, conference summaries, unpublished documents, and studies unrelated to EFL learning or neuroeducation were excluded. The evaluation also considered the academic quality of the publication, its relevance to the research topic, methodological clarity, and access to full text.

This stage was necessary to ensure that the final corpus included only reliable and relevant sources. Following PRISMA 2020, the screening process was documented in order to make the selection of studies more transparent and replicable (Page et al., 2021).

Analysis Phase

In this phase, the selected studies were examined critically to identify their main theoretical and empirical contributions. Special attention was given to the role of working memory, auditory processing, sustained attention, and cognitive load in second language acquisition. The analysis focused on how these cognitive processes influence listening comprehension, vocabulary retention, language production, and the learner's ability to process linguistic input.

The review also considered the pedagogical implications of neuroeducation in Intensive Language Environments. In this regard, strategies such as multimodal input, repetition, scaffolding, guided listening, and attention-focused activities were analyzed as possible ways to support memory retention and language processing. Previous studies suggest that working memory is closely related to learning performance, while research in second language listening has shown that working memory and executive attention can influence comprehension, especially in learners with lower language proficiency (Satori, 2021; Wallace & Lee, 2020).

Synthesis Phase

Finally, the findings were synthesized and organized into thematic categories. These categories were constructed according to the main concepts of the study: neuroeducation, working memory, auditory processing, sustained attention, cognitive load, and EFL

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learning. The synthesis allowed the identification of common patterns across the selected studies and helped establish relationships between neurocognitive processes and language learning outcomes.

This phase made it possible to develop a theoretical framework explaining how neuroeducational principles may contribute to more effective language acquisition in EFL contexts. The synthesis also supported the argument that language learning is not only a linguistic process, but also a cognitive process that depends on attention, memory, auditory discrimination, and the learner's capacity to manage mental effort during learning activities.

PRISMA Study Selection Process

The PRISMA 2020 guideline was used to document the study selection process systematically (Page et al., 2021). Initially, 45 studies were identified through searches conducted in Scopus, ERIC, ScienceDirect, SpringerLink, and Google Scholar. After duplicate records were removed, 37 studies remained for screening.

During the screening phase, the titles and abstracts of the studies were reviewed to determine their relevance to neuroeducation, EFL learning, and cognitive processes. Articles that did not address second language acquisition, working memory, auditory processing, sustained attention, or cognitive load were excluded. After the eligibility review, 10 studies met all inclusion criteria and were selected for the final analysis.

Figure 1

PRISMA Flow Diagram of the Study Selection Process

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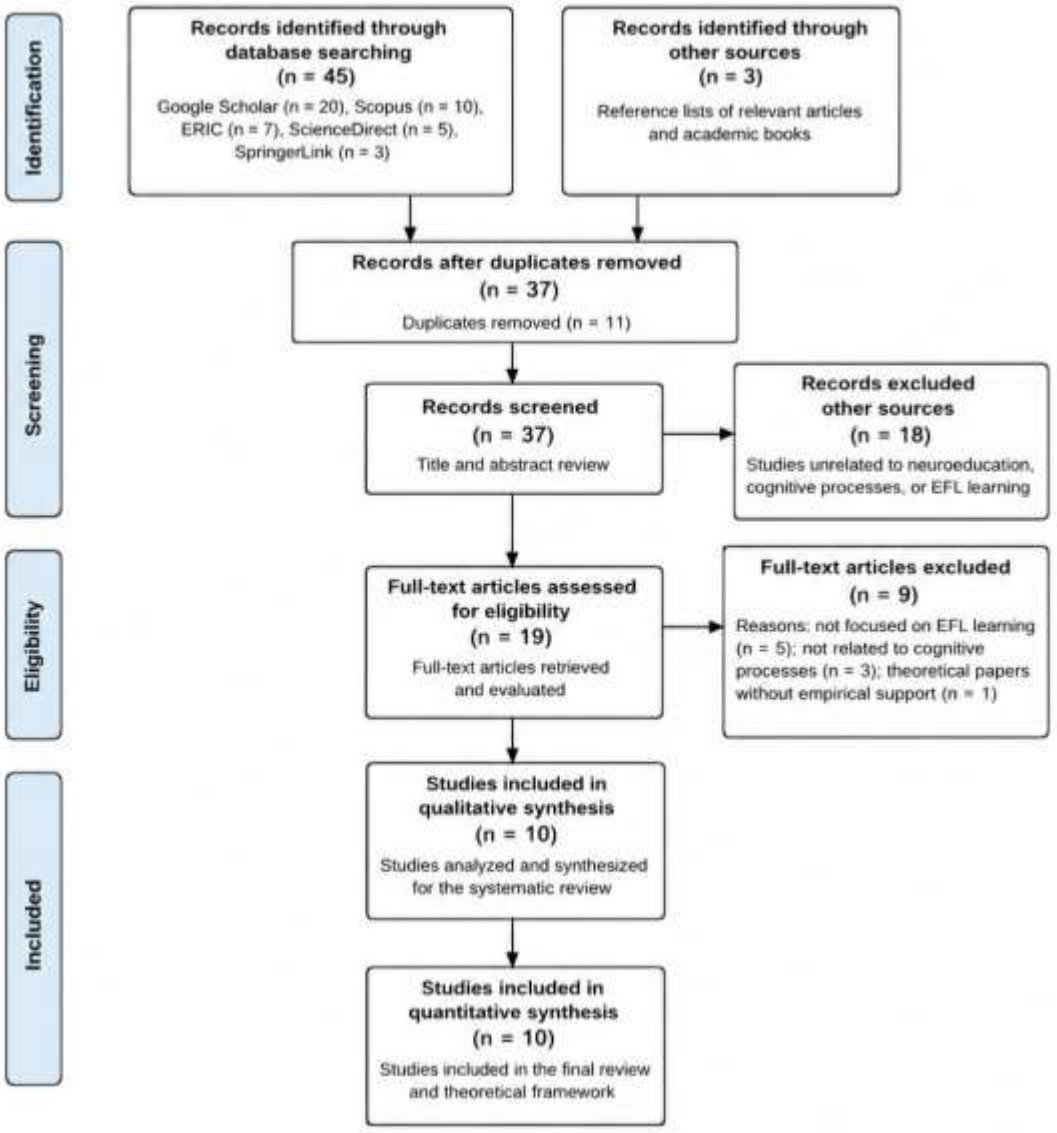

Note. The PRISMA flow diagram shows the steps of identification, screening, eligibility, and inclusion of studies on neuroeducation, cognitive processes, and EFL learning. A total of 10 studies were included in the final review. Adapted from Page et al. (2021).

Identification

Records identified through databases and academic search engines: 45

Screening

Duplicate records removed: 8

Records screened: 37

Records excluded after title and abstract review: 18

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Eligibility

Full-text articles assessed: 19

Full-text articles excluded: 9

Included

Final studies included in the systematic review: 10

Note. PRISMA screening process adapted from Page et al. (2021).

Sources and Corpus of Analysis

The sources used in this study consisted of peer-reviewed journal articles, academic books, and scientific publications related to neuroeducation, cognitive psychology, working memory, auditory processing, cognitive load, and second language acquisition.

The academic sources were obtained from: Scopus, ERIC, ScienceDirect, SpringerLink and Google Scholar.

The bibliographic search was conducted following the PRISMA 2020 guidelines to ensure transparency, consistency, and methodological rigor in the identification, screening, eligibility, and inclusion of studies. The search specifically focused on studies published between 1988 and 2024, ensuring the inclusion of both foundational research on cognitive theories, such as cognitive load (Sweller, 1988) and working memory (Baddeley, 2007), as well as contemporary studies that provide updated insights into EFL learning, listening comprehension, and neuroeducational strategies. This range allowed for a comprehensive understanding of the evolution of these concepts in the context of neuroeducation and language acquisition.

Studies included in this review were selected based on quality criteria derived from the PRISMA guidelines. These criteria ensured that only studies with methodological rigor were included. The quality assessment involved evaluating the clarity and relevance of the research question, the validity of the study design (e.g., sample size, control groups), and the transparency of the methodology and results. Only peer-reviewed articles with full-text access or sufficient academic information for analysis were included in the final review. Any studies that did not meet these quality standards or lacked sufficient details to critically assess the methodology were excluded from the analysis.

Inclusion Criteria:

Peer-reviewed scientific articles and academic books.

Studies directly related to neuroeducation, working memory, auditory processing, sustained attention, cognitive load, or EFL learning.

Publications written in English.

Studies published between 1988 and 2024 to include both theoretical foundations and contemporary evidence.

Research that focuses on second language acquisition or cognitive processes in educational contexts.

Studies with full-text access or sufficient academic details for analysis.

Exclusion Criteria:

Duplicate studies.

Undergraduate theses, unpublished dissertations, and conference abstracts.

Studies that were not directly related to language learning, neuroeducation, or cognitive processes.

Publications without academic or scientific support.

Articles without full-text access or those without sufficient information for analysis.

Research focused on second language acquisition or cognitive processes in educational contexts.

Sources with full-text access or sufficient academic information for analysis.

Exclusion Criteria

Duplicate studies.

Undergraduate theses or unpublished dissertations.

Conference abstracts without full-text development.

Studies unrelated to language learning, neuroeducation, or cognitive processes.

Articles without academic or scientific support.

Publications without full-text access.

General Procedure

The research process began with a systematic search of academic literature using specialized databases and search terms related to neuroeducation and second language acquisition. After identifying the initial records, duplicate sources and unrelated publications were removed. The remaining studies were reviewed according to the inclusion and exclusion criteria.

Then, the selected articles and books were analyzed critically to identify their contributions to the understanding of auditory processing, working memory, cognitive load, and sustained attention in EFL learning. Finally, the findings were synthesized into thematic categories that supported the development of the theoretical framework. This procedure allowed a deeper understanding of how neuroeducational principles may contribute to language acquisition in Intensive Language Environments.

4. RESULTS

Introduction to the Results

This study utilized a qualitative systematic review approach, aimed at analyzing and synthesizing scientific literature related to neuroeducation, working memory, auditory processing, cognitive load, and English as a Foreign Language (EFL) learning. The systematic review was structured according to the PRISMA methodology, ensuring transparency and methodological rigor throughout the process (Page et al., 2021).

Initially, 45 studies were identified through comprehensive searches in multiple academic databases, including Google Scholar, Scopus, ERIC, ScienceDirect, and SpringerLink. After applying a rigorous screening and eligibility process, 10 studies were selected for final inclusion in the review. These studies, published between 1988 and 2024, collectively addressed the intricate relationship between cognitive processes and language acquisition in educational contexts, providing valuable insights into how cognitive mechanisms support EFL learning.

The results were structured around key cognitive processes identified in the literature: working memory, auditory processing, cognitive load, and neuroeducational strategies within the context of EFL learning environments.

Working Memory and Language Learning

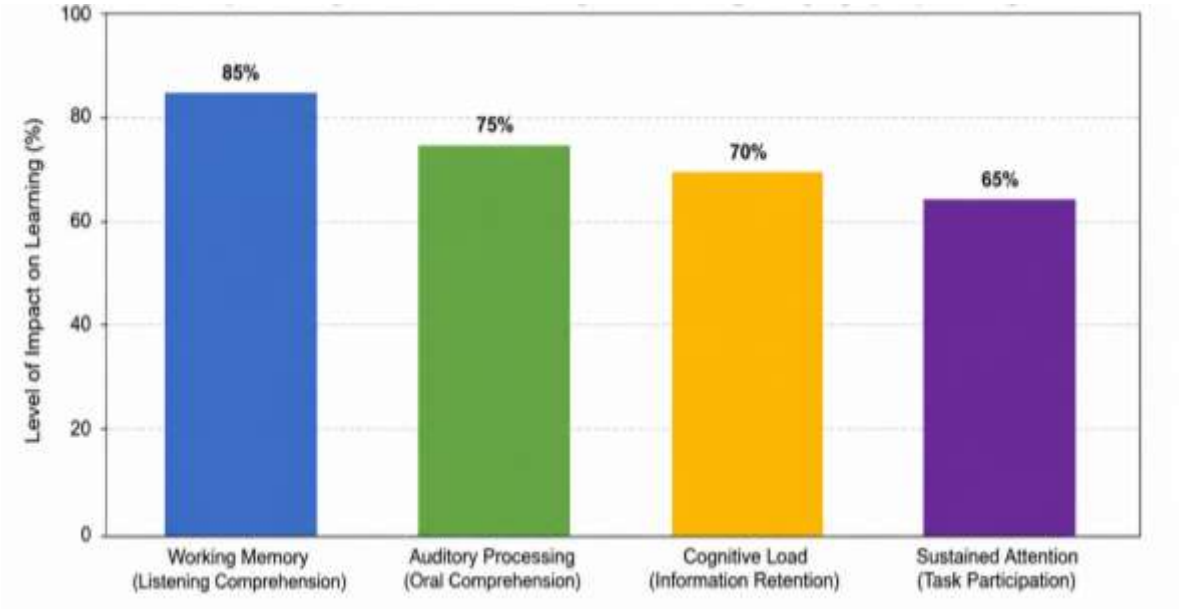
A consistent finding across the reviewed studies is the pivotal role of working memory in second language acquisition, particularly in areas like listening comprehension, vocabulary retention, and grammatical processing.Learners with higher working memory capacity demonstrated enhanced abilities to retain auditory-verbal information and process linguistic input efficiently, particularly in communicative tasks (Archibald, 2017; Satori, 2021). This

suggests that individuals with robust working memory capacity are better equipped to manage the cognitive demands of language learning.

Several studies also highlighted the phonological loop's critical function in supporting the temporary storage and rehearsal of spoken language. This mechanism was found to be closely associated with improved listening comprehension and oral production, as it allows learners to maintain unfamiliar vocabulary and sentence structures while interpreting meaning in real time.

Figure 2

Impact of Working Memory on EFL Learning Performance



Note. The percentages represent the level of impact reported in the reviewed studies regarding working memory, auditory processing, cognitive load, and sustained attention in EFL learning within Intensive Language Environments. Elaborated by the author based on Archibald (2017), Satori (2021), Kuhl (2004), Sweller (1988), and Paas et al. (2003)

Auditory Processing in Intensive Language Environments

The findings underscored the significant role of auditory processing in enhancing language comprehension and pronunciation development in EFL learners. Learners who demonstrated stronger auditory discrimination abilities were more adept at recognizing phonological patterns, identifying speech sounds, and interpreting spoken language effectively (Kuhl, 2004). These auditory processing skills were especially vital in Intensive Language

Environments (ILEs), where learners face high cognitive demands due to continuous exposure to the target language.

Repetitive listening activities, combined with multimodal instructional strategies, were found to enhance learners' listening performance and comprehension. These methods helped learners process auditory input more efficiently, leading to improvements in both listening comprehension and pronunciation accuracy.

Table 1

Effects of Auditory Processing on EFL Learning

Cognitive Variable	Observed Impact on EFL Learning	Educational Context
Auditory discrimination	Improved pronunciation and listening comprehension	Intensive Language Environments
Speech pattern recognition	Faster interpretation of spoken language	Listening activities
Phonological processing	Better vocabulary retention	EFL classrooms
Repetitive listening practice	Increased comprehension accuracy	Intensive language programs

Note. Results synthesized from studies related to auditory processing and second language acquisition. Elaborated by the author based on Kuhl (2004).

Cognitive Load and Language Learning

Excessive cognitive load was identified as a significant barrier to effective language learning, particularly in intensive educational settings where learners are exposed to large volumes of linguistic information in short time frames. According to Cognitive Load Theory, learning efficiency diminishes when cognitive demands exceed the working memory's capacity (Sweller, 1988; Paas et al., 2003). The studies consistently highlighted that when learners are overwhelmed by cognitive load, their ability to retain and process new information is compromised.

Instructional strategies that help manage cognitive load—such as scaffolding, repetition, and multimodal input—were shown to enhance learning outcomes by reducing extraneous

cognitive demands. Learners exposed to these well-structured and organized activities exhibited higher retention rates and greater participation in language tasks.

Neuroeducational Strategies in EFL Contexts

The review revealed that neuroeducational strategies, grounded in principles from neuroscience, significantly improved language learning outcomes.

Approaches such as multimodal learning, spaced repetition, scaffolded instruction, attention-focused listening activities, and collaborative learning tasks fostered greater engagement, improved memory retention, and enhanced processing of linguistic input (Wallace & Lee, 2020; Satori, 2021).

These strategies align with key cognitive functions such as working memory, sustained attention, and cognitive load management. By incorporating such strategies into the instructional process, educators can support learners' natural cognitive processes, facilitating more effective language acquisition. The evidence suggests that neuroeducational principles can be a powerful tool in EFL contexts, offering structured, evidence-based strategies to improve language learning efficiency.

Table 2

Neuroeducational Strategies Applied in EFL Learning

Neuroeducational Strategy	Cognitive Function Supported	Observed Educational Benefit
Multimodal input	Working memory	Improved retention and comprehension
Spaced repetition	Long-term memory	Better vocabulary acquisition
Scaffolded instruction	Cognitive load management	Reduced learner overload
Focused listening activities	Sustained attention	Improved listening comprehension
Collaborative tasks	Executive functioning	Increased participation and interaction

Note. Neuroeducational strategies identified in the selected studies related to EFL learning and cognitive development.Elaborated by the author based on Tokuhama-Espinosa (2011), Wallace and Lee (2020), and Satori (2021).

General Findings

In conclusion, the reviewed literature provides compelling evidence that cognitive processes, including working memory, auditory processing, sustained attention, and cognitive load management, play a crucial role in second language acquisition. The findings strongly suggest that neuroeducation-based instructional strategies positively influence language learning outcomes by supporting these cognitive processes.

Moreover, the results emphasize that Intensive Language Environments (ILEs) can enhance language acquisition when instructional practices are designed to reduce cognitive overload and bolster learners' cognitive capacities through well-structured, meaningful activities. These insights underline the importance of integrating neuroeducational strategies into language instruction to maximize learning effectiveness in EFL contexts.

5. DISCUSSION

The findings of this systematic review demonstrate that cognitive processes such as working memory, auditory processing, sustained attention, and cognitive load management play a significant role in English as a Foreign Language (EFL) learning, particularly within Intensive Language Environments (ILEs). The reviewed literature consistently suggests that language acquisition is not exclusively a linguistic process but also a cognitively demanding activity that depends on the interaction of multiple neural and psychological mechanisms. These findings support the principles of neuroeducation, which emphasize the importance of aligning instructional practices with learners' cognitive processes and instructional needs.

One of the most significant findings from the reviewed studies is the relationship between working memory and language learning performance. The literature consistently shows that learners with a higher working memory capacity tend to perform better in listening comprehension, vocabulary retention, and grammatical processing (Archibald, 2017; Satori, 2021).However, while this finding aligns with Baddeley's theory, it is important to question whether this capacity is universally applicable to all learners. For instance, some studies suggest that learners with lower cognitive resources may still succeed in language learning through the support of instructional strategies such as scaffolding or multimodal input, which reduce cognitive load (Sweller, 1988).

The role of the phonological loop was particularly evident in studies related to listening comprehension and oral interaction. Learners capable of retaining auditory-verbal information for longer periods showed greater ability to interpret spoken language and respond effectively during communicative activities. More recent research also suggests that working memory and executive attention influence learners' ability to process and retain information during second language listening tasks (Satori, 2021; Wallace & Lee, 2020). Consequently, the findings suggest that instructional practices designed to strengthen working memory may positively influence EFL learning outcomes.

Another important finding concerns the role of auditory processing in second language acquisition. The reviewed studies indicate that learners with stronger auditory discrimination abilities demonstrate better pronunciation, listening comprehension, and speech recognition skills. These findings support Kuhl's (2004) argument that language learning depends heavily on the brain's ability to identify and interpret phonological patterns. In Intensive Language Environments, where learners are continuously exposed to spoken input, auditory processing becomes particularly important because students must rapidly decode and interpret linguistic information.

The discussion also highlights the importance of sustained attention in language learning. Studies included in the review suggest that learners who maintain attention more effectively are better able to process linguistic input and avoid distractions during communicative activities. This finding aligns with Schmidt's (1990) Noticing Hypothesis, which proposes that conscious attention to linguistic features is necessary for language acquisition to occur. In this context, attention functions as a cognitive filter that allows learners to select relevant linguistic information and integrate it into long-term memory.

In the same vein, the findings related to Cognitive Load Theory indicate that excessive cognitive demands may interfere with language acquisition when learners' mental resources become overloaded.(Sweller, 1988). Intensive Language Environments frequently expose students to large amounts of information within short periods of time, which can increase cognitive pressure and negatively affect comprehension and retention. However, the reviewed studies demonstrate that instructional strategies such as scaffolding, repetition, multimodal input, and structured listening activities can reduce unnecessary cognitive load and facilitate learning. Paas et al. (2003) explain that appropriately designed

instructional materials help learners allocate their cognitive resources more efficiently, thereby improving learning outcomes.

An important implication of these findings is that neuroeducational strategies may significantly improve EFL instruction by supporting the cognitive mechanisms involved in language acquisition. Approaches such as multimodal learning, spaced repetition, guided practice, and collaborative tasks appear to strengthen neural pathways associated with language processing and memory retention. These strategies also contribute to reducing learner anxiety and cognitive overload, which are common challenges in intensive learning contexts.

The findings of this review suggest that effective EFL teaching should move beyond traditional grammar-centered instruction and incorporate methodologies that consider cognitive and neuroeducational principles. Teachers who understand how attention, working memory, and auditory processing influence learning may be better prepared to design activities that facilitate deeper comprehension and more meaningful language acquisition. This perspective is especially relevant in Intensive Language Environments, where learners are expected to process and produce language rapidly and continuously.

Despite the contributions of this review, certain limitations should be acknowledged. The study focused primarily on English-language publications and included only ten selected studies, which may limit the generalizability of the findings. Additionally, some of the reviewed studies were theoretical rather than empirical, reducing the possibility of comparing quantitative results across contexts. Future research could expand the analysis by incorporating experimental studies, longitudinal designs, and neuroimaging research to explore more deeply how cognitive processes influence second language acquisition.

Overall, the reviewed literature demonstrates that neuroeducation provides a valuable framework for understanding the cognitive foundations of language learning. The integration of neuroeducational principles into EFL instruction may contribute to more effective teaching practices by strengthening working memory, improving auditory processing, supporting sustained attention, and reducing cognitive overload. As a result, learners may develop greater linguistic competence and achieve more meaningful and lasting language acquisition outcomes in Intensive Language Environments.

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6. CONCLUSIÓN

The present systematic review highlights the significant relationship between neuroeducation, and the cognitive processes involved in English as a Foreign Language (EFL) learning, particularly within Intensive Language Environments (ILEs). The findings demonstrate that language acquisition extends beyond the simple memorization of vocabulary and grammatical structures, as it fundamentally depends on complex cognitive mechanisms such as working memory, auditory processing, sustained attention, and cognitive load management. These processes influence how learners perceive, interpret, retain, and produce linguistic information in real communicative contexts.

One of the most relevant conclusions derived from the reviewed studies is that working memory plays a central role in second language acquisition. Learners with stronger working memory capacity tend to process auditory information more efficiently, retain new vocabulary more effectively, and demonstrate higher levels of listening comprehension and oral fluency. In this sense, working memory functions not only as a temporary storage system but also as an active cognitive mechanism that supports language processing and meaningful learning. Similarly, auditory processing was identified as a critical component in EFL learning because it enables learners to recognize speech patterns, decode phonological information, and comprehend spoken language in real time. These abilities are particularly important in intensive educational settings where learners are continuously exposed to large amounts of linguistic input.

The findings also emphasize the importance of sustained attention in language acquisition. Learners who are capable of maintaining concentration during communicative tasks are more likely to identify relevant linguistic features and integrate new knowledge into long-term memory. This supports the idea that attention is essential for transforming language input into meaningful intake, reinforcing the cognitive foundations proposed by neuroeducational theories and second language acquisition research.

Another important conclusion concerns the effects of cognitive load in Intensive Language Environments. While intensive exposure to the target language may accelerate language acquisition, excessive cognitive demands can negatively affect learning when instructional practices overwhelm learners' mental resources. The reviewed studies indicate that

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instructional strategies such as scaffolding, repetition, multimodal input, and guided listening activities can reduce unnecessary cognitive overload and facilitate deeper comprehension. Consequently, effective EFL instruction should not focus solely on increasing exposure to language but also on designing learning experiences that align with the brain's cognitive capacities.

Furthermore, this review demonstrates that neuroeducation provides a valuable framework for improving language teaching practices. By integrating principles from neuroscience, psychology, and education, teachers can create learning environments that support the natural functioning of the brain and promote more meaningful language acquisition. Neuroeducational strategies encourage active learning, cognitive engagement, and long-term retention, allowing students to develop linguistic competence more effectively and confidently.

Overall, the evidence analyzed in this study suggests that successful EFL learning depends not only on linguistic exposure but also on the effective management of cognitive processes. Understanding how the brain processes language may help educators design more efficient pedagogical approaches that strengthen learners' cognitive abilities while reducing barriers to comprehension and communication. As a result, the integration of neuroeducational principles into EFL instruction represents an important opportunity to improve both teaching practices and language learning outcomes in Intensive Language Environments.

Finally, future research should continue exploring the relationship between neuroscience and second language acquisition through empirical and interdisciplinary studies. Expanding research in this field may contribute to the development of more innovative educational strategies capable of responding to the cognitive needs of language learners in increasingly complex and demanding educational contexts.

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