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Neuroscience Foundations and Parental Engagement in Children's Vocabulary Development: A Bibliometric-Supported Systematic Literature Review

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Abstract. This study investigated the neural underpinnings of children's vocabulary development and the influence of parental involvement in facilitating early language learning. While prior research has examined vocabulary development, neurobiology, and home literacy practices individually, few reviews have systematically synthesised these areas using an integrated bibliometric and evidence synthesis approach. This study employed a bibliometric-supported Systematic Literature Review (B-SLR) guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework. Articles published between 2015 and 2025 were retrieved from the Scopus and Dimensions AI databases using keywords related to neuroscience, vocabulary development, language acquisition, parental involvement, and home literacy environment. Bibliometric coupling analysis using VOSviewer was combined with

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thematic synthesis to identify conceptual relationships, methodological patterns, and recurring findings across the selected studies. Articles published from 2015 to 2025 were obtained from the Scopus and Dimensions AI databases utilising keywords pertinent to neuroscience, vocabulary development, language acquisition, parental participation, and home literacy environment. Bibliometric mapping was performed using VOSviewer, and thematic synthesis was employed to systematically synthesise recurring findings and themes across the selected papers. After screening and eligibility assessments, 12 empirical studies were incorporated into the final analysis. The results demonstrate that vocabulary development is affected by interrelated neurocognitive, socioeconomic, parental, and socioemotional factors. Recurring themes included brain connectivity, lexical processing speed, socioeconomic status, collaborative reading practices, parental education, and emotionally nurturing home environments. The review indicates that parental involvement may facilitate the implementation of neuroscience-informed literacy initiatives in early childhood educational settings. Despite the relatively small corpus, the review provides an interdisciplinary synthesis integrating neurocognitive and environmental perspectives on children's vocabulary development and highlights the importance of parental involvement in neuroscience-informed literacy practices.

Keywords: neuroscience; vocabulary development; parental engagement; home literacy environment; systematic literature review

1. Introduction

Vocabulary development is fundamental to literacy, reading comprehension, and academic success, establishing the basis for children's educational progress from the earliest stages of schooling. An extensive vocabulary allows learners to interpret and generate meaning from texts, affecting fluency, understanding, and engagement. Research repeatedly demonstrates robust correlations between vocabulary knowledge and academic achievement across several disciplines, with early competency forecasting long-term effects (Magyar et al., 2025).

Nonetheless, gaps in vocabulary acquisition endure due to socioeconomic inequality, linguistic diversity, and restricted access to educational resources, especially among children from low-income or multilingual homes (Wagner, 2017). In underdeveloped countries, these issues are exacerbated by poor teacher training and insufficient educational materials, while locally, rote-based learning and delayed interventions further impede progress (Zhou et al., 2025; Zubrick et al., 2022). Researchers have utilised neuroscience and family interaction to comprehend the biological and environmental determinants influencing language and literacy development, thereby addressing these gaps.

In this study, the terms vocabulary acquisition, vocabulary learning, and vocabulary development are conceptually linked but not completely synonymous. Vocabulary acquisition often denotes the innate and frequently subconscious mechanism by which youngsters assimilate new lexicon through exposure and interaction. Vocabulary learning, conversely, typically denotes

deliberate or pedagogical methods that facilitate the enhancement of word knowledge in educational settings. This study employs vocabulary development as a comprehensive concept that includes the progressive enhancement of children's receptive and expressive vocabulary knowledge across time, facilitated by cognitive maturation and environmental interaction. Consequently, although the examined studies sometimes use these categories interchangeably, this review predominantly emphasises vocabulary development as a multifaceted process influenced by neurocognitive, social, and parental factors.

The neuroscience of learning offers critical insights into the processing, storage, and retrieval of language in the brain, connecting cognitive theory with educational practice. Vocabulary acquisition engages various neural regions, including Broca's and Wernicke's areas, the superior temporal gyrus, and the prefrontal cortex, interconnected via ventral and dorsal pathways that facilitate comprehension and phonological processing (Barbeau et al., 2023; Ranjan & Singh, 2025; Roger et al., 2022). These findings elucidate the processes by which young children acquire new vocabulary, solidify meanings, and generalise language information. Neuroeducation combines neuroscience, psychology, and pedagogy to enhance teaching methods that correspond with cerebral function and plasticity, the brain's capacity to establish new connections through experience (Pradeep et al., 2024).

Brain-based methodologies prioritise active participation, emotional management, and diverse strategies such as gamification, inquiry-driven learning, and collaboration (Shvarts-Serebro et al., 2024; Zhumabayeva et al., 2025). When implemented properly, these techniques improve attention, motivation, and executive functioning, hence enhancing language retention and comprehension (Granado De la Cruz et al., 2025). Neuroscience emphasises that language acquisition is fundamentally linked to emotional and social circumstances, with parental involvement being crucial for fostering neurocognitive development and literacy outcomes.

Parental involvement serves as a link between neuroscience and practical learning, translating brain principles into everyday interactions that foster language and cognition. Parents impact brain development via activities like storytelling, reading aloud, and talking, which stimulate neural networks linked to attention, emotion, and executive control (Deng et al., 2023; Horowitz-Kraus et al., 2025). An affluent home literacy environment improves these processes by providing regular exposure to significant language usage (Guo et al., 2022; Sundqvist et al., 2024). The quality of engagement, characterised by responsiveness and dialogic reading, is a stronger predictor of vocabulary increase than the frequency of activities (Adam et al., 2025). Parental warmth and sensitivity provide emotional security, enhancing brain preparedness for learning and cognitive resilience.

Enhancing parents' comprehension of neuroscience-based practices via educational initiatives and school collaborations can improve early literacy results. The connection between neurocognitive development and parental

involvement can be elucidated through overarching developmental theories. Bronfenbrenner's Bioecological Theory underscores that a child's development is influenced by ongoing interactions between biological traits and environmental systems, particularly the familial context. Likewise, Vygotsky's Social Development Theory underscores the significance of guided social interaction and language-rich communication in fostering cognitive and linguistic advancement. These viewpoints align with contemporary neuroscience findings indicating that repeated linguistic exposure, emotional responsiveness, and collaborative literacy activities enhance neural plasticity and the development of language networks during early childhood. Thus, vocabulary development should be regarded not merely as a cognitive process, but as a socially mediated and environmentally reinforced developmental outcome.

Although there is an expanding body of literature on children's vocabulary development, existing studies have predominantly examined neurocognitive processes, literacy development, and parental involvement as separate domains of inquiry. Previous reviews have often focused independently on educational neuroscience, home literacy practices, or language acquisition, with limited integration of how neuroscientific insights may inform family-oriented vocabulary development strategies. Furthermore, few studies have systematically synthesised empirical evidence while simultaneously examining the intellectual and conceptual structure of this interdisciplinary field through bibliometric analysis.

This gap limits a comprehensive understanding of how neurocognitive mechanisms, socioeconomic influences, and parental involvement collectively shape vocabulary development in early childhood and lower primary education. Therefore, this study aims to systematically synthesise empirical evidence concerning the neurocognitive foundations of children's vocabulary development and examine how parental involvement supports neuroscience-informed literacy practices. By integrating bibliographic coupling analysis with a Systematic Literature Review (SLR) approach, the study identifies research trends, methodological patterns, conceptual relationships, and recurring themes across studies published between 2015 and 2025.

2. Methodology

This study employed a bibliometric-supported Systematic Literature Review (B-SLR) to synthesise empirical evidence regarding the neurocognitive foundations of children's vocabulary development and the role of parental involvement in early literacy practices. The review integrated bibliographic coupling analysis with systematic thematic synthesis to provide both structural and interpretative insights into the interdisciplinary literature. The review procedures were guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework to ensure methodological transparency, consistency, and replicability throughout the review process.

The bibliometric component was utilised as an exploratory analytical tool to find intellectual connections, publication patterns, and collaboration links within the

chosen literature. Bibliographic coupling was employed to analyse linkages between studies through shared references, facilitating the identification of conceptual similarities and emergent research clusters. Given the concentrated, interdisciplinary nature of the final corpus, the bibliometric analysis was conducted descriptively rather than as an extensive mapping endeavour.

Multiple screenings of database records increased methodological openness. First, duplicate records were deleted before title and abstract screening. Next, full-text screening assessed relevance to review objectives and eligibility criteria. Studies addressing vocabulary development in relation to neurocognitive processes, parental involvement, home literacy contexts, or socioemotional development were screened. To ensure study selection and thematic categorisation, the researchers iterated and verified during screening and data-charting. However, the study acknowledged that the tiny corpus and English-language publication limitation hampered the review process.

There are five stages comprised the review:

1. Formulating research questions;
2. Finding relevant papers through database searching;
3. Predefined eligibility criteria for study screening and selection;
4. Data charting and classifications;
5. Thematic synthesis and bibliometric interpretation.

This structured process identified, organised, and synthesised neurocognitive mechanisms, vocabulary development, parental interaction, and early literacy literature. The review used iterative refinement throughout screening and data charting to ensure consistency and relevance to the study objectives. The research questions were developed to guide the systematic synthesis of empirical evidence concerning neurocognitive, environmental, and parental factors associated with children's vocabulary development.

2.1 Stage 1: Developing research questions

Table 1: Research Questions and Review Objectives

Research Questions	Specific Objectives
1. What is the distribution of past studies on the neurocognitive elements of vocabulary acquisition in primary school across years, authors, publications, and countries?	1. To identify the distribution of past studies on the neurocognitive elements of vocabulary acquisition in primary school across years, authors, publications, and countries.
2. What study approaches and methodologies have been utilised in previous investigations regarding the neurocognitive foundations of vocabulary development?	2. To determine the study approaches and methodologies have been utilised in previous investigations regarding the neurocognitive foundations of vocabulary development.
3. What is the primary research aims and objectives of studies investigating the neurocognitive processes associated with children's language acquisition?	3. To analyse the primary research aims and objectives of studies investigating the neurocognitive processes associated with children's language acquisition.

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| <p>4. Which variables and neurocognitive constructs have been examined concerning language development and parental involvement?</p> <p>5. What are the principal findings and thematic trends identified in prior research about neurocognitive factors that affect vocabulary development in lower primary students?</p> | <p>4. To investigate the variables and neurocognitive constructs have been examined concerning language development and parental involvement?</p> <p>5. To report the principal findings and thematic trends identified in prior research about neurocognitive factors that affect vocabulary development in lower primary students.</p> |
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2.2 Stage 2: Finding relevant papers through database searching

Relevant papers were obtained from the Scopus and Dimensions AI databases because of their extensive multidisciplinary scope in educational, neuroscientific, and social science research. The databases were chosen for their provision of access to peer-reviewed articles, citation metrics, and bibliometric data pertinent to multidisciplinary review studies.

The search method employed various keyword permutations and Boolean operators related to neuroscience, vocabulary enhancement, language learning, parental engagement, and home literacy practices to improve comprehensiveness and reduce the risk of omitting potentially pertinent studies. The search strings as shown in Table 2 below were progressively adjusted to achieve conceptual consistency across both databases while preserving relevance to the review objectives.

Table 2: Search string

Search Directory	Search String
Dimension AI	("neuroscience" OR "neurocognitive") AND ("vocabulary development" OR "vocabulary acquisition" OR "vocabulary learning" OR "language development") AND ("parental involvement" OR "caregiver involvement" OR "home literacy environment") AND ("primary school" OR "elementary education" OR "early childhood")
Scopus	("neuro*") AND ("vocabulary*" OR "language development" OR "oral language") AND ("parent*" OR "caregiver*" OR "home literacy") AND ("children*" OR "primary school" OR "early childhood")

2.3 Stage 3: Predefined eligibility criteria for study screening and selection

The selection of studies was determined by specified inclusion and exclusion criteria. The inclusion criteria stipulated that studies:

The inclusion criteria stipulated that studies:

Table 3: Inclusion and exclusion criteria

Inclusion Criterion	Exclusion Criterion
1. Article published from 2015 – 2025	1. Irrelevant educational context Not available in full-text access non-English publications4. Studies unrelated to vocabulary or language development
2. Peer-reviewed journal articles	2. Studies without relevance to parental or neurocognitive factors
3. Studies involving lower primary educational settings	3. Publications other than journal articles
4. Studies related to neurocognitive, neuroscience or brain-based learning	
5. Available to access full-text papers	

To enhance methodological rigour, the selected studies underwent quality assessment based on relevance to the review objectives, methodological clarity, empirical evidence, and alignment with the inclusion criteria. Only peer-reviewed empirical journal articles with accessible full texts were retained to ensure the reliability and consistency of the final synthesis.

2.4 Stage 4: Data charting and classification

A systematic data charting matrix was created to organise and categorise the information obtained from the chosen studies. This systematic method enabled comparative analysis across various studies, while maintaining transparency and consistency in data management. The charting framework underwent iterative refinement, enabling the incorporation of new variables or emerging themes, including brain regions associated with language processing and types of parental involvement, as the review advanced. This adaptable process facilitated a thorough synthesis of findings and demonstrated the dynamic nature of research in educational neuroscience and vocabulary development.

Microsoft Excel was utilised to organise, filter, and classify collected records during the data-charting procedure. Bibliometric visualisation and coupling analysis were performed utilising VOSviewer software, facilitating the mapping of publication interrelations and bibliographic connections at the county level. Thematic classification and narrative synthesis were performed by iterative manual coding and comparative examination of reoccurring topics in the selected studies.

2.5 Stage 5: Thematic synthesis and bibliometric interpretation

A thematic synthesis was conducted to identify recurring themes and relationships across studies related to neuroscience, vocabulary development, and parental involvement. The selected studies were systematically analysed through iterative coding, comparison, and thematic categorisation aligned with the review objectives. A PRISMA 2020 flowchart (Figure 1) was used to illustrate the identification, screening, eligibility assessment, and final study inclusion procedures. A total of 2,606 records were initially retrieved from Scopus and Dimensions AI, of which 12 empirical studies fulfilled all inclusion criteria and were included in the final synthesis and bibliometric coupling analysis.

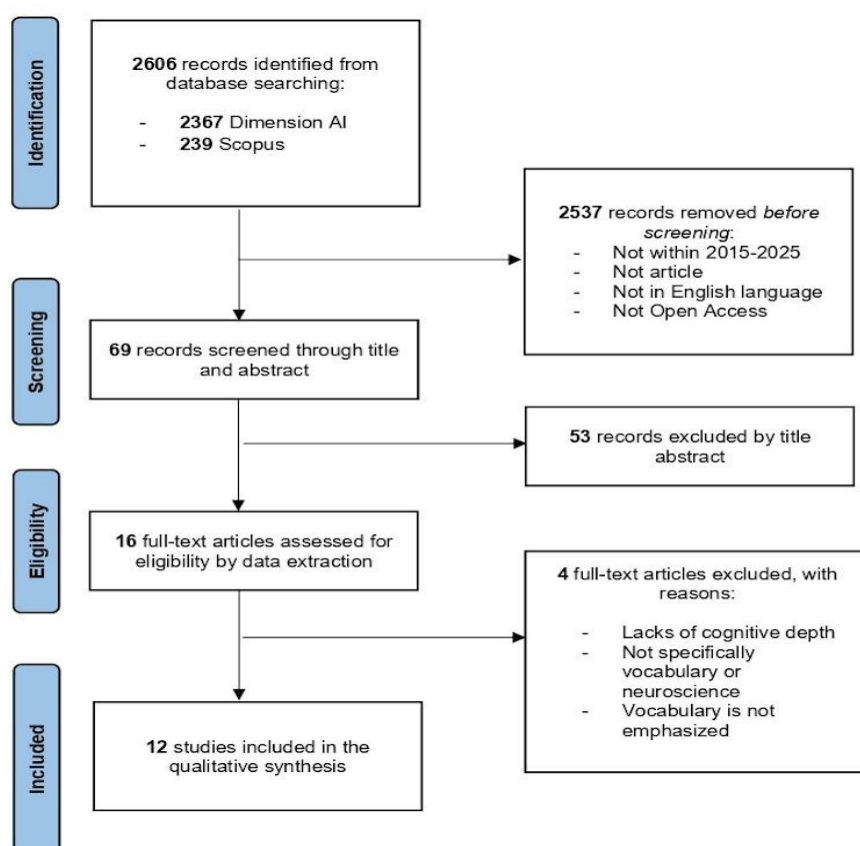


Figure 1: PRISMA flow chart

Initially, 2,606 records were retrieved; however, the final corpus was significantly reduced after the elimination of duplicates, title and abstract screening, full-text evaluation, and the enforcement of stringent eligibility criteria. The limited number of studies included indicates the nascent and interdisciplinary character of research integrating neuroscience, vocabulary acquisition, and parental involvement in early educational settings. Thus, the bibliometric results are to be regarded as exploratory and descriptive rather than universally applicable.

3. Results

3.1 Bibliographic Coupling by Countries

The bibliographic coupling analysis offered an exploratory summary of national contributions and intellectual connections within the chosen literature on neuroscience-informed vocabulary development and parental engagement. The analysis revealed that the United States was the foremost contributor in the examined corpus, highlighting the focus on research related to neurocognitive mechanisms, literacy development, and home literacy practices in North American educational settings. The United Kingdom and China emerged as consistent contributors, reflecting growing global interest in multidisciplinary approaches to children's vocabulary development.

The bibliographic connections identified by VOSviewer indicate that research from these nations shares common conceptual and methodological

underpinnings, particularly regarding socioeconomic factors, neurocognitive processing, collaborative reading practices, and early literacy settings. Nonetheless, because to the relatively restricted number of works included, the bibliographic coupling results should be taken descriptively and with caution, rather than as conclusive indicators of worldwide research supremacy or collaboration trends. The analysis indicates that research on neuroscience-informed vocabulary development is predominantly focused within a narrow range of educational and research settings, whereas interest in incorporating neurocognitive and parental viewpoints is progressively broadening across various regions.

Table 4: Top Countries' Contributions

Country	Documents	Citations	Total Link Strength
United States	6	247	160
Netherlands	3	52	75
United Kingdom	3	31	362
China	2	9	217
Italy	1	30	130
Canada	1	8	119
Japan	1	2	1
Austria	1	1	213
Germany	1	1	213

The Netherlands contributes three publications, 52 citations, and a link strength of 75. In addition, China's increasing involvement in neuroscience-informed literacy research is evidenced by two publications, nine citations, and a link strength of 217. Italy (30 citations, link strength 130) and Canada (8 citations, link strength 119) have robust bibliographic connections, indicating aligned theoretical and methodological perspectives with Western partners. Austria and Germany, each represented by a single article, exhibit high link strengths (213), indicating significant intellectual connectedness within the research network. The connection pattern highlights a Western-centric yet progressively global domain, characterised by increasing Asian participation and enhanced international collaboration in neuroscience, vocabulary acquisition, and parental involvement in early education.

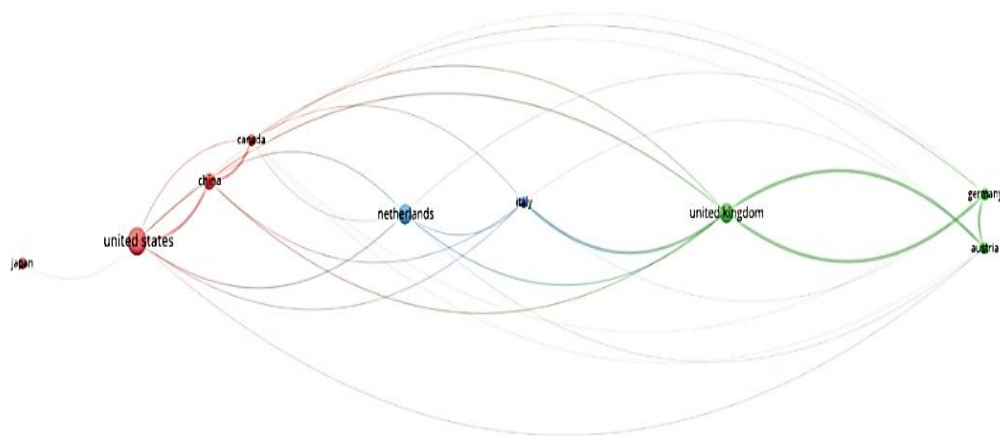


Figure 2: Regional Research Clusters (VOSviewer Visualisation)

The bibliographic coupling visualisation illustrates regional research clusters pertaining to the neuroscience foundations of vocabulary development and parental involvement. The red cluster, comprising the United States, China, and Canada, signifies the central hub of global research activity, focusing on neurocognitive models of early language acquisition and family literacy practices. The blue cluster, which includes the Netherlands and Italy, illustrates European collaborations utilising cross-linguistic and neuroimaging methodologies for vocabulary acquisition.

The green cluster, comprising the United Kingdom, Germany, and Austria, demonstrates a robust European network focused on evidence-based interventions and policy-related educational neuroscience. Japan is increasingly recognised as a contributor, indicating the expanding incorporation of Asian perspectives in this field. The visualisation depicts a connected yet regionally distinct research landscape, highlighting the significance of international collaboration in furthering neuroscientific understanding of vocabulary development and improving parental involvement in early literacy.

3.2 Systematic Literature Review Analysis

3.2.1 Distribution analysis

The analysed papers span from 2015 to 2025, illustrating a decade of increasing interdisciplinary focus on neuroscience and parental engagement in children's language advancement. The United States was the foremost contributor in the selected corpus, with six studies, followed by China with three studies, the United Kingdom with two studies, and Japan with one research. This distribution indicates that neuroscience-informed vocabulary research has been predominantly represented in well-funded educational and research environments, although recent contributions from East Asian nations like China and Japan reflect a growing international interest in culturally contextualized neurodevelopmental studies.

Recent studies (Li et al., 2025; Villa et al., 2025; Xu et al., 2024; Zhang et al., 2024) illustrate an increasing trend towards integrative frameworks that link

neurocognitive, environmental, and parental influences in the vocabulary development of children. In contrast to previous studies that mostly concentrated on individual cognitive or socioeconomic factors, contemporary research increasingly integrates interdisciplinary approaches encompassing neurological processing, home literacy contexts, and socioemotional impacts. This evolution indicates a growing acknowledgment that vocabulary development is influenced by the interplay of biological, cognitive, and environmental factors.

Table 5: Literature Matrix Table

No	Authors & Year	Country	Research Approach & Methods	Research Aims	Variables	Findings
1	Bignardi et al (2023)	United Kingdom	Structural equation modelling; large scale cohort data	Examine SES influence on specific cognitive and academic skills	SES, Vocabulary, General cognitive ability	SES forecast's general cognitive ability, whereas vocabulary continues to be influenced by SES.
2	Davison et al (2023)	United States	Longitudinal neuroimaging; DTI and behavioural tasks	Examine how neural connectivity predicts reading ability	Shared reading time, White matter structure, Reading outcomes	Collaborative reading enhances white matter associated with reading proficiency.
3	Demir-Lira et al (2018)	United States	Longitudinal observation; parent-child book reading	Assess early reading predicts literacy beyond general parental talk	Book reading frequency, Parental talk, SES, Vocabulary	Early reading forecasts vocabulary development independent of SES influences.
4	Konda et al (2015)	Japan	Quantitative; questionnaires	Identify cognitive, linguistic, and parental factors in academic and behavioural difficulties	Working memory, Grammar skill, Parental education	Working memory and paternal education influence learning.
5	Lancaster et al (2020)	United Kingdom	Machine learning; genetic & environmental modelling	Explore biological pathways linked to reading disability	Genetic variants, SES, Receptive language	Reading difficulty exemplifies the interaction between genetic and environmental factors.

6	Li et al (2025)	China	Path analysis; questionnaires	Examine parental and cognitive predictors of math and vocabulary skills	Parental education, Learning approach, Vocabulary	Parental education directly influences vocabulary development.
7	Marchman et al (2015)	United States	Quantitative longitudinal; Bayley Scales, LWL task, Peabody Picture Vocabulary Test	Identify predictors of receptive vocabulary in preterm children	SES, Prematurity, Lexical processing speed	Processing speed forecasts subsequent receptive vocabulary.
8	Marchman et al (2019)	United States	Longitudinal; LWL task, parental reports	Compare predictor of vocabulary growth in preterm and full-term children	Processing speed, Medical complication, Expressive vocabulary	Accelerated processing indicates enhanced vocabulary development.
9	Vernon-Feagans et al (2022).	United States	Longitudinal; video recordings, classroom observations	Examine maternal language input and classroom quality on literacy growth	Maternal vocabulary diversity, Involvement, Instructional quality	The language used by mothers reflects literacy development over time.
10	Villa et al (2025)	United States	Structural equation modelling; neuroimaging and literacy data	Model SES influence on literacy through oral language and brain structure	SES, Oral language, White matter integrity, Reading	Socioeconomic status affects reading via oral language than neurological structure.
11	Xu et al (2024)	China	Accelerated longitudinal design; questionnaire; behavioural & observational experiments; AI based analysis	Develop integrated framework for early language and socio-emotional development	Language development, Socio-emotional regulation, Parental well-being, Parenting style	Parental influences determine the initial development of brain linguistic capabilities.

12	Zhang et al (2024)	China	Structural equation modeling	Examine the relation between HLE, parents' reading skills, and children's emergent literacy skills and reading.	HLE, Parental reading skills, SES, Vocabulary	Home literacy significantly influences vocabulary development.
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3.2.2 Methods Analysis

The examined research predominantly employs longitudinal designs (7 studies), highlighting the significance of monitoring language and brain development trajectories over time. Structural Equation Modelling (SEM) is a frequently utilised quantitative method (Bignardi et al., 2023; Villa et al., 2025; Zhang et al., 2024), demonstrating a tendency for modelling causal pathways among socioeconomic status (SES), brain processes, and linguistic outcomes.

Neuroimaging (Davison et al., 2023; Villa et al., 2025) and machine learning methodologies (Lancaster et al., 2020) signify the integration of biological and computational neuroscience with vocabulary study. Simultaneously, questionnaire-based and behavioural methodologies (Konda et al., 2015; Li et al., 2025; Xu et al., 2024) provide socio-contextual insights, exemplifying methodological pluralism. This diversity indicates a science progressing towards multimodal data triangulation, incorporating neurobiological, environmental, and parental aspects.

3.2.3 Research Aims Analysis

The examined studies illustrate the evolution of research on vocabulary acquisition over time. Previous research concentrated on identifying characteristics that influence vocabulary development, including family wealth and the frequency of parental reading with children (Bignardi et al., 2023; Demir-Lira et al., 2018). These studies largely conceptualised vocabulary acquisition primarily as a consequence of the extent and quality of children's linguistic exposure in the family environment.

Subsequent studies incorporated neurocognitive characteristics such as white matter development, linguistic processing velocity, and neural connections that facilitate reading and verbal communication (Davison et al., 2023; Marchman et al., 2019). This elucidated how early events influence the development of the child's brain. Recent studies (Villa et al., 2025 ; Xu et al., 2024 ; Zhang et al., 2024) examine vocabulary from a broader perspective. They integrate cognitive, parental, and emotional elements, demonstrating that language acquisition relies on both neurocognitive mechanisms and environmental influences. The objectives of the studies indicate a transition from perceiving language as a mere ability to comprehending it as an integral component of a broader system encompassing the brain, carers, and social environment.

3.2.4 Variable Analysis

The analysed research investigated a broad spectrum of interrelated factors linked to children's language acquisition. The variables can be classified into neurocognitive, socioeconomic, parental, and socioemotional domains, illustrating the multifaceted nature of vocabulary development study.

Neurocognitive factors, including white matter organisation, brain connections, lexical processing speed, working memory, and language processing efficiency (Davison et al., 2023; Marchman et al., 2015). These characteristics were frequently analysed to comprehend the influence of brain-related processes on language acquisition and literacy development. Socioeconomic variables chiefly encompassed parental education, occupation, household income, and socioeconomic status (SES) (Bignardi et al., 2023; Li et al., 2025), which were often correlated with disparities in children's access to literacy resources and opportunities for language exposure.

Variables of parental participation encompassed the frequency of shared reading, the quality of home discourse, caregiver response, and the richness of the home literacy environment (HLE) (Demir-Lira et al., 2018; Vernon-Feagans et al., 2022; Zhang et al., 2024). Numerous studies also included socioemotional and contextual factors such as parental well-being, family stress, emotional regulation, and children's behavioural adjustment (Xu et al., 2024). The interplay among these variables indicates that vocabulary development is influenced by dynamic interactions between neurocognitive performance, affective experiences, and environmental language exposure, rather than by separate developmental factors alone.

3.2.5 Key Findings Analysis

The analysed research consistently indicates that children's vocabulary development is shaped by the interplay between neurocognitive processes and environmental factors. Socioeconomic status (SES) has been identified as a consistent factor influencing disparities in children's language exposure, literacy opportunities, and vocabulary results (Bignardi et al., 2023; Villa et al., 2025). Nevertheless, numerous studies have demonstrated that supportive parental engagement practices, such as shared reading, responsive communication, and language-rich home environments, can alleviate certain disadvantages linked to lower socioeconomic conditions (Demir-Lira et al., 2018; Zhang et al., 2024).

Neuroscientific research has revealed correlations between language and literacy performance and particular neurocognitive traits, including white matter organisation, brain connection, and language-processing efficiency (Davison et al., 2023; Marchman et al., 2019). These findings indicate that language acquisition encompasses both behavioural and neurological aspects of development. Furthermore, research integrating genetic and computational viewpoints (Lancaster et al., 2020) emphasized the intricate interplay between inherent cognitive predispositions and environmental literacy experiences in influencing vocabulary development trajectories.

The analysed research indicates that vocabulary development is optimally comprehended as a multifaceted developmental process shaped by cognitive abilities, environmental language exposure, emotional support, and parental involvement. The expansion of children's vocabulary seems to be enhanced when neurocognitive development is fostered through consistent, responsive, and literacy-enriched interactions in the familial setting.

4. Discussion

4.1 Neurocognitive Foundations of Vocabulary Development

The reviewed studies generally suggest that children's vocabulary development is intricately linked to neurocognitive processes in language processing, memory, neural connectivity, and reading development. Instead of operating as discrete cognitive functions, these neurocognitive systems seem to engage dynamically with children's linguistic contexts and literacy experiences.

Davison et al. (2023) utilised neuroimaging and behavioural assessments to demonstrate that the duration of shared reading correlates with enhanced white matter pathways associated with reading skill. Marchman et al. (2015) and Marchman et al. (2019) similarly found that early language-processing speed forecasted later receptive and expressive vocabulary growth, even in infants born preterm. The findings indicate that processing efficiency and brain organisation may serve as a crucial neurodevelopmental basis for language learning and literacy advancement.

Villa et al. (2025) demonstrated that socioeconomic status indirectly affected reading outcomes via oral vocabulary development, rather than through direct impacts on brain structure, emphasising the mediation function of language experience in neurocognitive development. These findings collectively endorse the concept of neuroplasticity, which posits that cerebral language networks evolve through ongoing interaction between biological predispositions and contextual linguistic input. Thus, vocabulary development can be comprehended as the outcome of dynamic interactions between neurobiological processes and language-rich educational experiences.

4.2 Socioeconomic and Demographic Factors

The analysed research consistently demonstrates that socioeconomic and demographic factors correlate with variations in children's vocabulary acquisition and literacy prospects. Bignardi et al. (2023) reported a correlation between socioeconomic status (SES) and general cognitive ability, as well as long-term language performance, whereas Li et al. (2025) further demonstrated that parental educational attainment influenced children's language proficiency and literacy-related experiences. These findings indicate that socioeconomic factors may influence children's access to language-rich settings, educational opportunities, and literacy exposure in early development.

Lancaster et al. (2020) emphasised the interplay between genetic predispositions and environmental factors in elucidating reading-related challenges, suggesting that vocabulary development cannot be exclusively ascribed to either biological

or environmental influences in isolation. This viewpoint emphasises the significance of comprehending vocabulary development as the result of dynamic interactions between cognitive predispositions and contextual influences.

The examined evidence indicates that the correlation between socioeconomic level and vocabulary development is not deterministic. Demir-Lira et al. (2018) found that early shared reading practices predict vocabulary development regardless of socioeconomic status, suggesting that attentive parental involvement may alleviate certain disadvantages associated with lower socioeconomic status. These findings correspond with Bronfenbrenner's Bioecological Theory, which underscores that children's development is influenced by ongoing interactions between personal attributes and environmental settings. Thus, although socioeconomic factors may affect the accessibility of literacy opportunities, the quality of parental engagement and home literacy experiences significantly contributes to children's vocabulary development.

4.3 Parental and Home Environment Factors

The analysed research consistently indicates that parental involvement is a significant environmental element linked to children's language acquisition and early literacy results. Demir-Lira et al. (2018) found that both the frequency of shared book reading and the quality of parental speech independently forecast vocabulary development, irrespective of socioeconomic position, underscoring the need for direct and meaningful language exposure in early life. Vernon-Feagans et al. (2022) similarly discovered that maternal vocabulary diversity and classroom quality both significantly impacted literacy proficiency, illustrating the synergistic effect of home and educational contexts on vocabulary development.

Zhang et al. (2024) indicated that a supportive home literacy environment (HLE) and parental reading proficiency were significantly correlated with vocabulary acquisition, whereas Xu et al. (2024) demonstrated that parental well-being and parenting style affected both linguistic and socioemotional development. These findings indicate that vocabulary development is influenced by children's cognitive capacities as well as the consistency, attentiveness, and quality of familial language exchanges.

These findings can also be analysed through Vygotsky's Social Development Theory, which underscores that language acquisition transpires via supervised social engagement and collaborative communication. In this context, parents serve as linguistic facilitators who enhance children's cognitive and vocabulary development through consistent conversational interaction, storytelling, collaborative reading, and emotionally nurturing engagement. The examined evidence indicates that neuroscience-informed literacy practices can be effectively implemented in daily home settings through responsive communication, literacy-enhanced routines, and ongoing parent-child interactions that foster both neurocognitive and linguistic development.

4.4 Socioemotional and Contextual Factors

The reviewed studies indicate that socioemotional factors significantly influence children's vocabulary acquisition and early literacy experiences. Xu et al. (2024) established that parental well-being and socioemotional regulation affected early language-related cognitive functioning, suggesting that emotionally supportive environments may enhance children's linguistic development. Vernon-Feagans et al. (2022) similarly indicated that classroom quality and teacher interaction enhanced home language intake, underscoring the synergistic impact of familial and educational contexts on literacy development.

Konda et al. (2015) underscored the correlation between working memory and father's educational attainment with academic and behavioural results, indicating an interplay of cognitive, emotional, and environmental components in children's vocabulary development. These studies collectively suggest that vocabulary acquisition is affected by cognitive and neurobiological processes, as well as emotional security, secure relationships, and supportive learning contexts. Children who receive responsive communication, emotional support, and continuous connection in home and school environments may exhibit enhanced engagement, attention, and motivation in language-learning activities. These findings substantiate the perspective that vocabulary acquisition is influenced by social and emotional contexts rather than being exclusively cognitive.

Overall, the reviewed studies collectively demonstrate that children's vocabulary development should be understood as a multidimensional process shaped by interactions between neurocognitive functioning, socioeconomic conditions, emotional experiences, and parental literacy practices. The systematic synthesis further indicates that neuroscience-informed literacy interventions are most effective when supported by responsive, language-rich, and emotionally supportive home environments.

5. Conclusion

This bibliometric-supported Systematic Literature Review synthesised empirical evidence concerning the neurocognitive foundations of children's vocabulary development and the role of parental involvement in early literacy contexts. The review identified recurring neurocognitive, socioeconomic, parental, and socioemotional factors influencing vocabulary development across early educational settings. The examined evidence indicates that vocabulary development is influenced by the interplay of neurocognitive functioning, environmental language exposure, emotional support, and family literacy practices. The results suggest that parental involvement, collaborative reading activities, and nurturing home literacy settings may significantly enhance children's vocabulary development in conjunction with neurobiological and cognitive mechanisms.

The bibliographic coupling analysis also revealed a growing multidisciplinary interest in neuroscience-informed vocabulary research throughout both Western and Asian educational settings. Nevertheless, the results must be interpreted with caution owing to the limited corpus size, methodological variability across

studies, and the exploratory character of the bibliometric analysis. This review provides an interdisciplinary approach linking neuroscience, literacy development, and parental participation in children's vocabulary study. Future research could gain from more extensive transdisciplinary datasets, culturally varied longitudinal studies, and increased examination of how neuroscience-informed literacy practices can be adapted for inclusive educational and family-oriented interventions.

Conflict of Interest

The authors declare no conflict of interest.

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