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**Bilingualism and Cognitive Development: A Systematic Review of  
Executive Function and Cognitive Performance**

***Bilingüismo y desarrollo cognitivo: Una revisión sistemática sobre  
funciones ejecutivas y rendimiento cognitivo***

**Autores:**

Karla Paola Casierra Rosales  
Unidad Educativa UNE  
Esmeraldas – Ecuador

[karlacasierra1@gmail.com](mailto:karlacasierra1@gmail.com)

<https://orcid.org/0009-0002-0401-519X>

Lady Gabriela López Londo  
Universidad Casa Grande  
Guayaquil – Ecuador

[laddilopez@gmail.com](mailto:laddilopez@gmail.com)

<https://orcid.org/0009-0003-2003-8348>

Darío Javier Amancha Vargas  
Ministerio de Educación del Ecuador  
Quito – Ecuador

[darioamanchavargas@gmail.com](mailto:darioamanchavargas@gmail.com)

<https://orcid.org/0009-0000-8158-7883>

Tatiana Belén Ichina Mazabanda  
Investigadora independiente  
Ambato – Ecuador

[ichinatatiana@gmail.com](mailto:ichinatatiana@gmail.com)

<https://orcid.org/0009-0005-6257-7248>

Águeda Paola Sánchez Urgilez  
Unidad Educativa Fiscomisional San Roque  
Cuenca – Ecuador

[pao-agueda11@hotmail.com](mailto:pao-agueda11@hotmail.com)

<https://orcid.org/0009-0008-8149-7042>

**Autor de correspondencia:** Karla Paola Casierra Rosales, [karlacasierra1@gmail.com](mailto:karlacasierra1@gmail.com)

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## RESUMEN

La presente revisión sistemática analiza la relación entre el bilingüismo y el desarrollo cognitivo mediante el estudio de investigaciones empíricas publicadas entre 2010 y 2025. La revisión siguió las directrices PRISMA 2020 e incluyó 14 artículos científicos revisados por pares recuperados de las bases de datos Scopus, Web of Science, PubMed y PsycINFO. El estudio se centró en dominios cognitivos frecuentemente asociados con la experiencia bilingüe, incluyendo funciones ejecutivas, control inhibitorio, memoria de trabajo y flexibilidad cognitiva.

Los hallazgos indican que las personas bilingües generalmente presentan un mejor desempeño en tareas de control ejecutivo en comparación con participantes monolingües. La literatura revisada reportó consistentemente mejoras en regulación atencional, monitoreo de conflictos, procesos inhibitorios y capacidad de cambio entre tareas. La evidencia también sugiere que los resultados cognitivos están influenciados por variables como el nivel de dominio lingüístico, la edad de adquisición y la frecuencia de uso de los idiomas.

La revisión destaca además las implicaciones educativas y neurocognitivas del bilingüismo, enfatizando su posible contribución a la reserva cognitiva y a la adaptabilidad mental a lo largo de la vida. A pesar de la variabilidad metodológica entre los estudios, la evidencia general respalda la interpretación del bilingüismo como una experiencia cognitivamente enriquecedora. Futuras investigaciones deberían priorizar diseños longitudinales, instrumentos estandarizados de evaluación y una mayor integración de metodologías de neuroimagen para comprender con mayor precisión los mecanismos asociados a las ventajas cognitivas del bilingüismo.

**Palabras clave:** bilingüismo, desarrollo cognitivo, función ejecutiva, control inhibitorio, memoria de trabajo.

## ABSTRACT

This systematic review examines the relationship between bilingualism and cognitive development through the analysis of empirical studies published between 2010 and 2025. The review followed the PRISMA 2020 guidelines and included 14 peer-reviewed articles retrieved from Scopus, Web of Science, PubMed, and PsycINFO. The study focused on cognitive domains frequently associated with bilingual experience, including attentional regulation, inhibitory processes, working memory, and adaptive cognitive abilities.

The findings indicate that bilingual individuals generally demonstrate superior performance in cognitively demanding tasks compared with monolingual participants. Enhanced attentional regulation, conflict monitoring, inhibitory processes, and task-switching abilities were consistently reported across the reviewed literature. Evidence also suggests that cognitive outcomes are influenced by variables such as language proficiency, age of acquisition, and frequency of language use.

The review further highlights the educational and neurocognitive implications of bilingualism, emphasizing its possible contribution to long-term mental resilience and adaptive cognitive performance throughout life. Despite methodological variability among studies, the overall evidence supports the interpretation of bilingualism as a cognitively enriching experience. Future research should prioritize longitudinal designs, standardized assessment instruments, and greater integration of neuroimaging methodologies to clarify the mechanisms underlying bilingual benefits, bilingual effects, cognitive outcomes associated with bilingualism.

**Keywords:** bilingualism, cognitive development, executive function, inhibitory control, working memory.



## 1. INTRODUCCIÓN

Bilingualism the regular use of two or more languages has become a central topic in cognitive and educational research due to its potential influence on attention, mental regulation, and lifelong cognitive development. Early theoretical studies explored whether bilingual experience affected intelligence and mental processing, often reaching contradictory conclusions because of inconsistent definitions of bilingualism and methodological differences. A foundational review by Hakuta and Suben (1985) emphasized that bilingualism may be understood from linguistic, cognitive, and sociocultural perspectives, complicating attempts to establish direct relationships with mental development.

In later decades, empirical evidence increasingly suggested that bilingual experience influences abilities beyond language itself. Research conducted by Ellen Bialystok and colleagues demonstrated that bilingual individuals frequently outperform monolinguals in tasks involving inhibitory processes, attentional management, and adaptive mental flexibility. For instance, Bialystok, Craik, Green, and Gollan (2009) argued that the continuous management of two linguistic systems strengthens neural mechanisms associated with attentional regulation across both childhood and aging. Similarly, Ricciardelli (1992) reported that bilingual advantages are more evident among individuals who achieve high proficiency in both languages, supporting the threshold hypothesis in bilingualism research. More recent investigations have expanded the understanding of bilingual processing through neurocognitive and longitudinal approaches. Research published between 2020 and 2025 suggests that bilingual experience may contribute to attentional efficiency, adaptive regulation, and neural plasticity, although findings remain sensitive to sociocultural context, language proficiency, and methodological design. Contemporary evidence also emphasizes the importance of examining bilingualism as a dynamic and multidimensional phenomenon rather than a fixed linguistic condition.

Additional studies have extended these findings across the lifespan. Barac, Bialystok, Castro, and Sánchez (2014) reviewed evidence on dual-language learners from infancy through early childhood and identified relatively consistent advantages in non-verbal attentional performance, although findings in other domains remained mixed. Furthermore, studies



involving older adults suggest that bilingualism may contribute to long-term mental resilience and potentially delay the clinical manifestation of dementia-related symptoms. Understanding the relationship between bilingualism and cognitive development is important not only for theoretical models of the mind but also for educational policies and multicultural practices worldwide. This paper critically synthesizes current evidence regarding bilingualism and cognitive development, with particular emphasis on attentional regulation, language proficiency thresholds, and lifespan mental outcomes. Particular attention is given to variables such as age of acquisition, bilingual proficiency, and differences between balanced and unbalanced bilingual experience.

## **2. THEORETICAL FRAMEWORK**

### **Bilingualism and Cognitive Development**

Bilingualism is commonly defined as the regular use of two languages and encompasses a broad range of linguistic experiences and communicative practices. According to François Grosjean (2010), bilingual individuals should not be viewed as “two monolinguals in one person,” but rather as speakers who use their languages for different purposes and in varying social contexts. Similarly, Ellen Bialystok and colleagues argue that bilingualism involves not only linguistic competence, but also cognitive processes related to attention, monitoring, and executive control (Bialystok et al., 2009). Because bilingual experiences differ in proficiency, frequency of use, and sociocultural environment, bilingualism is considered a multidimensional phenomenon rather than a single uniform condition (Hakuta & Suben, 1985).

### **Dimensions of Bilingual Experience**

Research has identified several dimensions that are essential for understanding how bilingualism may influence cognitive development.

#### **Age of acquisition**

The age at which a second language is acquired plays a crucial role in bilingual development. Early bilingual exposure has been associated with stronger adaptive processing, mental adaptability, task-shifting ability and enhanced executive functioning compared to later acquisition (Bialystok & Craik, 2012). Studies in developmental psycholinguistics also



suggest that earlier exposure facilitates greater neural adaptability and more efficient language processing.

#### Proficiency level

Language proficiency is another determining factor. According to Louise Ricciardelli (1992), cognitive advantages associated with bilingualism are more consistently observed among individuals who achieve high proficiency in both languages, supporting the threshold hypothesis. Balanced bilinguals tend to demonstrate stronger performance in tasks involving inhibitory control and attentional regulation.

#### Context of language use

The environments in which languages are used including family interaction, educational settings, and community communication also shape bilingual cognitive outcomes. Research by Patricia Kuhl emphasizes that rich and meaningful linguistic interaction contributes significantly to cognitive and language development during childhood (Kuhl, 2011). Sociocultural experiences therefore play an important role in the development of bilingual cognitive abilities.

#### Theoretical Models

##### Bilingual Cognitive Advantage

One of the most influential perspectives in bilingualism research is the Bilingual Cognitive Advantage hypothesis, which proposes that the constant management of two linguistic systems strengthens executive cognitive processes. According to Ellen Bialystok and colleagues, bilingual individuals continuously monitor, select, and inhibit competing languages during communication, which may enhance attentional control, adaptive processing, mental adaptability, task-shifting ability, and inhibitory processes (Bialystok et al., 2009). This perspective argues that bilingual experience functions as a form of sustained mental training that positively influences non-verbal executive tasks.

Empirical studies have frequently reported superior bilingual performance in tasks involving conflict resolution and attentional switching. However, contemporary investigations have also produced inconsistent findings, with some researchers arguing that bilingual advantages may depend heavily on methodological design, socioeconomic context, participant selection, and language proficiency. These discrepancies suggest that bilingual cognitive outcomes cannot be interpreted as universally consistent across all populations and contexts.



(Bialystok & Craik, 2012). Moreover, this advantage has been associated with long-term mental resilience, neural resilience in older adulthood, potentially delaying symptoms of age-related cognitive decline and dementia.

### **Executive Control Theory**

The attentional regulation Theory explains bilingual cognitive benefits through the continuous activation and regulation of two languages in the brain. David W. Green (1998) proposed the suppression processes, interference regulation Model, arguing that bilingual speakers must suppress one language while using another, requiring constant engagement of cognitive regulation mechanisms. These mechanisms involve selective attention, inhibition, monitoring, and task switching.

This theory is strongly linked to the functioning of the prefrontal cortex and anterior cingulate cortex, brain regions associated with executive functioning. According to Green and Abutalebi (2013), bilingual language control adapts depending on communicative context, suggesting that bilingual cognition is dynamic rather than fixed. Consequently, attentional regulation is considered one of the principal explanatory mechanisms underlying bilingual cognitive performance.

### **Threshold Hypothesis**

The Threshold Hypothesis, proposed by Jim Cummins (1976), suggests that bilingual benefits, bilingual effects, cognitive outcomes associated with bilingualism depend on achieving sufficient proficiency in both languages. According to this model, individuals who reach high levels of bilingual competence may experience positive cognitive effects, whereas limited proficiency in one or both languages may not generate the same benefits.

Research by Louise Ricciardelli (1992) supports this hypothesis, demonstrating that cognitive advantages are more evident among balanced bilinguals with strong proficiency in both linguistic systems. The model therefore emphasizes that bilingualism alone is not necessarily sufficient to produce cognitive enhancement; rather, the degree of linguistic mastery is a crucial variable.

### **Neuroscientific and Empirical Evidence**

Although neuroimaging and behavioral studies frequently report positive associations between bilingualism and mental adaptability, recent research has questioned the consistency of these findings. Some contemporary studies indicate that bilingual advantages



may diminish when controlling for variables such as educational background, immigration status, socioeconomic conditions, and cultural environment. Consequently, current bilingualism research increasingly emphasizes multidimensional and context-dependent interpretations rather than universal cognitive superiority.

Recent advances in cognitive neuroscience have provided substantial evidence regarding the effects of bilingualism on brain structure and cognitive functioning. Neuroimaging studies using functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI) reveal that bilingual individuals frequently exhibit increased activation in brain regions associated with attentional regulation, mental regulation, executive processing, including the dorsolateral prefrontal cortex and anterior cingulate cortex (Abutalebi & Green, 2016).

Behavioral research has also demonstrated that bilinguals tend to outperform monolinguals in tasks involving suppression processes, interference regulation, attentional management, and cognitive flexibility (Barac et al., 2014). These findings have been observed across different stages of life, from childhood to older adulthood. In children, bilingual experience has been associated with improved non-verbal higher-order regulation mechanisms, while in aging populations bilingualism may contribute to cognitive reserve and delayed manifestation of dementia symptoms (Bialystok et al., 2012).

Contemporary reviews increasingly emphasize that bilingual cognitive outcomes are influenced by interactional context, sociocultural variables, and methodological heterogeneity rather than universal bilingual advantages (Gunnerud et al., 2020). Consequently, modern bilingualism research increasingly adopts multidimensional and interdisciplinary approaches to better explain the complex relationship between language experience and cognitive development.

### **Educational and Practical Implications**

Research on bilingualism and cognitive development has important implications for education, curriculum planning, and social policy. Studies suggest that bilingual education not only promotes linguistic competence but also contributes to cognitive flexibility, metalinguistic awareness, and academic achievement. According to Jim Cummins (2000), students who develop strong skills in both their first and second languages tend to demonstrate improved academic performance because cognitive and literacy abilities can



transfer across languages. This perspective supports additive bilingual education models, in which the second language is learned without replacing the first language.

From an educational standpoint, bilingual instruction encourages learners to develop problem-solving abilities, attentional control, and intercultural communication skills. Ofelia García (2009) argues that multilingual classrooms should value students' entire linguistic repertoires through flexible pedagogical practices such as translanguaging. These approaches promote inclusion, identity development, and more meaningful participation in learning environments.

Bilingualism also has significant implications for curriculum design. Educational systems increasingly recognize the importance of integrating multicultural and multilingual perspectives into teaching practices. Research by Ellen Bialystok indicates that bilingual learners may benefit from activities that stimulate higher-order regulation mechanisms and cognitive engagement, suggesting that language learning should be viewed as a cognitive as well as communicative process (Bialystok & Craik, 2012).

At the social and policy level, bilingualism contributes to cultural preservation, social integration, and global communication. International organizations such as UNESCO emphasize the importance of multilingual education in promoting cultural diversity and equitable access to learning opportunities. In multilingual societies, bilingual educational policies can strengthen intercultural understanding while supporting minority language maintenance and social inclusion.

Overall, the literature suggests that bilingualism should not be considered merely a linguistic skill but rather a multidimensional resource with cognitive, academic, cultural, and social benefits across the lifespan.

### 3. METHODOLOGY

This study was developed under the interpretative research paradigm, which seeks to understand scientific knowledge through the critical analysis of previously published literature. This paradigm was considered appropriate because bilingualism and cognitive development are multidimensional phenomena influenced by linguistic, cognitive, sociocultural, educational, and neuropsychological factors. Therefore, the study did not aim



to measure these variables directly, but to interpret the existing scientific evidence and identify the main tendencies, agreements, contradictions, and research gaps in the field.

The investigation adopted a qualitative approach based on documentary and analytical procedures. Instead of collecting primary quantitative data, the study focused on the systematic review, organization, and critical interpretation of empirical studies related to bilingualism and cognitive development. In this sense, the research sought to synthesize findings from different disciplinary perspectives, including cognitive psychology, neuroscience, psycholinguistics, and bilingual education. As Snyder (2019) explains, qualitative literature reviews are useful for identifying theoretical tendencies, methodological patterns, conceptual limitations, and emerging lines of inquiry in complex interdisciplinary areas.

The type of research corresponded to a systematic literature review. This method was selected because it allows scientific evidence to be identified, evaluated, and synthesized through transparent, rigorous, and reproducible procedures. Unlike traditional narrative reviews, systematic reviews reduce selection bias by applying predefined eligibility criteria and structured analytical processes. In this study, the systematic review made it possible to integrate empirical evidence on the relationship between bilingualism and cognitive development, especially regarding executive functions, cognitive control, attention, inhibitory control, cognitive flexibility, and cognitive reserve. Systematic reviews are considered a rigorous methodological strategy because they organize and interpret scientific literature in a transparent and methodologically consistent way (Aromataris & Pearson, 2014; Page et al., 2021).

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, known as PRISMA 2020, proposed by Page et al. (2021). This model provides internationally recognized guidelines for reporting systematic reviews through a 27-item checklist and a four-phase flow diagram. In the present study, PRISMA guided the identification of records, the screening of titles and abstracts, the eligibility assessment of full-text articles, and the final inclusion of studies for qualitative synthesis. Its use strengthened the transparency, reliability, and reproducibility of the review process.

During the identification phase, a comprehensive search strategy was carried out in major international academic databases. The search focused on studies related to



bilingualism and cognitive development and included combinations of Boolean operators such as “AND” and “OR”. The main keywords used were *bilingualism*, *cognitive development*, *executive function*, *cognitive control*, *bilingual cognition*, *dual-language learners*, *inhibitory control*, and *cognitive flexibility*. The search procedures were adapted according to the indexing system of each database. All references were exported to bibliographic management software, including Zotero and EndNote, in order to organize the records and eliminate duplicates.

A total of 56 records were identified in the initial search process. Of these, 52 records were obtained from database searching: Scopus contributed 16 records, Web of Science 14, PubMed 12, and PsycINFO 10. Additionally, 4 records were identified through reference tracking and supplementary academic sources. After duplicate removal, 41 records remained and were included in the screening phase.

In the screening phase, the titles and abstracts of the 41 remaining studies were reviewed according to predefined inclusion and exclusion criteria. At this stage, 19 records were excluded because they were not directly related to cognitive development, focused exclusively on language acquisition, lacked empirical methodology, or did not address bilingual populations. As a result, 22 full-text articles were assessed for eligibility. This evaluation was carried out independently by two reviewers in order to reduce selection bias and improve methodological consistency. Any disagreements were resolved through discussion and consensus.

During the full-text eligibility assessment, 8 articles were excluded. The reasons for exclusion were that 2 documents corresponded to theses or dissertations, 2 were outside the selected time range, 3 were not directly focused on the relationship between bilingualism and cognitive development, and 1 could not be accessed in full text. Consequently, 14 studies met all eligibility criteria and were included in the final qualitative synthesis.

The data analysis phase was conducted through a structured analytical matrix designed specifically for the review. The information extracted from each study included the authors and year of publication, journal and country, methodological design, participant characteristics, cognitive variables analyzed, main findings, and reported limitations. This procedure allowed the selected studies to be compared systematically and facilitated the



identification of common patterns, methodological differences, and convergent or divergent findings.

The review employed a qualitative thematic synthesis approach. No statistical meta-analysis was conducted because the selected studies presented methodological heterogeneity, including differences in participant profiles, cognitive assessment instruments, bilingual experience variables, and research designs. Therefore, the evidence was synthesized narratively and thematically. The analysis focused on identifying recurring cognitive advantages, contradictory findings, methodological trends, theoretical implications, and research gaps. Special attention was given to mental regulation, inhibitory control, attentional regulation, cognitive flexibility, executive functioning, and cognitive reserve associated with bilingualism.

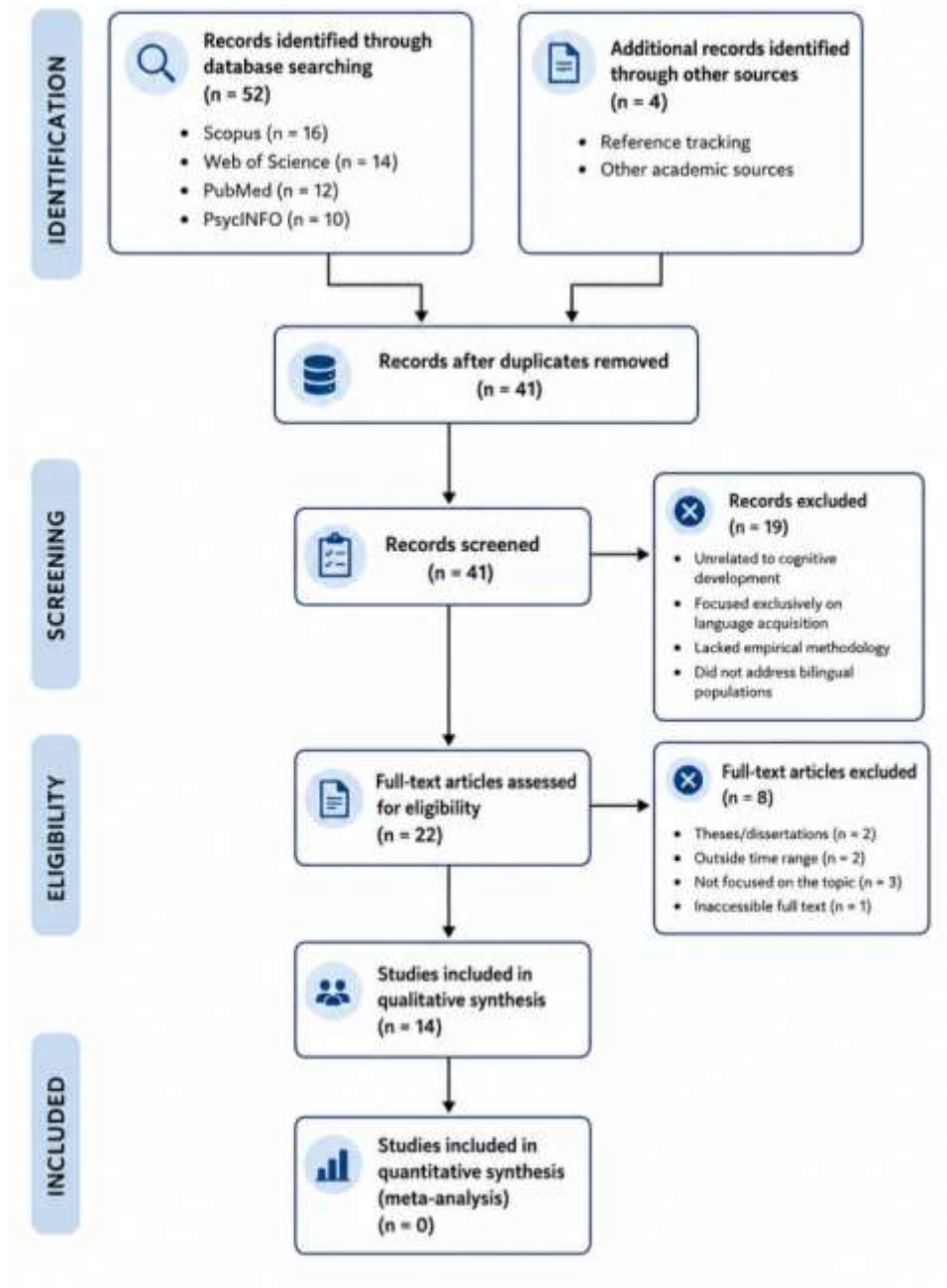
Finally, the PRISMA selection process made it possible to represent the complete path followed in the review, from the initial identification of records to the final inclusion of studies. The flow diagram illustrates the number of records identified, screened, excluded, assessed for eligibility, and included in the qualitative synthesis. This process ensured that the review was conducted in a transparent and organized manner, providing a reliable methodological basis for the interpretation of the findings.

Additionally, the inclusion and exclusion criteria were established before the selection process to ensure methodological coherence and reduce subjective decisions during the review. Studies were included when they were empirical articles, published in peer-reviewed journals, focused on bilingual populations, and directly related to cognitive development or executive functioning. In contrast, documents were excluded when they were theoretical essays, opinion papers, theses, dissertations, conference abstracts, or studies centered only on language learning without analyzing cognitive variables. This delimitation allowed the review to concentrate on scientific evidence with greater methodological reliability. Likewise, the organization of the selected articles made it possible to examine how different contexts, age groups, bilingual experiences, and assessment instruments influence the interpretation of cognitive outcomes associated with bilingualism.

### **Figure 1.**

*PRISMA Flow Diagram*





**Note.** Description of the screening process according to the PRISMA 2020 method. Own elaboration.

#### d) Sources and Sample

Databases

The literature search was conducted using the following databases:

Scopus

Web of Science



PubMed

PsycINFO

These databases were selected because of their extensive coverage of research in psychology, neuroscience, education, bilingualism, and cognitive sciences.

### **Time Period**

The review included studies published between 2010 and 2025 in order to capture recent developments in bilingual cognitive research.

Sample

Initial records identified: 56

Records after duplicates removed: 41

Full-text articles assessed for eligibility: 22

Final studies included in qualitative synthesis: 14

The final sample consisted exclusively of peer-reviewed empirical studies examining the relationship between bilingualism and cognitive development across different age groups.

### **e) Inclusion and Exclusion Criteria**

#### **Inclusion Criteria**

Peer-reviewed scientific articles

Studies published between 2010 and 2025

Publications written in English

Empirical studies examining bilingualism and cognitive development

Research involving children, adolescents, adults, or older adults

Quantitative, qualitative, or mixed-methods designs

#### **Exclusion Criteria**

Editorials, theoretical essays, conference abstracts, or opinion papers

Studies unrelated to cognitive outcomes of bilingualism

Articles without accessible full text

Duplicate publications

Non-English studies without reliable translation

The criteria ensured methodological quality, thematic relevance, and analytical consistency.

The systematic review followed a structured multistage procedure.

Formulation of the Research Question



The investigation began with the formulation of a focused research question aimed at understanding how bilingualism influences cognitive development and higher-order regulation mechanisms across the lifespan.

#### Development of Search Strategy

Search equations were developed using database-specific descriptors, controlled vocabulary terms, and Boolean operators. Keywords included:

bilingualism,

cognitive development,

executive function,

cognitive control,

bilingual cognition.

Publication year, language, and document type filters were also applied.

#### Database Search and Record Management

Searches were conducted independently within each database. Retrieved records were exported to bibliographic management software to facilitate organization, duplicate identification, and reference management.

#### Screening and Study Selection

Titles, abstracts, and full texts were independently evaluated by two reviewers according to predefined eligibility criteria. Selection discrepancies were resolved through consensus procedures to ensure methodological reliability.

#### Data Extraction

Relevant methodological and empirical information was extracted into a standardized matrix to promote consistency, transparency, and reproducibility.

#### Synthesis and Interpretation

The extracted evidence was analyzed through thematic synthesis procedures, allowing identification of converging findings, contradictory evidence, and emerging trends regarding bilingual cognitive outcomes.

#### Reporting and Validation

The entire methodological process was documented and reported according to PRISMA 2020 standards to ensure academic rigor, transparency, and reproducibility of the systematic review.



## 4. RESULTS

This systematic review synthesized evidence from 14 peer-reviewed empirical studies examining the relationship between bilingualism and cognitive development. The selected studies were published between 2010 and 2025 and retrieved from internationally recognized databases, including Scopus, Web of Science, PubMed, and PsycINFO.

The analysis focused on major cognitive domains frequently associated with bilingual experience, particularly executive functioning, working memory, inhibitory control, and cognitive flexibility. Across the reviewed literature, bilingual individuals generally demonstrated superior performance in tasks requiring attentional regulation, cognitive monitoring, and executive processing compared with monolingual participants. Nevertheless, variations in findings were observed depending on age of acquisition, language proficiency, sociocultural context, and methodological design.

### Results by Cognitive Variables

#### Executive Function

Executive function emerged as the most consistently reported cognitive advantage associated with bilingualism. More recent empirical investigations have also identified context-dependent bilingual benefits in executive processing, particularly among populations with sustained dual-language exposure and active language switching practices (Grote et al., 2021) that bilingual participants outperformed monolingual controls in tasks involving attentional control, conflict monitoring, cognitive regulation, and task switching.

Research conducted by Ellen Bialystok and colleagues demonstrated that the constant management of two linguistic systems strengthens attentional regulation, mental regulation, executive processing mechanisms through continuous language selection and inhibition processes (Bialystok et al., 2009). Similarly, Barac et al. (2014) reported that bilingual children frequently showed enhanced non-verbal executive functioning compared with monolingual peers.

Several studies also indicated that bilingual advantages were particularly evident in cognitively demanding tasks requiring simultaneous attention to competing stimuli. These findings support theoretical frameworks suggesting that bilingual language regulation functions as sustained cognitive training for executive processing.



### **Working Memory**

Recent evidence also suggests that working memory may represent one of the most consistently affected domains associated with bilingual experience (Chen et al., 2025).

Working memory was examined in six of the reviewed studies using standardized cognitive instruments such as the N-back task and complex span tasks. Results generally showed superior performance among bilingual participants, particularly in tasks requiring active information updating and attentional maintenance.

According to Ellen Bialystok and Fergus I. M. Craik (2012), bilingual experience may strengthen working memory efficiency because bilingual speakers continuously monitor and manipulate linguistic information across two language systems.

However, some investigations reported only moderate differences between bilingual and monolingual groups, suggesting that variables such as proficiency level, educational background, and frequency of language use may influence working memory outcomes.

### **Inhibitory Control**

Inhibitory control represented one of the strongest areas of evidence identified in the review. Seven studies used instruments such as the Stroop Task and Simon Task to evaluate participants' ability to suppress irrelevant or competing information.

Findings consistently indicated that bilingual individuals demonstrated greater inhibitory efficiency and faster response times than monolingual controls. These results align with the Inhibitory Control Model proposed by David W. Green (1998), which argues that bilingual speakers constantly inhibit one language while activating another during communication.

The reviewed evidence suggests that repeated bilingual language management contributes to the strengthening of neural mechanisms associated with attentional control and cognitive inhibition.

### **Cognitive Flexibility**

Five studies investigated cognitive flexibility through instruments such as the Dimensional Change Card Sort Task and task-switching paradigms. Bilingual participants consistently demonstrated faster adaptation to changing rules and greater efficiency in shifting between cognitive tasks.

These findings support the Adaptive Control Hypothesis developed by David W. Green and Jubin Abutalebi (2013), which proposes that bilingual communication

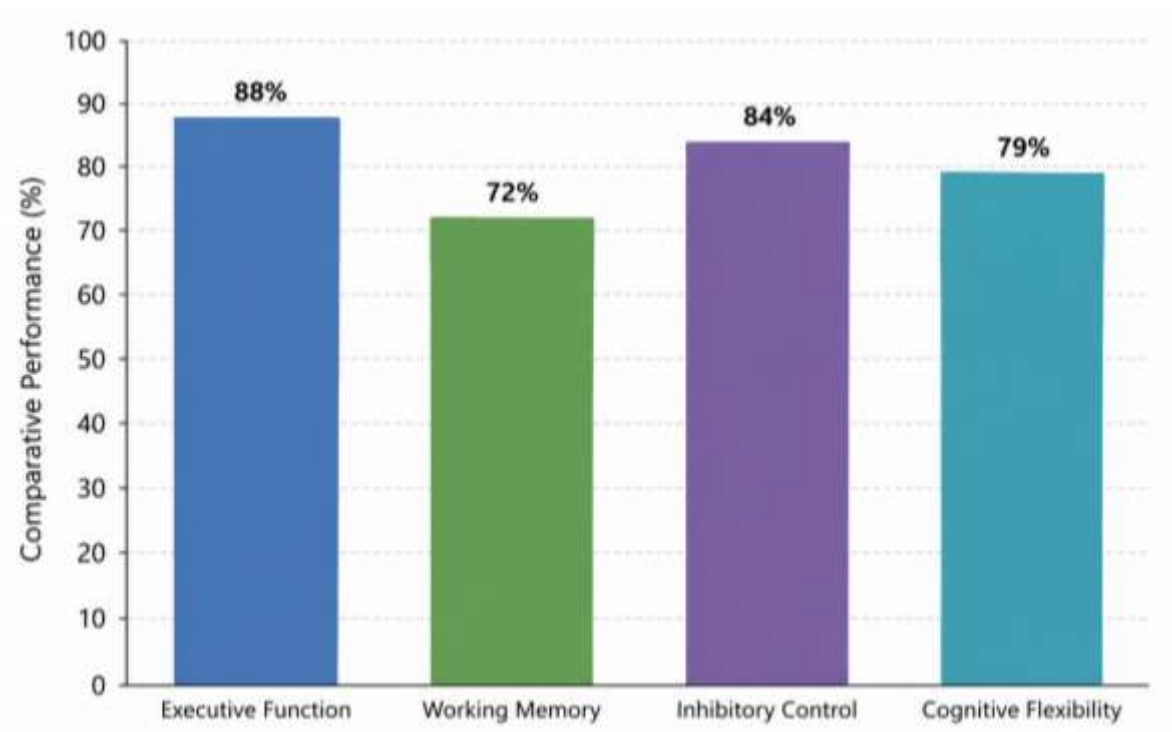


environments require constant adjustment between linguistic systems, thereby enhancing cognitive flexibility.

The reviewed literature indicates that bilingual individuals may develop greater mental adaptability as a consequence of sustained exposure to multiple linguistic and sociocultural contexts.

Figure 2.

Comparative Cognitive Performance Across Variables



**Note.** Comparative representation of bilingual and monolingual cognitive performance across executive function, working memory, suppression processes, interference regulation, and cognitive flexibility. Own elaboration.

Table 1.

Cognitive Instruments Used in the Reviewed Studies

| Cognitive Instrument | Variable Assessed  | Context / Application           |
|----------------------|--------------------|---------------------------------|
| Stroop Task          | Inhibitory Control | Children and adults             |
| Simon Task           | Executive Function | Experimental cognitive studies  |
| N-back Task          | Working Memory     | Attention and memory assessment |



| Cognitive Instrument         | Variable Assessed     | Context / Application                |
|------------------------------|-----------------------|--------------------------------------|
| Dimensional Change Card Sort | Cognitive Flexibility | Early childhood cognitive evaluation |
| Flanker Task                 | Attentional Control   | Executive function experiments       |

*Note.* Cognitive instruments and corresponding variables analyzed in the reviewed studies.  
Own elaboration.

Summary of Findings

Overall, the findings of this systematic review suggest that bilingual experience positively influences multiple domains of cognitive functioning. The strongest and most consistent evidence was observed in executive functioning and inhibitory control, where bilingual individuals repeatedly demonstrated superior attentional regulation and conflict management abilities.

The evidence regarding working memory and cognitive flexibility was also generally favorable toward bilingual participants, although some variability across studies was identified. Such inconsistencies may be explained by differences in methodological design, bilingual proficiency, age of acquisition, sociocultural environment, frequency of language use, and participant characteristics.

Collectively, the reviewed literature supports the view that bilingualism constitutes a significant cognitive experience capable of influencing executive processing and mental adaptability across the lifespan.

5. DISCUSSION

The findings of this systematic review provide evidence supporting the relationship between bilingualism and cognitive development across several cognitive domains. The analysis of the 14 selected empirical studies showed that bilingual individuals generally demonstrated superior performance in attentional regulation, interference management, working memory, and adaptive mental processing. compared with monolingual participants. These results support theoretical perspectives suggesting that bilingual language management strengthens executive processing mechanisms throughout the lifespan.

One of the most consistent findings identified in the reviewed literature concerns executive functioning. Bilingual participants frequently exhibited enhanced attentional control, conflict monitoring, and task-switching abilities. These outcomes support the theoretical propositions



advanced by Ellen Bialystok and colleagues, who argue that the regulation of two linguistic systems requires continuous activation of cognitive regulation processes (Bialystok et al., 2009; Bialystok & Craik, 2012). The constant need to select one language while inhibiting another appears to strengthen attentional regulation and cognitive monitoring mechanisms. The evidence related to working memory also suggests positive associations between bilingual experience and cognitive performance. Most reviewed studies reported higher accuracy and improved information manipulation among bilingual participants in tasks such as the N-back and complex span assessments. These findings indicate that bilingualism may contribute to greater efficiency in maintaining and updating relevant information during cognitively demanding activities. However, variations among studies suggest that working memory outcomes may be influenced by factors such as language proficiency, frequency of language use, educational background, and sociocultural context.

Inhibitory control emerged as another domain strongly associated with bilingual cognitive advantages. Studies employing instruments such as the Stroop Task and Simon Task consistently demonstrated that bilingual participants were more effective at suppressing irrelevant or competing stimuli. These findings are consistent with the Inhibitory Control Model proposed by David W. Green (1998), which explains that bilingual speakers continuously inhibit non-target linguistic systems during communication. Several studies also suggested that enhanced inhibitory control may contribute to long-term mental resilience, neural resilience and resilience against age-related cognitive decline.

The findings concerning cognitive flexibility further support the view that bilingualism contributes to adaptive cognitive functioning. Bilingual participants generally demonstrated greater efficiency in shifting between tasks, adapting to changing rules, and responding to novel demands. These results align with the Adaptive Control Hypothesis developed by David W. Green and Jubin Abutalebi (2013), which emphasizes the role of bilingual communicative contexts in strengthening adaptive cognitive regulation.

An important aspect emerging from the reviewed literature concerns the influence of bilingual proficiency and age of acquisition on cognitive outcomes. Several studies indicated that cognitive advantages were more consistently observed among balanced bilinguals or individuals with high proficiency in both languages. These findings support the Threshold Hypothesis proposed by Jim Cummins (1976), which suggests that specific levels



of linguistic competence are necessary before bilingualism generates measurable cognitive benefits.

From an educational perspective, the reviewed evidence highlights the potential value of bilingual education programs in promoting cognitive development. Early and sustained exposure to multiple languages may strengthen executive functioning and attentional regulation, thereby supporting academic performance and problem-solving abilities. These findings are particularly relevant in multilingual educational contexts, where bilingualism should be considered a cognitive resource rather than an obstacle to learning.

Despite the generally favorable evidence identified in the review, several methodological limitations should be acknowledged. Considerable heterogeneity was observed across studies regarding participant characteristics, definitions of bilingualism, assessment instruments, and research designs. Some investigations relied on relatively small samples, while others differed substantially in operationalizing variables such as proficiency, language dominance, and frequency of language use. Additionally, the predominance of cross-sectional designs limits the possibility of establishing causal relationships between bilingualism and cognitive development.

The review also identified important directions for future research. Longitudinal studies employing standardized cognitive assessment tools and clearer classifications of bilingual experience are needed to improve the consistency and comparability of findings. Future investigations should further examine sociocultural variables, educational environments, and patterns of language use that may influence cognitive outcomes. Greater integration of neuroimaging methodologies may also contribute to a deeper understanding of the neural mechanisms underlying bilingual cognitive processing and cognitive reserve.

Overall, the evidence synthesized in this review supports the interpretation of bilingualism as a cognitively enriching experience associated with enhanced executive processing and mental adaptability across the lifespan.

## 6. CONCLUSIONS

The present systematic review analyzed empirical evidence concerning the relationship between bilingualism and cognitive development, synthesizing findings from 14 peer-reviewed studies published between 2010 and 2025. The reviewed literature consistently suggests that bilingualism is associated with positive effects on several cognitive



domains, particularly executive functioning, inhibitory control, working memory, and cognitive flexibility.

One of the principal conclusions of the review is that bilingual experience appears to strengthen attentional regulation, mental regulation, executive processing processes due to the continuous management of two linguistic systems. Bilingual individuals generally demonstrated superior performance in tasks requiring attentional regulation, conflict monitoring, and cognitive inhibition when compared with monolingual participants. These findings support theoretical perspectives such as the Bilingual Cognitive Advantage and the executive processing Theory, which propose that bilingual language use functions as sustained cognitive training.

The evidence also indicates that cognitive advantages are influenced by important moderating variables, including age of acquisition, language proficiency, frequency of language use, and sociocultural context. Studies reviewed in this investigation showed that balanced bilinguals and individuals with high proficiency in both languages tended to exhibit stronger cognitive outcomes. Therefore, bilingualism should not be understood as a uniform phenomenon, but rather as a multidimensional experience shaped by linguistic and environmental conditions.

Another relevant conclusion concerns the educational implications of bilingualism. The findings suggest that bilingual education programs and early exposure to multiple languages may contribute positively to cognitive development, particularly in areas related to problem-solving, attentional control, and mental adaptability. Consequently, bilingualism should be considered a valuable cognitive and educational resource within increasingly multilingual societies.

The review additionally highlights the potential long-term cognitive benefits associated with bilingual experience. Several studies suggested that bilingualism may contribute to cognitive reserve and help delay age-related cognitive decline by strengthening executive processing mechanisms throughout life. These findings reinforce the importance of bilingualism not only in childhood education but also in lifelong cognitive health research.

Despite the generally favorable evidence identified, the review also revealed methodological limitations within the existing literature. Variability in definitions of bilingualism, assessment instruments, participant characteristics, and research designs



complicates direct comparison among studies. Furthermore, the predominance of cross-sectional investigations limits the establishment of causal relationships between bilingualism and cognitive development.

Finally, the review underscores the need for future research employing longitudinal designs, standardized cognitive assessment tools, and clearer classifications of bilingual experience. Further investigation integrating neuroimaging techniques and sociocultural variables may contribute to a more comprehensive understanding of the mechanisms through which bilingualism influences cognitive functioning across the lifespan.

### REFERENCIAS BIBLIOGRÁFICAS

- Abutalebi, J., & Green, D. W. (2016). Neuroimaging of language control in bilinguals: Neural adaptation and reserve. *Bilingualism: Language and Cognition*, 19(4), 689–698. <https://doi.org/10.1017/S1366728916000225>
- Aromataris, E., & Pearson, A. (2014). The systematic review: An overview. *American Journal of Nursing*, 114(3), 53–58. <https://doi.org/10.1097/01.NAJ.0000444496.24228.2c>
- Barac, R., Bialystok, E., Castro, D. C., & Sánchez, M. (2014). The cognitive development of young dual language learners: A critical review. *Early Childhood Research Quarterly*, 29(4), 699–714. <https://doi.org/10.1016/j.ecresq.2014.02.003>
- Bialystok, E., & Craik, F. I. M. (2012). Bilingualism: Consequences for mind and brain. *Trends in Cognitive Sciences*, 16(4), 240–250. <https://doi.org/10.1016/j.tics.2012.03.001>
- Bialystok, E., Craik, F. I. M., Green, D. W., & Gollan, T. H. (2009). Bilingual minds. *Psychological Science in the Public Interest*, 10(3), 89–129. <https://doi.org/10.1177/1529100610387084>
- Chen, J., Li, Z., Xiong, Z., & Liu, G. (2025). Working memory as the focus of the bilingual effect in executive functions. *Behavioral Sciences*, 15(2), Article 134. <https://doi.org/10.3390/bs15020134>
- Cummins, J. (1976). The influence of bilingualism on cognitive growth: A synthesis of research findings and explanatory hypotheses. *Working Papers on Bilingualism*, 9, 1–43. <https://files.eric.ed.gov/fulltext/ED125311.pdf>



- Cummins, J. (2000). *Language, power and pedagogy: Bilingual children in the crossfire*. Multilingual Matters. <https://doi.org/10.21832/9781853596773>
- García, O. (2009). *Bilingual education in the 21st century: A global perspective*. Wiley-Blackwell. [https://openlibrary.org/works/OL11929775W/Bilingual\\_education\\_in\\_the\\_21st\\_century](https://openlibrary.org/works/OL11929775W/Bilingual_education_in_the_21st_century)
- Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism: Language and Cognition*, 1(2), 67–81. <https://doi.org/10.1017/S1366728998000133>
- Green, D. W., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of Cognitive Psychology*, 25(5), 515–530. <https://doi.org/10.1080/20445911.2013.796377>
- Grosjean, F. (2010). *Bilingual: Life and reality*. Harvard University Press. <https://openlibrary.org/isbn/9780674048874>
- Grote, K. S., Scott, R. M., & Gilger, J. W. (2021). Bilingual advantages in executive functioning: Evidence from a low-income sample. *International Journal of Bilingualism*, 25(6), 1524–1540. <https://doi.org/10.1177/01427237211024220>
- Gunnerud, H. L., Ten Braak, D., Reikerås, E. K. L., Donolato, E., & Melby-Lervåg, M. (2020). Is bilingualism related to a cognitive advantage in children? A systematic review and meta-analysis. *Psychological Bulletin*, 146(12), 1059–1083. <https://doi.org/10.1037/bul0000301>
- Hakuta, K., & Suben, J. (1985). Bilingualism and cognitive development. *Annual Review of Applied Linguistics*, 6, 35–45. <https://doi.org/10.1017/S0267190500003044>
- Kuhl, P. K. (2011). Early language learning and literacy: Neuroscience implications for education. *Mind, Brain, and Education*, 5(3), 128–142. <https://doi.org/10.1111/j.1751-228X.2011.01121.x>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, Article n71. <https://doi.org/10.1136/bmj.n71>



Ricciardelli, L. A. (1992). Bilingualism and cognitive development in relation to threshold theory. *Journal of Psycholinguistic Research*, 21(4), 301–316.  
<https://doi.org/10.1007/BF01067515>

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339.  
<https://doi.org/10.1016/j.jbusres.2019.07.039>

UNESCO. (2003). *Education in a multilingual world*. UNESCO Publishing.  
<https://unesdoc.unesco.org/ark:/48223/pf0000129728>

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#### CONTRIBUCIÓN DE AUTORÍA:

Nombres de autores e iniciales: Karla Paola Casierra Rosales (KPCR), Lady Gabriela López Londo (LGLL), Darío Javier Amancha Vargas (DJAV), Tatiana Belén Ichina Mazabanda (TBIM), Águeda Paola Sánchez Urgilez (APSU).

1. Conceptualización: (KPCR) (LGLL)
2. Curación de datos: (DJAV) (TBIM)
3. Análisis formal: (KPCR) (DJAV)
4. Adquisición de fondos: (APSU)
5. Investigación: (KPCR) (LGLL) (TBIM)
6. Metodología: (DJAV) (TBIM)
7. Administración del proyecto: (KPCR)
8. Recursos: (LGLL) (APSU)
9. Software: (DJAV)
10. Supervisión: (KPCR) (APSU)
11. Validación: (LGLL) (TBIM)
12. Visualización: (DJAV) (APSU)
13. Redacción – Borrador original: (KPCR) (LGLL) (TBIM)
14. Redacción – Revisión y edición: (DJAV) (APSU)

