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Original Article

Executive Functions in Children with Speech Sound Disorders: A Qualitative Content Analysis of Studies Conducted in Türkiye

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What is already known on this topic?

- *Speech sound disorder (SSD) is associated not only with speech production difficulties but also with broader cognitive processes, particularly executive functions (EF).*
- *International research on EF in children with SSD has predominantly focused on working memory, while other EF components such as inhibitory control and cognitive flexibility have received comparatively limited attention.*
- *In Türkiye, studies examining the relationship between SSD and EF have increased in recent years, largely through postgraduate thesis research, but findings remain dispersed and unsynthesized.*

What this study adds on this topic?

- *This study provides the first systematic synthesis of research conducted in Türkiye on EF in children with SSD using qualitative content analysis.*
- *The findings demonstrate that the national literature conceptualizes EF primarily through working memory, with inhibitory control and cognitive flexibility being markedly underrepresented in both measurement and research focus.*
- *By mapping methodological trends, measurement approaches, and reported findings, this study highlights critical gaps and offers directions for more multidimensional, ecologically informed, and developmentally sensitive future research on EF in SSD.*

ABSTRACT

Objective: Speech sound disorder (SSD) is common developmental communication disorders increasingly viewed as embedded within broader cognitive processes. Executive functions (EF) support speech production, phonological representation, and self-regulation; however, their multidimensional nature is not consistently reflected in SSD research. This study aimed to systematically examine how EF have been conceptualized, operationalized, and reported in studies of children with SSD conducted in Türkiye.

Methods: A qualitative content analysis was conducted on studies published up to 2025 that investigated EF in children with SSD. Postgraduate theses and peer-reviewed journal articles were retrieved from databases and analyzed using predefined categories focusing on methodological characteristics, EF components, measurement approaches, and reported findings. All studies were independently coded by 2 researchers, and discrepancies were resolved through consensus.

Results: Eleven studies met the inclusion criteria, the majority of which were master's theses. The analysis revealed a strong tendency to conceptualize EF primarily through working memory, while inhibitory control and cognitive flexibility were markedly underrepresented. Measurement approaches relied mainly on standardized, performance-based assessments targeting verbal working memory. Executive function performance in children with SSD varied with age, sex, and clinical severity. Limited intervention-based evidence suggested that EF may be sensitive to the cognitive scope of therapeutic approaches.

Conclusion: The national literature on EF in children with SSD in Türkiye reflects a consistent but narrow focus. Future research should adopt more multidimensional, ecologically informed, and longitudinal designs to strengthen conceptual understanding and clinical relevance.

Keywords: Executive function, qualitative research, speech-language pathology, speech sound disorders

Introduction

Speech sound disorder (SSD) refers to age-inappropriate difficulties in the perception, production, and phonological representation of speech sounds.[1] Speech sound disorder range from mild articulation errors to pervasive phonological difficulties that substantially reduce speech intelligibility. They are among the most common speech and language disorders in childhood, affecting approximately 10%-15% of preschool children and about 5% of school-age children worldwide.[2,3]

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When not adequately addressed, SSD is associated with long-term difficulties in language, literacy, academic achievement, social communication, and self-regulation. These outcomes reflect reciprocal interactions among phonological limitations, reduced speech intelligibility, and broader cognitive processes, such as attention, memory, reasoning, and problem-solving.[1,4] Accordingly, SSD is increasingly conceptualized as developmental conditions embedded in broader cognitive and psychosocial processes, with particular attention to executive functions (EF). Core EF components, working memory, inhibitory control, and cognitive flexibility, support goal-directed behavior and are closely linked to language acquisition, phonological representation, and speech motor planning.[5,6]

From a multidisciplinary health sciences perspective, EF are viewed as an integrative construct linking language, speech, cognitive development, and psychosocial functioning. Empirical studies indicate that EF limitations influence phoneme selection, phonological rule acquisition, and speech intelligibility in children with SSD. Moreover, EF performance varies systematically with age, sex, and clinical severity, underscoring its relevance for early identification and clinical decision-making.[7-10]

Despite this multidimensional conceptualization, the empirical literature does not consistently reflect the full scope of EF in the context of SSD. International studies have largely focused on working memory, whereas higher-order EF components such as inhibitory control and cognitive flexibility have received comparatively limited attention.[7,11] This pattern suggests a conceptual and methodological imbalance in how EF are represented within SSD research, raising questions about whether similar tendencies characterize national research contexts.

A similar pattern is evident in studies conducted in Türkiye. Despite the growing number of postgraduate theses and a limited number of journal articles examining the relationship between SSD and EF, the national literature remains fragmented. To date, no comprehensive synthesis has examined methodological characteristics, EF components, measurement approaches, or reported findings. This lack of integration constrains the monitoring of research trends and the development of evidence-informed clinical implications. In this context, qualitative content analysis provides an appropriate framework for identifying overarching patterns and research orientations within the Turkish SSD–EF literature.

In other health science fields, literature-based analytic approaches have been used to map dominant themes and methodological tendencies in postgraduate research.[12,13] However, no study to date has systematically synthesized national research on SSD and EF in children. Accordingly, this study aimed to systematically examine research conducted in Türkiye up to 2025 on EF in children with SSD using qualitative content analysis. The objective was to identify dominant research orientations and underrepresented areas within the national literature. The study addressed the following research question:

How is the relationship between SSD and EF conceptualized, operationalized, and reported in studies conducted in Türkiye?

Method

Research Design

This study employed directed qualitative content analysis to examine studies conducted in Türkiye up to 2025 that investigated EF in children with SSD.

This approach was selected over systematic or scoping review frameworks because the aim was not merely to map the breadth of existing evidence. Rather, the study sought to analytically interpret conceptual and methodological orientations within the national SSD-EF literature. The search question required an interpretive synthesis of how EF has been conceptualized and operationalized, making directed content analysis methodologically appropriate.[14]

Data Sources and Search Process

To capture the national literature produced in Türkiye, postgraduate theses and journal articles were retrieved from national and international databases, including YÖKTez, TR Index, DergiPark, Google Scholar, Web of Science, and PubMed. All searches were completed in September 2025.

All studies meeting the inclusion criteria were included regardless of publication type, in line with qualitative content analysis approaches that emphasize multi-score data collection.

A total of 197 records were identified through searches conducted in Turkish and English databases. After removing 116 duplicates, 81 records remained. Five records (2 book chapters and 3 conference proceedings) were excluded due to document type, leaving 76 studies for full-text assessment.

During full-text evaluation, 21 studies were excluded due to incompatible sample characteristics and 44 were excluded because they did not specifically examine EF. Ultimately, 11 studies met the inclusion criteria and were included in the final analysis. The complete study selection process is illustrated in Figure 1.

Keywords and Search Strategy

To identify relevant studies, Turkish and English search terms related to SSD and EF were used to capture the national literature. Searches encompassed terminology referring to SSD subtypes and core EF components, including working memory, inhibitory control, and cognitive flexibility. After removing duplicates, all eligible studies were included in the analysis, with theses and their derivative articles treated as a single study to prevent data duplication.[15]

Searches were conducted in Turkish and English, and where applicable, title and abstract fields were screened. No lower year limit was applied; all studies available up to September 2025 were considered. Detailed search strings and applied filters for each database are presented in Supplementary Table 1.

Inclusion and Exclusion Criteria

Studies were included in the analysis if they met the following criteria: being published up to 2025; being conducted in Türkiye; involving children or adolescents diagnosed with SSD; addressing EF components through measurement, assessment, or conceptual discussion; being published in Turkish or English; and having accessible full texts.

Studies conducted outside Türkiye, involving only adult participants, lacking EF data, or without accessible full texts were excluded from the analysis.[14]

Researcher Expertise

The first author has advanced experience in qualitative research and teaches methodology at the graduate level. The second author conducted her graduate thesis on SSD and EF, contributing domain-specific expertise to the analysis. Together, the authors ensured a systematic and methodologically sound analytic process.

Analytic Focus

The content analysis focused on how EF were conceptualized and examined across studies, including the EF components addressed, the measurement approaches employed, and the methodological

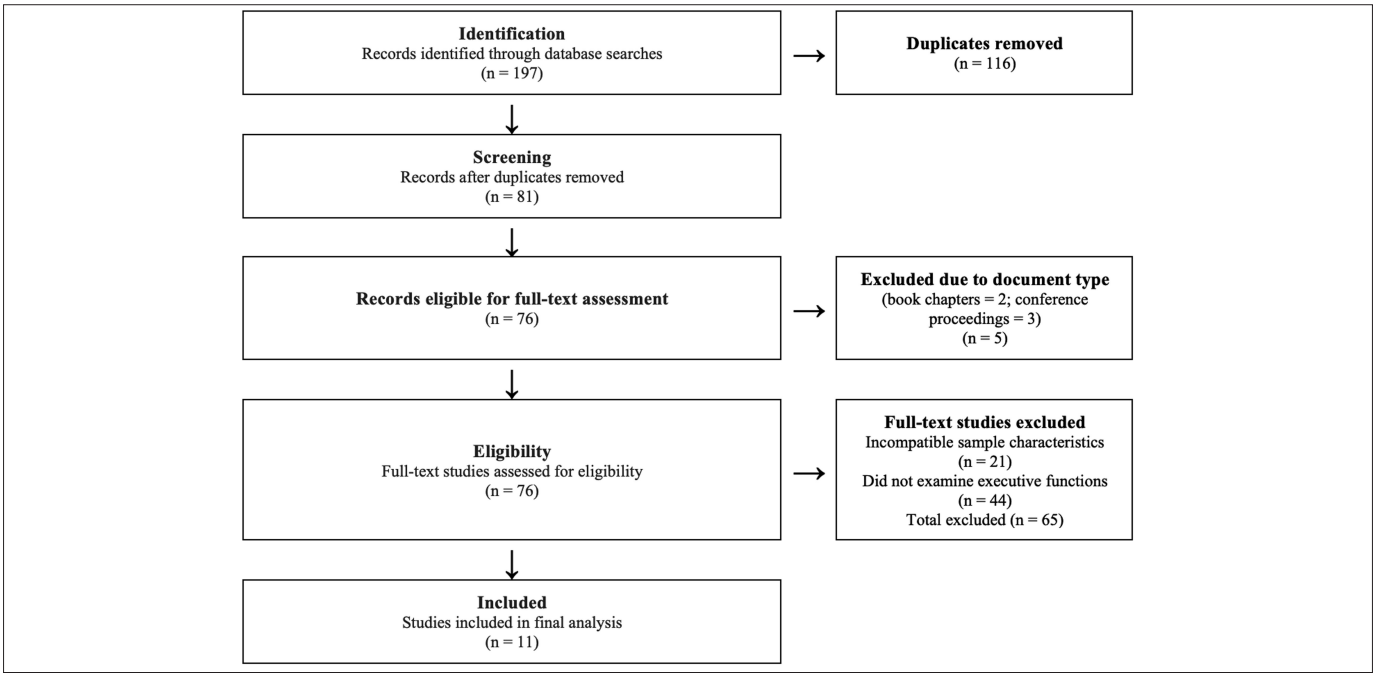


Figure 1. Flow diagram of the study selection process.

designs used to investigate the SSD–EF relationship. This focus allowed the identification of dominant research orientations and underrepresented areas within the national literature.[14]

Data Analysis

Data analysis was conducted using a structured review form based on predefined analytic categories and applied to each included study. Studies were coded according to descriptive characteristics, methodological features, EF components examined, measurement instruments used, and the direction of reported findings.[14]

The analysis proceeded in 2 stages. First, descriptive analyses were used to summarize the overall structure of the national literature. Second, a thematically oriented qualitative content analysis was conducted to identify recurring patterns and dominant research orientations across studies, rather than focusing on findings at the level of individual investigations.[14]

To enhance reliability, all studies were independently coded by 2 researchers. Inter-rater agreement reached 96%, and discrepancies were resolved through consensus. To ensure coding reliability, all studies were independently coded by 2 researchers during the initial coding phase. Intercoder agreement was calculated using percentage agreement, which yielded a 96% concordance across coded units. Discrepancies were subsequently resolved through discussion and consensus. These procedures supported the trustworthiness of the analytic process by strengthening its credibility and dependability.[14,16]

Results

In this study, 11 studies conducted in Türkiye up to 2025 that examined EF in children with SSD were analyzed using qualitative content analysis. The majority of the included studies consisted of graduate theses (n = 10), while only 1 study had been published as a peer-reviewed journal article.

The methodological characteristics of the included studies, the EF components addressed, the measurement instruments employed, and the direction of the reported findings are summarized in an analytic framework in Table 1.

As presented in the Table 1, the national literature demonstrates a clear tendency to conceptualize EF predominantly through the working memory component. In contrast, other components, such as inhibitory control and cognitive flexibility, remain comparatively underrepresented. This tendency is consistently reflected in both measurement preferences and the focus of the reported findings. Together, these patterns point to an imbalance in how different EF components are addressed within the national research context.

Descriptive Characteristics of the Studies

Of the included studies, 9 were master's theses, 1 was a doctoral dissertation, and 1 was a peer-reviewed article derived from a master's thesis. Although the studies were published between 2016 and 2024, most (n = 8) were completed in 2023-2024, indicating a recent increase in academic interest in EF among children with SSD.

Research output was concentrated within a small number of universities, suggesting that knowledge production in this area remains limited to a few academic centers. Most studies were conducted within thesis-based master's programs in Speech and Language Therapy, with only 1 doctoral-level study in Audiology and Speech Disorders. Notably, only 1 study had been published as a peer-reviewed journal article, indicating that the national literature on EF in children with SSD is largely represented at the graduate thesis level rather than in indexed publications.

Methodological Characteristics of the Studies

The content analysis showed that all included studies employed quantitative research methods. Most studies used descriptive designs (n = 10), whereas only 1 study adopted a randomized controlled experimental design.[17] Among the descriptive studies, correlational and comparative designs were the most common approaches.

Sampling procedures were not explicitly reported in the majority of studies (n = 8). In studies that described sampling methods, quota sampling, simple random sampling, and criterion-based sampling

Table 1. Methodological and Findings Patterns of Studies on Executive Functions in Children with Speech Sound Disorders in the Turkish Context

Study ID	Research Design	Sample (N / Group Structure)	EF Components Examined/Measurements	Direction of Findings
Bacı (2016)	Comparative	60 children (30 SSD, 30 TD)	WM-NRT	SSD < TD (WM)
Bacık Tırank (2020)	RCT, repeated measures	68 children (34 SSD, 34 TD)	CF, IC, WM-DCCS	SSD < TD (EF); UYTE → EF ↑
Kurtaran (2021)	Correlational	22 children (SSD)	WM-WMS	WM ↔ rapid naming, phonological awareness
Albayrak (2023)	Correlational	60 children (30 SSD, 30 TD)	WM-WMS	SSD < TD (WM)
Bal (2023)	Comparative	56 children (28 SSD: hearing impaired, 28 SSD: typically hearing)	WM-WMS	Typically hearing SSD > hearing impaired SSD (WM)
Sarıyıldız (2023)	Comparative	20 children (10 PD, 10 Dyslexia)	WM-WMS	PD > dyslexia; PD < TD (WM)
Taşdemir (2023)	Descriptive	30 children (15 SSD, 15 TD)	WM-WMS	WM ↔ early literacy
Yıldız (2023)	Comparative	34 children (17 SSD, 17 TD)	WM-NRT	SSD < TD (WM)
Evereklioğlu (2024)	Correlational	43 children (SSD)	WM-WMS	WM ↔ maternal education, income; WM ↓ → psychosocial problems ↑
Yalduz (2024)	Comparative	45 children (15 SSD, 15 PD, 15 TD)	WM-WMS	SSD < TD (verbal memory)
Gör and Cankuvvet	Cross-sectional	66 children (SSD)	IC, WM–CHEXI-Teacher Form	SSD severity ↑ → WM, IC ↓; girls > boys

CF, cognitive flexibility; CHEXI, Childhood Executive Function Inventory; DCCS, Dimensional Change Card Sorting; EF, executive function; IC, inhibitory control; NRT, Nonword Repetition Task; PD, phonological disorder; RCT, randomized controlled trial; SSD, speech sound disorder; TD, typical development; UYTE, Practical Therapy; WM, working memory; WMS, Working Memory Scale.

were used. Sample sizes ranged from 20 to 68 participants, yielding data from a total of 439 children. Power analysis was reported in only 1 study. Despite this, all studies clearly specified inclusion and exclusion criteria, reflecting consistency in sample definition. Common criteria included Turkish as the first language, bilateral normal hearing (except in the hearing impairment study), typical language development indicated by scores above 85/90 on the Turkish Early Language Development Test, and the absence of additional neurological or neurodevelopmental diagnoses.

Across studies, participants were most frequently grouped as children with SSD and typically developing peers. Comparisons with other clinical groups, such as children with dyslexia or hearing impairment, were limited. Reported SSD severity ranged from mild to severe, with moderate severity being most common.

Executive Function Components

The analysis indicates that, across the reviewed studies, working memory emerged as the primary focus among EF components. Notably, this emphasis was not grounded in a unified conceptual framework; rather, working memory was addressed across multiple terminological levels, including verbal working memory,[18-22] verbal memory,[23-26] and a more general conceptualization of working memory.[10,17]

This terminological variability suggests that working memory has functioned as a broad and flexible construct within the national literature. This broad usage may obscure distinctions between executive control processes and domain-specific memory functions. In contrast, inhibitory control was examined in only 2 studies,[10,17] and cognitive flexibility was addressed in a single study.[17] This imbalance indicates that EF has not been examined as an integrated system of interrelated components, but rather through a selective focus on a single cognitive domain.

Measurement Approaches and Operationalization

The content analysis further revealed a consistent pattern in measurement preferences. In the majority of studies (n = 7), the Working Memory Scale was used as the primary instrument for assessing executive functioning. Verbal working memory was additionally assessed in a limited number of studies using the Nonword Repetition Test.[18,22] Measurement tools targeting EF components beyond working memory were scarce and limited to the Dimensional Change Card Sort task[17] and the Childhood Executive Function Inventory–Teacher Form.[10]

Taken together, these measurement patterns reinforce a working memory–centered operationalization of EF, while constraining the empirical visibility of inhibitory control and cognitive flexibility within the national research landscape.

Working Memory

The content analysis indicates that working memory is the most consistently examined EF component and the most frequently reported area of difficulty in children with SSD within the national literature. Across studies, children with SSD consistently demonstrate lower performance than typically developing peers on measures of verbal working memory, including tasks tapping phonological storage and processing such as nonword repetition and word recall, reflecting a robust and recurring performance gap.[17,18,21,23,26] This pattern persists across clinical comparisons and contextual variables, with working memory performance varying systematically by age, sex, clinical severity, hearing status, and associated language and literacy skills. Importantly, working memory difficulties are not described as isolated cognitive limitations but as part of a broader developmental profile that encompasses linguistic, emotional, and psychosocial characteristics.[10,21,23-25]

Inhibitory Control

Inhibitory control was examined in a limited number of studies but demonstrated a consistent pattern of vulnerability in children with SSD. Across studies, children with SSD showed lower inhibitory control performance than typically developing peers, suggesting that inhibitory control difficulties are associated with SSD rather than representing a peripheral cognitive feature.[17] Inhibitory control further differentiated levels of clinical severity, with greater difficulties reported in children with severe SSD, indicating its potential relevance to more complex clinical profiles.[10] Developmental patterns revealed higher inhibitory control performance in older children and in girls, highlighting sensitivity to maturation-related factors. Limited intervention evidence suggests that inhibitory control is responsive to cognitively broader therapy approaches, supporting its characterization as a modifiable EF component in the context of SSD.

Cognitive Flexibility

Cognitive flexibility was examined in only 1 study, indicating its very limited representation in the national literature. Available findings suggest that children with SSD demonstrate lower cognitive flexibility performance than typically developing peers and that this component is associated with higher-order linguistic abilities and overall

EF scores.[17] Although evidence is limited, cognitive flexibility appears to be sensitive to intervention type, with improvements reported following a cognitively broader therapy approach. These findings point to cognitive flexibility as a potentially relevant, yet underexamined, EF component in the context of SSD.

Effects of Intervention Programs on Executive Functions

Limited intervention-based evidence suggests that EF are sensitive to the cognitive scope of therapy in children with SSD. Only 1 experimental study examined intervention effects on EF, reporting gains in working memory, inhibitory control, and cognitive flexibility following a cognitively broader intervention, while a phonology-focused approach yielded no comparable change.[17] Although based on limited data, this finding indicates that EF may respond selectively to interventions that extend beyond speech production targets.

Discussion

When considered collectively, the findings indicate that EF in children with SSD in Türkiye have been predominantly conceptualized through working memory, rather than examined as a multidimensional regulatory system.

Across the reviewed studies, children with SSD were consistently reported to exhibit lower EF performance than their typically developing peers or normative data. This finding aligns with contemporary perspectives emphasizing that SSD should not be understood solely as a speech production difficulty, but as a developmental condition associated with broader cognitive regulation processes.[1,5,27] However, the national literature largely describes these difficulties at the level of performance differences, with limited discussion of the underlying regulatory mechanisms contributing to such outcomes.

The strong emphasis on verbal and verbal working memory observed in the reviewed studies aligns with theoretical accounts highlighting the central role of working memory in phonological representation and speech production planning.[5,6] It also parallels international research that similarly prioritizes verbal working memory in studies examining EF in children with SSD.[7] In contrast, inhibitory control and cognitive flexibility were examined in a markedly limited number of studies, despite their established roles in speech motor planning, error monitoring, fluency, and adaptation to feedback.[5,27] Although evidence links inhibitory control difficulties to speech flow and phonological error patterns,[11,28] such relationships remain largely unexplored in the national literature, indicating a conceptually narrow representation of EF in the context of SSD.

From the perspective of the Unity and Diversity Model, EF constitute a multidimensional system composed of interrelated yet functionally distinct components, including working memory, inhibitory control, and cognitive flexibility.[5,29] The predominant emphasis on working memory within the national literature suggests that the diversity dimension of EF is largely overlooked. This narrow focus limits insight into how different EF components interact with one another and with linguistic outcomes in children with SSD. The analysis further indicates that EF performance is shaped in conjunction with age, sex, clinical severity, and environmental factors. Such patterns are consistent with developmental models proposing that EF are dynamically organized and sensitive to both maturational processes and contextual influences.[5] In line with international findings, EF appear to be embedded within reciprocal relationships involving language development, self-regulation, and psychosocial adjustment, particularly during early childhood.[1,30]

Methodologically, the reviewed studies were overwhelmingly quantitative and relied on standardized, performance-based assessments. Measurement tools were concentrated around a limited number of tests primarily targeting verbal working memory. This methodological orientation suggests that EF in the context of SSD is largely conceptualized through cognitive outputs measured under structured testing conditions. As a result, difficulties that emerge in everyday communication and self-regulation contexts remain less visible.

International literature emphasizes the importance of complementing standardized assessments with ecologically oriented measures, such as teacher and parent reports, to capture executive functioning in naturalistic contexts.[31,32] Studies conducted in Türkiye similarly highlight that reliance on test-based performance alone may insufficiently reflect children‘s real-life regulatory challenges, underscoring the clinical value of ecological assessments in supporting decision-making processes.[9] The predominance of standard-test–based approaches identified in this content analysis therefore represents a structural limitation that constrains the functional interpretation of EF in SSD.

Intervention-related findings, although limited in number, suggest that EF are sensitive to the type of therapeutic approach employed. In particular, intervention programs with broader cognitive scope have been associated with gains in working memory, inhibitory control, and cognitive flexibility. In contrast, approaches focused primarily on phonological outcomes have shown more restricted effects on executive functioning.[17] These findings align with international evidence indicating that interventions directly or indirectly supporting EF can strengthen speech and language outcomes.[33]

Despite these insights, the national literature remains characterized by a predominance of cross-sectional and comparative designs, limiting examination of developmental trajectories, responsiveness to intervention, and functional outcomes of EF over time.[32,34] The scarcity of intervention-based and longitudinal studies further restricts the transferability of findings to clinical practice. Consequently, evidence guiding how EF should be systematically integrated into assessment and intervention processes for SSD remains limited in the Turkish context.

Conclusion

This qualitative content analysis examined how EF have been conceptualized and investigated in studies of children with SSD conducted in Türkiye. The findings indicate that the national literature is characterized by a consistent but narrow focus, with EF predominantly operationalized through working memory, while inhibitory control and cognitive flexibility remain underrepresented.

EF performance in children with SSD varies systematically with developmental and clinical variables such as age, sex, and disorder severity, supporting models that conceptualize EF as context-sensitive regulatory processes. However, the predominance of cross-sectional designs and standardized performance-based assessments limits insight into functional and developmental change.

Although intervention-based evidence remains limited, available findings suggest that EF are sensitive to the cognitive scope of therapeutic approaches, underscoring their clinical relevance. Overall, this study highlights the need for future research in Türkiye to adopt more multidimensional, ecologically informed, and longitudinal approaches to advance understanding of the cognitive dimensions of SSD.

Limitations and Future Research Directions

The findings of this study should be interpreted within the scope of the qualitative content analysis employed. First, the analysis was limited to studies conducted in Türkiye up to 2025 that met predefined inclusion criteria; thus, the identified patterns reflect reported and accessible

studies rather than the entire national research output. Second, the analysis relied exclusively on information explicitly presented in the texts, meaning that EF-related aspects not clearly articulated by the authors could not be systematically captured. Third, the study focused on identifying conceptual and methodological patterns rather than synthesizing effect sizes or causal relationships, in line with the aims of qualitative content analysis.

Despite these limitations, the findings point to clear directions for future research. Greater emphasis should be placed on examining EF as a multidimensional system by incorporating inhibitory control and cognitive flexibility alongside working memory. The integration of ecologically oriented assessments with standardized measures may enhance understanding of EF in everyday communication contexts. Finally, longitudinal and intervention-based designs are needed to clarify developmental trajectories and clinical relevance.

Overall, this content analysis delineates current research tendencies while highlighting key priorities for conceptual and methodological advancement in studies of EF and SSD.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

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Informed Consent: Informed consent was not required because the study did not involve human participants.

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Supplementary Table 1. Database-Specific Search Strings and Applied Filters

YÖK National Thesis Center (YÖKTez)	Turkish	Title and Abstract	("konuşma sesi bozukluğu" OR "artikülasyon bozukluğu" OR "fonolojik bozukluk" OR "çocukluk çağı konuşma apraksisi") AND ("yürütücü işlev" OR "çalışma belleği" OR "ketleyici kontrol" OR "bilişsel esneklik")	Publication type: Master's and Doctoral Theses. No lower year limit applied. Up to September 2025. Full-text accessible
TR Index / DergiPark	Turkish	Title and Abstract	("konuşma sesi bozukluğu" OR "artikülasyon bozukluğu" OR "fonolojik bozukluk") AND ("yürütücü işlev" OR "çalışma belleği" OR "ketleyici kontrol" OR "bilişsel esneklik")	Publication type: Journal Articles. No lower year limit applied. Up to September 2025
Web of Science / PubMed	English	Title and Abstract	("speech sound disorder" OR "articulation disorder" OR "phonological disorder" OR "childhood apraxia of speech") AND ("executive function" OR "working memory" OR "inhibitory control" OR "cognitive flexibility") AND (Turkey OR Türkiye)	No lower year limit applied. Up to September 2025. Human subjects
Google Scholar	Turkish & English	Title	konuşma sesi bozukluğu yürütücü işlev speech sound disorder executive function Turkey	No lower year limit applied. Up to September 2025

Note. Deduplication Process: Duplicate records were removed manually. Theses and derivative articles based on the same dataset were treated as a single study to prevent data duplication.