Pegem Journal of Education and Instruction, Vol. 16, No. 1, 2026 (pp. 2462-2483)

RESEARCH ARTICLE WWW.PEGEGOG.NET

Characterizing the Profiles of Executive Dysfunction in Children with Autism Spectrum Disorder

Zoubida BENESSEDDIK [1], Abdelaziz BENABDELMALEK [2]

[1] PhD Candidate in Autism and Behavioral Disorders Psychological and Educational Applications Laboratory
[1]University of Abdelhamid Mehri - Constantine 2, Algeria
Email: zoubida.benssedik@univ-constantine2.dz

[2] Professor of Education Sciences
[2] University of Abdelhamid Mehri - Constantine 2, Algeria
Email: abdelaziz.benabdelmelek@univ-constantine2.de

Received: 16/08/2025 ; Accepted: 07/03/2026 ; Published: 17/04/2026

Abstract:

This research sought to identify disorders of executive function in children diagnosed with Autism Spectrum Disorder (ASD). The sample comprised 20 children aged between 6 and 7 years, all of whom were free from other disabilities. To achieve this, the Childhood Autism Rating Scale (CARS) was employed, supplemented by a semi-structured interview and an observation checklist to evaluate executive functions, all within a case study framework. The findings revealed significant deficits in several fundamental executive functions, including planning, cognitive flexibility, working memory, response inhibition, and initiation. It was determined that these deficits are closely linked to challenges in communication and social interaction, as well as the presence of repetitive and stereotyped behaviors, which are hallmark characteristics of ASD. In light of these results, the study advocates for further investigations that concentrate on the evaluation of executive functions in children with ASD, highlighting the necessity of incorporating this assessment into early diagnostic practices. Furthermore, it recommends the development of training programs and therapeutic interventions designed to enhance these functions, given their critical role in mitigating the severity of ASD symptoms.

Keywords: Autism Spectrum Disorder, Executive Function Disorder.

Introduction:

Modern societies have observed a significant advancement in the degree of focus directed towards the individual throughout different

phases of their growth and development.resulting in heightened awareness about the necessity of supporting all members of society across all categories, encompassing those with special needs. Focusing on this category has emerged as a humanitarian, social, and scientific imperative, necessitating the collaboration of all societal institutions to deliver suitable care and support. This is essential to empower individuals to enhance their capabilities, refine their skills, and elevate their quality of life, ultimately facilitating their full integration into society in accordance with their abilities and potential.

Autism spectrum disorder (ASD(is considered one of the most important neurodevelopmental disorders that has recently received increased focus , due to the difficulties faced by children with ASD in various developmental areas, such as behavioral, cognitive, and linguistic domains. These difficulties manifest as deficits in communication and social interaction, along with repetitive stereotyped behaviors and restricted interests.

Psychiatrist Leo Kanner is recognized as the pioneer in the description of ASD, having published his seminal article titled "Autistic Disturbances of Affective Contact" in 1943 (Kanner, 1943). In this work, he detailed the cases of 11 children, comprising three girls and eight boys, whose ages ranged from two and a half to eight years. These children exhibited traits of "extreme self-isolation" and a pronounced "insistence on sameness in routine," and were diagnosed with intellectual disabilities.

Kanner's research on these children continued for four years, during which he observed that their behaviors were characterized by specific traits that did not align with the distinctive features of childhood schizophrenia, nor did they resemble the symptoms of intellectual disability. Instead, these symptoms formed a pattern unique to these children, and he subsequently named this disorder Early Infantile Autism. He characterized it as a developmental disorder manifesting within the initial three years of life, marked by profound emotional detachment, a deficiency in forming typical social connections, challenges in both verbal and non-verbal communication, as well as repetitive behavioral patterns and restricted interests (Kanner, 1943).

The initial recognition of ASD in the Diagnostic and Statistical Manual of Mental Disorders, published by the American Psychiatric Association, occurred in 1980 with the release of the third edition of the DSM (DSM-III), where it was identified as a behavioral disorder. This classification persisted in the revised third edition (1987) until the introduction of the fourth edition (1994), which reclassified it under the category of pervasive developmental disorders. These disorders are defined as a collection of

conditions marked by deficits in reciprocal social interaction, communication and language abilities, as well as the presence of restricted and stereotyped behaviors, interests, and activities. Typically manifesting in early childhood, these disorders are often linked to varying levels of intellectual disability. They encompass five distinct categories: autism, Asperger's syndrome, Rett's syndrome, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS).

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) introduced numerous modifications to the diagnostic criteria for various disorders, including ASD, which is now recognized under a singular diagnosis termed Autism Spectrum Disorder (ASD). This change replaces the earlier classifications that encompassed autism, such as Autism, Asperger's Disorder, Childhood Disintegrative Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified. Rett Syndrome was omitted from this classification as it is a genetic condition with the causative gene MECP2 having been identified. Furthermore, the previous three domains used for diagnosing ASD have been condensed into two primary domains: the first domain focuses on deficits in communication and social interaction, while the second domain addresses restricted and repetitive patterns of behavior and interests (DSM-5, 2013).

Numerous researchers have suggested that the behavioral challenges faced by autistic children, including stereotyped and repetitive behaviors, stem from a child's inflexibility, inclination towards rigidity and persistence, insistence on routines, diminished capacity to engage in new non-routine activities, as well as their strong focus on and attachment to specific objects... along with other abilities typically associated with executive functions.

Problem Statement

Recent global statistics reveal a notable rise in the incidence of Autism Spectrum Disorder (ASD), with the World Health Organization estimating that one in every 160 children is impacted by this condition. It is important to note that this statistic serves as a global average and may differ based on research methodologies and regional contexts (World Health Organization, 2023). This rise is attributed to several factors, particularly advancements in diagnostic methods, increased societal awareness, and enhanced research efforts regarding this disorder.

The U.S. Centers for Disease Control and Prevention (CDC) indicated that the prevalence of ASD reached one in every 44 children in 2021, marking a considerable increase in comparison to earlier years (CDC, 2021).

Additional estimates suggest that the global number of individuals affected reached approximately 52 million in 2010,

underscoring the growing health and social challenges posed by this disorder (Talantseva & et al., 2023).

The Centers for Disease Control and Prevention (CDC) in the United States announced that the prevalence of ASD was one in every 44 children in 2021, indicating a notable rise in comparison to earlier years (CDC, 2021).

Additional estimates suggest that the total number of individuals impacted globally reached approximately 52 million in 2010, underscoring the increasing health and social challenges posed by this disorder (Talantseva & et al, 2023).

ASD is recognized as one of the intricate neurodevelopmental disorders, typically manifesting within the initial three years of a child's life, after a phase of typical development. This condition influences various developmental domains, particularly in social communication, repetitive behaviors, and cognitive flexibility (WHO, 2021). Given the diverse symptoms and their overlap with other disorders, researchers have increased their efforts to comprehend its underlying causes and characteristics, as well as to create precise diagnostic instruments and effective intervention strategies.

Numerous theories have been suggested to elucidate ASD, including the organic theory, which emphasizes genetic and biological elements such as injuries occurring before or during birth, and the environmental theory, which posits that children may encounter significant environmental stimuli at an early age that impact their neural development (Rizo & Zabel, 2010).

One of the most significant contemporary methods for elucidating this disorder is the neuropsychological approach, which associates ASD with impairments in executive functions. This perspective posits that certain social and non-social behaviors exhibited by affected individuals may indicate dysfunction within the frontal lobe, which is crucial for cognitive and emotional regulation (Jurado & Rosselli, 2007).

Executive functions are characterized as a collection of higher-order mental processes that allow an individual to manage and organize their behavior in a dynamic environment. These functions encompass planning, working memory, cognitive flexibility, response initiation, the inhibition of inappropriate responses, and self-monitoring (Roberts et al., 1998; Stuss & Knight, 2002).

Research has demonstrated that impairments in these functions are closely linked to the symptoms of ASD, thereby rendering them a primary focus in educational and psychological interventions.

Executive functions are higher-order cognitive processes that enable individuals to plan, organize, inhibit, exercise cognitive flexibility, self-monitor, and use working memory. They are essential for adapting to environmental changes and regulating behavior.

Psychological literature has shown that deficits in these functions are among the core features associated with ASD, negatively affecting the social, cognitive, and behavioral performance of affected children.

In this context, Hill (2004) noted that children diagnosed with ASD face challenges in redirecting their attention and moving between tasks, which indicates deficiencies in mental flexibility and working memory. Gil (2010) similarly highlighted that the struggle to grasp abstract concepts and figurative meanings in these children is associated with shortcomings in cognitive flexibility, thereby restricting their capacity to comprehend intricate social situations.

Conversely, Boyd et al. (2009) suggested that impairments in inhibition, cognitive flexibility, and emotional regulation are correlated with repetitive stereotyped behaviors, which are fundamental characteristics of ASD. A subsequent study by Miller et al. (2015) corroborated these results, highlighting that diminished cognitive flexibility plays a role in the persistence of stereotyped behaviors.

In their research, Leung et al. (2016) discovered that deficits in executive functions, especially inhibition and cognitive flexibility, are associated with compromised social skills and emotional regulation among children and adolescents diagnosed with autism.

Furthermore, Freeman et al. (2017) identified deficiencies in initiative, working memory, and self-monitoring, which adversely impact social interactions.

In a recent comparative study, Carotenuto et al. (2019) discovered that children diagnosed with autism exhibited lower scores on tests measuring executive function and cognitive flexibility when compared to their typically developing peers, indicating a distinct deficiency in these areas. In a similar vein, Pasqualotto et al. (2021) validated the efficacy of cognitive training programs, especially those that are computerized, in enhancing executive functions and alleviating symptoms associated with autism.

In the context of the Arab world, Al-Hassni (2022) conducted a study in Algeria that revealed a statistically significant correlation between the performance of executive functions (including response inhibition, working memory, and cognitive flexibility) and both verbal and non-verbal communication abilities in children with ASD, underscoring the critical nature of early cognitive interventions. Furthermore, Qarbou (2023) corroborated that these children experience pronounced executive function impairments, as evidenced by results from specialized neuropsychological assessments. Lastly, Al-Samman (2024) pointed out that executive functions serve a moderating role in the interplay between autism symptoms and skills necessary for independent living, highlighting the necessity for intervention

programs that specifically address these functions.

In consideration of the aforementioned points, it is evident that Autism Spectrum Disorder (ASD) is regarded as one of the most intricate developmental disorders due to the diversity of its manifestations and their intersection with other disorders, which renders its diagnosis and interpretation an ongoing challenge for both researchers and practitioners. Recent studies have indicated that impairments in executive functions represent one of the fundamental cognitive factors associated with this disorder, as they correlate with a variety of behavioral and social symptoms that influence a child's capacity to adapt and engage with others. This has led to an increased necessity to explore these functions in greater depth among children with autism, to examine how they relate to the manifestations of the disorder, and to pose the following inquiry: To what degree do children with ASD demonstrate deficits in executive functions (such as planning, working memory, mental flexibility, initiation, and response inhibition), and what are the consequences of these deficits on social communication and stereotypical behaviors?

Study Hypothesis

Children diagnosed with ASD demonstrate considerable deficiencies in executive functions, which include planning, working memory, cognitive flexibility, initiative, and response inhibition. These deficiencies adversely impact their social communication abilities and contribute to stereotypical behaviors.

Study Objectives

The objectives of this study are to:

- Identify impairments in executive functions among children with ASD.
- Emphasize the significance of evaluating executive functions as an integral component of early diagnostic assessments for ASD.
- Suggest educational and therapeutic strategies aimed at enhancing executive functions to mitigate the severity of the symptoms associated with the disorder.

Significance of the Research

The significance of this research arises from multiple factors: It emphasizes a specific cognitive dimension linked to ASD, namely the impairment in executive functions, a domain that often lacks adequate focus during the diagnostic evaluation. Furthermore, it offers a scientific basis for comprehending the connection between executive functions and the behavioral and social manifestations observed in children with ASD, thereby aiding in the creation of more precise assessment instruments.

Operational Definitions

Autism Spectrum Disorder: In this study, ASD is operationally defined as a

neurodevelopmental disorder diagnosed in children based on the criteria specified in the DSM-5. Diagnosis is determined by the total score on the CARS scale, which reflects the presence of typical symptoms associated with the disorder, as well as behavioral manifestations such as deficits in social communication (both verbal and non-verbal), impairments in social interaction, and repetitive stereotyped behaviors. Furthermore, qualitative data gathered from semi-structured interviews and field observations are also taken into account.

Executive Functions: In this study, Executive Functions are operationally defined as a collection of higher cognitive processes evaluated through a series of behavioral field observations, which include:

Planning: The capacity of the child to sequence the steps involved in an activity and to organize tasks effectively.

Working Memory: The ability of the child to retain information and utilize it while executing the task at hand.

Cognitive Flexibility: The child's capability to transition between activities and adjust to changes in the environment.

Initiation: The child's proficiency in commencing an activity or interaction without the need for direct guidance.

Response Inhibition: The child's ability to control impulsive or inappropriate behaviors.

The theoretical framework of the study

Defining concepts

Autism Spectrum Disorder: According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR, 2022), ASD is classified as a neurodevelopmental condition characterized by persistent deficits in social communication and social interaction, along with restricted and repetitive patterns of behavior, interests, or activities, which appear in early childhood and significantly impact daily functional performance.

Symptoms of Autism Spectrum Disorder:

- Impairment in Social Communication and Interaction.

- A fundamental symptom of ASD is the difficulty in developing social skills and engaging in social interactions. This difficulty manifests in various ways:

Impairment in Reciprocal Emotional Interaction: Individuals with autism may struggle to exchange emotions and feelings, often failing to respond to the emotions shared by others. They might not participate in conversations or interact with those around them in a typical manner, which can make them seem uninterested or disconnected from their social surroundings.

- Difficulties in Nonverbal Communication: Those with autism may find it challenging to utilize or interpret nonverbal signals, such as eye contact or facial expressions. They may have trouble understanding body language and may not naturally use or comprehend gestures.

Difficulty in Forming and Maintaining Social Relationships: Individuals with autism may encounter challenges in making friends or engaging with peers. This difficulty is reflected in their lack of interest in participating in shared social activities or imaginative play, and they may exhibit minimal interest in establishing or sustaining friendships. (APA, 2013)

Repetitive and Specific Behavior Patterns:

These symptoms encompass repetitive or specific behaviors that manifest consistently in individuals diagnosed with ASD:

- Stereotyped and repetitive movements: Children diagnosed with autism often engage in repetitive actions such as hand flapping, spinning, or the repetitive arrangement of toys. These actions are frequently unrelated to the context and are recognized as part of the autism symptomatology.

Strict adherence to routines: Individuals on the autism spectrum typically exhibit a strong insistence on maintaining routines. They may experience significant distress when even minor alterations occur in their surroundings or daily routines, such as changes in the sequence of activities or the paths they follow.

Specific and intense interests: Individuals with autism frequently demonstrate intense, focused interests in particular subjects that may appear unusual or unconventional. For instance, a person with autism might exhibit an atypical fascination with specific items such as trains, numbers, or maps.

- Atypical sensory reactions: People with autism display atypical sensory reactions, which can manifest as either heightened sensitivity or diminished responsiveness to specific stimuli. They might overlook sensations of pain or cold, or conversely, exhibit heightened sensitivity to particular sounds or textured surfaces. (Lord 2012, 53)

Definition of Executive Functions:

Establishing a clear definition of executive functions presents a challenging endeavor that continues to garner significant attention in neuropsychological research, owing to the variety of their components and their intersection with numerous cognitive and behavioral processes. In their efforts to articulate this concept, researchers have drawn upon anatomical investigations that examined lesions impacting the frontal lobe across its various subdivisions, which revealed behavioral and cognitive symptoms linked to what is termed "executive dysfunction syndrome."

Diamond (2013) characterizes executive functions as a collection of higher-order processes employed when engaging in non-routine tasks, particularly when automatic responses fall short. Research conducted by Lehto et al. (2003) and Miyake et al. (2000) bolsters the theory of multiplicity within executive functions, identifying three primary components: working memory, inhibition, and mental flexibility, which are regarded as the foundational elements upon which the

advancement of more intricate functions, such as planning, is established.

Executive functions are crucial in social interactions, as they aid in assessing situations and managing emotions during communication. Furthermore, they are vital for learning and academic success. (Gioia et al., 2002)

Components of Executive Functions:

Planning:

Planning is recognized as one of the advanced executive functions that allows an individual to set objectives, identify the necessary actions to achieve those objectives, and arrange thoughts and actions in a coherent and sequential order. This process necessitates the capacity to foresee potential outcomes, assess various options, and adjust behavior in accordance with the demands of the task. It is regarded as a sophisticated cognitive function that depends on the coordination of other abilities, including inhibition, mental flexibility, and working memory, which enable an individual to formulate hypotheses, devise strategies, and oversee performance throughout the execution of tasks (Diamond, 2013). Children diagnosed with ASD exhibit a significant impairment in their planning abilities, and numerous studies have investigated this area through neuropsychological assessments and behavioral evaluations. One such study utilized the Tower of London test to evaluate the planning capabilities of children with ASD, revealing that these children encounter challenges in structuring the necessary steps to resolve problems when compared to their typically developing peers.

Working Memory:

Working Memory represents a fundamental executive function that allows an individual to temporarily retain and manipulate a limited quantity of information while engaging in cognitive or behavioral tasks. This capability is utilized in various everyday scenarios, such as participating in conversations, following instructions, conducting mental arithmetic, or addressing problems. According to the framework established by Baddeley and Hitch (1994), working memory is comprised of three primary components: the phonological loop, which processes verbal information; the visuospatial sketchpad, which handles visual and spatial data; and the central executive, which orchestrates these systems and activates other executive functions as necessary. Working memory plays a crucial role in enhancing attention, structuring responses, and filtering out irrelevant information, thereby establishing a functional interconnection with inhibition and cognitive flexibility, and it is essential for academic success and cognitive adaptability.

Neuropsychological literature suggests that children diagnosed with ASD experience a notable impairment in working memory when compared to their typically developing peers,

which adversely impacts their capacity to execute tasks that necessitate the simultaneous retention and processing of information (Pennington & Ozonoff, 1996).

Working memory is regarded as a crucial element of executive functions, embodying a cognitive framework that is responsible for the temporary retention of information while engaging in cognitive activities such as comprehension, reasoning, and problem-solving (Baddeley, 1992).

Research conducted by Bonetto et al. (1996) revealed that children with ASD encounter challenges in tasks that demand substantial cognitive flexibility, highlighting deficiencies in both the verbal and visual aspects of working memory. These observations are corroborated by a study by Goldberg et al. (2005), which demonstrated that these children exhibit poor performance in tasks that require the updating or reorganization of information during cognitive processing.

In a similar vein, research conducted by Williams, Goldstein, & Minshew (2005) determined that the impairment in working memory does not impact all its components uniformly; rather, it is particularly noticeable in tasks necessitating the simultaneous processing of verbal and visual data, thereby hindering the child's capacity to alternate strategies during cognitive tasks. Furthermore, the study highlighted that the degree of this impairment correlates with the severity of the disorder's symptoms, indicating that children with more severe symptoms experience greater challenges in organizing information during sequential activities, such as the Tower of London test and the Stanford–Binet Intelligence Scales, both of which demand prior planning and the retention of information throughout their execution.

Collectively, these results underscore that deficits in working memory among children diagnosed with ASD represent a crucial cognitive element that impacts their challenges in planning, regulating behavior, and engaging in social interactions, which subsequently influences their capacity to effectively learn and develop both academic and social skills.

Response inhibition refers to the capacity to halt, postpone, or alter automatic or inappropriate reactions, whether they are behavioral or cognitive, in alignment with the requirements of the task or the social environment. This capability is vital for regulating emotions, controlling impulses, and focusing attention on pertinent objectives. It is recognized as one of the fundamental executive functions that aid in self-regulation and is often utilized in activities that necessitate the avoidance of distractions or the suppression of undesired responses (Diamond, 2013).

Research indicates that children diagnosed with ASD exhibit a notable deficiency in this particular function, which adversely impacts their self-regulation and social interaction capabilities. For instance, a study conducted by

Christ et al. (2007) revealed a marked deficit in response inhibition among children with ASD when compared to their typically developing peers, utilizing three distinct executive function assessments.

Cognitive Flexibility:

This is recognized as one of the fundamental executive functions, encompassing the capacity to adjust cognitive or behavioral patterns in reaction to alterations in environmental conditions or task requirements. It allows an individual to transition between various viewpoints, modify ineffective approaches, and devise innovative solutions when confronted with novel or intricate scenarios (Diamond, 2013).

Response Inhibition:

The role of response inhibition is characterized as the capacity to halt, postpone, or alter automatic or inappropriate reactions, whether they are behavioral or cognitive, in alignment with task demands or social circumstances. This capability is crucial for managing emotions, regulating impulses, and focusing attention on pertinent objectives. It is recognized as one of the fundamental executive functions that aid in self-regulation and is often employed in activities that necessitate the resistance of distractions or the suppression of undesired responses (Diamond, 2013).

Research indicates that children diagnosed with ASD display a notable deficiency in this function, which impacts their self-regulatory abilities and social interactions. For example, the investigation conducted by Christ et al. (2007) revealed a significant deficit in response inhibition among children with ASD when compared to their typically developing peers, utilizing three executive function assessments.

Cognitive Flexibility:

Cognitive Flexibility constitutes a fundamental executive function, defined as the capacity to adjust thought patterns or behaviors in response to alterations in environmental conditions or task requirements. This ability allows individuals to shift between various viewpoints, modify ineffective approaches, and devise innovative solutions when confronted with novel or intricate scenarios (Diamond, 2013).

It is regarded as a crucial executive function, alongside inhibition and working memory, as per the framework proposed by Miyake et al. (2000), which identifies these three functions as foundational to advanced cognitive operations. Cognitive flexibility plays a vital role in facilitating abstract reasoning, problem-solving, and social adaptability, and is also linked to the enhancement of self-regulation and attentional control (Gioia, 2002). Scholars differentiate between two categories of cognitive flexibility:

Interactive flexibility: This emerges when the environment shifts, necessitating an adjustment to enhance adaptability.

Spontaneous flexibility: This is characterized by the capacity to produce a stream of ideas or responses without being restricted to a conventional framework (Lorena et al., 2013).

Research indicates that the cultivation of mental flexibility relies on the amalgamation of other cognitive functions, including inhibition and working memory, as altering strategies demands the capability to suppress unproductive responses and maintain pertinent information in memory (Roukouz, 2020).

Executive Functions in Children with Autism Spectrum Disorder:

Executive functions encompass a collection of advanced cognitive processes that allow an individual to structure behavior, regulate emotions, strategize, and resolve issues. Neuropsychological research suggests that children diagnosed with ASD exhibit notable deficiencies in these functions, which adversely affects their capacity for social interaction, learning, and self-regulation (Hill, 2004).

A research study conducted by Ozonoff & Jensen (1999) demonstrated that children with autism experience challenges in planning, as they struggle to organize the necessary steps for problem-solving. Furthermore, another study by Ozonoff & Strayer (1997) highlighted deficiencies in response inhibition, particularly in tasks that necessitate the suppression of automatic reactions. Regarding cognitive flexibility, this aspect was explored in a study by Yerys et al. (2009), which discovered that children with autism encounter difficulties in modifying strategies when rules are altered, signifying a limitation in cognitive adaptability.

In a related context, research conducted by Corbou (2023) revealed that children diagnosed with ASD exhibit poor performance in assessments of working memory, inhibition, and cognitive flexibility, thereby affirming the complex nature of their executive deficits. In a similar vein, a study by Al-Samman (2024) indicated that executive functions serve as a mediating factor in the connection between autism symptoms and the skills required for independent living, with impairments in these functions linked to a reduced capacity for self-regulation and planning in daily life.

Collectively, these investigations underscore that executive function disorders in children with ASD are not simply secondary symptoms; rather, they represent a crucial element in understanding the cognitive and behavioral challenges these children encounter, highlighting the need for educational and therapeutic strategies that specifically focus on enhancing these functions.

The applied framework of the study

Research Methodology

The study employed a case study approach, which is one of the qualitative methodologies utilized for an in-depth analysis of psychological and behavioral phenomena among specific individuals. This approach allows for a thorough examination of the

manifestations of executive function disorders in children diagnosed with ASD by collecting and descriptively and interpretively analyzing data from multiple sources. This enables a better understanding of cognitive and behavioral interactions within their natural contexts. To enhance the accuracy of the analysis, some descriptive quantitative indicators derived from assessment tools were utilized, such as the percentage of responses on the executive function observation grid, aimed at supporting qualitative analysis and providing a numerical approximation of the executive deficits observed in the studied cases.

Sample of the Study

The sample was selected purposefully, consisting of (02) children aged between five and seven years based on the following criteria: a confirmed diagnosis of autism spectrum disorder using the CARS scale and the absence of comorbid disabilities associated with ASD.

Study Boundaries

Spatial Boundaries: The research was carried out at the Pedagogical Psychological Center for Children with Mental Disabilities located in Taibet, Touggourt Province.

Time Boundaries: The research took place in December 2024.

Study Tools

- Semi-structured interview: This was adopted to collect qualitative data on the child's daily behavior through direct communication with parents and educators. This allowed for obtaining accurate data and information on deficiencies in executive functions.

- Observation checklist for evaluating executive functions: This is a standardized systematic tool used to monitor and analyze an individual's behaviors in natural settings, aiming to assess their abilities in areas such as initiative, inhibition, cognitive flexibility, and working memory.

- Childhood Autism Rating Scale (CARS): Al-Suwaidan defines it as "an assessment tool aimed at evaluating the degree of autism disorder in a child by observing their behavior across several developmental domains and determining the extent of deviation from normal behavior, using a gradated scale that allows for identifying the severity of the disorder." Al-Suwaidan emphasizes that the scale relies on direct observation of the child, alongside information obtained from parents and educators, and it is used to determine whether behavioral symptoms correspond to ASD. It also helps classify the condition as mild, moderate, or severe based on the total score (Al-Suwaidan, 2010).

Study Results Presentation

Case 01: Anis is a six-year-old boy, the second child in his family, with an older brother who is two years older. His mother possesses a moderate level of education, while his father has passed away, and the family resides in

conditions that are economically below average. There were no complications noted during either the pregnancy or the birth, and his sensory-motor development was typical during his early childhood.

However, in terms of language development, he has exhibited a significant delay; Anis did not start to articulate meaningful words until he reached the age of four, and his verbal communication continues to be restricted to this day. He depends on single words to convey his needs and is unable to form simple two-word phrases or longer sentences. This delay in language has also impacted his ability to express emotions and interact socially. His mother observed from a young age a lack of eye contact, diminished emotional responsiveness, such as not smiling, and a lack of social initiative. Additionally, he displays repetitive stereotyped behaviors, including jumping and hand flapping, and demonstrates an excessive attachment to pens, consistently keeping them close and refusing to let them go.

There are no documented chronic organic illnesses, nor is there any known family history of neurological or psychiatric conditions. Nevertheless, the mother observed a distinct challenge in his social communication and adaptation to his environment. At the age of four, he was brought to pediatricians who recommended a variety of medications and vitamins; however, the mother remained unconvinced regarding the efficacy of this treatment, prompting her to seek the assistance of a psychologist. The psychologist performed a thorough assessment and compiled a detailed report on the symptoms, subsequently referring him to a specialist in child psychiatric and mental disorders. Following evaluation, Anis was diagnosed with ASD, with a suggestion for multidisciplinary care that included a psychologist, a speech therapist, and a specialist in psychomotor development.

When he turned five, Anis entered the preparatory class, yet he encountered considerable challenges in assimilating into the school setting. He struggled to engage in group activities, exhibited clear attention deficits, did not take the initiative in activities independently, and required ongoing support.

He exhibits indications of poor behavioral regulation, as he suddenly abandons tasks without a discernible rationale and exhibits strong resistance to alterations in his daily routine, resulting in considerable discomfort. He struggles to adjust to new directives or transitions between activities, fails to retain the essential information required to accomplish tasks, and rapidly forgets instructions.

Executive Functions Assessment Grid for Case 01 (Anis)

	Lack of Initiative	Yes	No
1	Unable to carry out a task	+	
2	Does not initiate actions toward a goal	+	
3	Does not plan his/ her work	+	
4	Easily distracted		+
5	Difficulty coordinating steps leading to task completion	+	
6	Often shows disinterest or laziness		+
7	Finds it difficult to follow instructions	+	
8	Finds it difficult to ask for help		+
	Ineffective Working Memory (Poor Information Management)		
9	Difficulty assembling and integrating information about a text	+	
10	Weak linkage between texts and information	+	
11	Does not group similar information		+
	Deficit in Cognitive Flexibility (Mental Flexibility)		
12	Easily stressed when something new occurs or routine changes	+	
13	Forgets what he/ she is capable of doing when the task is presented differently		+
14	Difficulty shifting from one task to another	+	
15	Hard to change his/ her opinion or understanding of a concept	+	
16	Corrects easily when making mistakes	+	
17	Takes things literally; struggles to understand inferences, hints, or jokes	+	
	Deficit in Inhibition (Inability to withhold a response to a stimulus)		
18	Impulsive in the activities and tasks he/she performs	+	
19	Does not respect stages or logical order in a task or activity	+	
20	Does not correct his/ her mistakes	+	
21	Ignores instructions during task execution	+	
22	Disorganized when the task is not presented in a structured framework	+	

Case (02)

Marwa is a seven-year-old girl, the fourth child in her family. She hails from a household with an average economic background, where her father has completed high school and her

mother has finished middle school. For the past two years, she has been enrolled at the Pedagogical-Psychological Center for the Mentally Disabled and has not participated in any formal educational settings due to significant developmental and behavioral challenges. Marwa resides in a relatively stable environment. There were no complications noted during her pregnancy or delivery, and her sensory-motor development in the early stages was typical; however, a noticeable delay in her language and social development emerged when she turned two.

When Marwa turned three years old, her mother recalls, we started to feel concerned about her, particularly as her unusual behaviors became increasingly noticeable to us and those in her vicinity. Her mother noted that it was evident she struggled with maintaining eye contact, exhibited limited emotional expression, and lacked social initiative, in addition to displaying repetitive stereotyped behaviors such as spinning, reiterating the same letters and words, forming an excessive attachment to certain objects, and demonstrating a strong aversion to alterations in her daily routine. Furthermore, she exhibited a distinct unwillingness to engage in play with her siblings and peers, opting instead for isolation or repetitive movements that seemed purposeless. We consulted a psychologist, who subsequently referred us to a child psychiatrist with expertise in psychological and mental disorders. Following a series of examinations and assessments, Marwa received a diagnosis of ASD, accompanied by a recommendation for a multidisciplinary approach to her care, which included a psychologist, a speech therapist, and a specialist in psychomotor development.

At the age of five, Marwa began her journey at the psychopedagogical center. Throughout the educational and therapeutic sessions provided at the center, Marwa demonstrated both behavioral and cognitive challenges. She requires direct and repeated guidance to initiate activities and frequently halts tasks for no discernible reason, which suggests a deficiency in her self-planning skills. When presented with multi-step instructions, she becomes easily distracted and struggles to retain information, which obstructs her ability to complete tasks. Additionally, she exhibited inflexible behavior, a pronounced resistance to change, and difficulty transitioning between activities, along with intense reactions when the schedule was altered or materials were rearranged. These behaviors indicate weaknesses in her cognitive flexibility and self-regulation. Marwa necessitates ongoing redirection during individual tasks, is unable to organize her materials or sequence her work steps effectively, has difficulty

grasping the objectives of activities, and tends to engage in repetitive movements without producing meaningful results.

	Lack of Initiative in the Executive Functions Assessment Grid for Case 02 (Marwa)	Yes	No
1	Unable to carry out a task	+	
2	Does not initiate actions toward a goal	+	
3	Does not plan his/ her work	+	
4	Easily distracted		+
5	Difficulty coordinating steps leading to task completion	+	
6	Often shows disinterest or laziness		+
7	Finds it difficult to follow instructions	+	
8	Finds it difficult to ask for help		+
	Ineffective Working Memory (Poor Information Management)		
9	Difficulty assembling and integrating information about a text	+	
10	Weak linkage between texts and information	+	
11	Does not group similar information		+
	Deficit in Cognitive Flexibility (Mental Flexibility)		
12	Easily stressed when something new occurs or routine changes	+	
13	Forgets what he/ she is capable of doing when the task is presented differently		+
14	Difficulty shifting from one task to another	+	
15	Hard to change his/ her opinion or understanding of a concept	+	
16	Corrects easily when making mistakes	+	
17	Takes things literally; struggles to understand inferences, hints, or jokes	+	
	Deficit in Inhibition (Inability to withhold a response to a stimulus)		
18	Impulsive in the activities and tasks he/she performs		+
19	Does not respect stages or logical order in a task or activity	+	
20	Does not correct his/ her mistakes	+	
21	Ignores instructions during task execution		+
22	Disorganized when the task is not presented in a structured framework	+	

Table (02): Percentages of Sample Responses on the Executive Functions Observation Grid

	Anis	Marwa
Number of "Yes" responses	17	15
Number of "No" responses	05	05
Percentage of "Yes" responses	77.27%	68.18%
Percentage of "No" responses	22.72%	31.81%

Analysis and Discussion of Results

The findings from the field study reveal a significant deficiency in executive functions among the children Anis and Marwa, thereby reinforcing the validity of the overarching hypothesis that children diagnosed with ASD experience considerable impairments in these functions. This conclusion was substantiated through the implementation of the executive function assessment network, which demonstrated that both subjects exhibited notable deficits in executive functions. A positive response was recorded for 17 out of 22 questions, equating to 77.27%, for the assessment directed at Anis, whereas for Marwa, a positive response was noted for 15 out of 22 questions, or 68.18%. Clinical and behavioral evaluations of both cases corroborated various manifestations of this deficit, such as inadequate self-planning skills, distractibility, challenges in adhering to instructions, abrupt cessation of activities, and pronounced resistance to alterations in routine or the arrangement of tools. Additionally, difficulties in mental flexibility, response inhibition, and self-regulation were also observed, all of which are critical indicators of executive function impairment. This aligns with findings from earlier research concerning executive function disorder in children with autism, characterized as a collection of advanced cognitive processes that allow a person to manage their behavior, organize their actions, adjust to alterations, and address challenges (Pennington & Ozonoff, 1996).

Numerous studies have validated that these functions are notably impaired in autistic children, which impacts their capacity for social interaction, learning, and emotional regulation (Hill, 2004).

These results further corroborate the conclusions drawn by recent Arab studies. Qarbou (2023) demonstrated that children diagnosed with ASD experience impairments in executive functions, especially in areas such as response inhibition, cognitive flexibility, and working memory, which significantly impacts their capacity to engage in daily activities and educational pursuits. In a similar vein, Al-Samman (2024) emphasized the moderating influence of executive functions on the connection between autism symptoms and skills necessary for independent living, pointing out that deficiencies in these functions are indicative of challenges in adaptation and independence. Conversely, research suggests that executive deficits are fundamental characteristics of ASD, rather than simply secondary symptoms.

A research conducted by Ozonoff et al. (1991) demonstrated that children diagnosed with autism face challenges in tasks that necessitate cognitive flexibility and response inhibition, exemplified by the Wisconsin Card Sorting Test. This suggests a dysfunction within the frontal brain system that is linked to executive functions. Furthermore, Hill's review (2004) corroborated that this deficit impacts social interactions, behavioral regulation, and environmental adaptation, marking it as a significant diagnostic criterion in high-functioning autism. Consequently, it can be asserted that the results from the field study involving Anis and Marwa not only illustrate individual instances of executive dysfunction but also validate the existence of a shared cognitive and behavioral pattern among children with ASD, which is characterized by deficiencies in fundamental executive functions. The alignment between field observations and theoretical insights reinforces the credibility of the overarching hypothesis and highlights the necessity for the incorporation of

cognitive and behavioral intervention strategies aimed at enhancing these functions within a multidisciplinary approach. This approach should involve psychologists, speech therapists, and specialists in sensory-motor development, thereby aiding in the reduction of ASD symptoms and promoting their educational and social integration.

Conclusion

Based on the results we reached in our study on executive function disorder in autistic children, it has become clear that children with ASD suffer from significant impairments in executive functions (planning, cognitive flexibility, working memory, response inhibition, and initiation). Executive function disorder is considered a central cognitive element in understanding the manifestations of ASD in children, and this impairment is closely linked to deficits in communication and social interaction. It is also associated with repetitive stereotyped behaviors, which are among the hallmark symptoms of this disorder. This interactive relationship between executive functions and behavioral and social symptoms highlights the necessity of integrating the assessment of these functions into early diagnostic procedures, due to their role in guiding therapeutic interventions more precisely and effectively.

Suggestions:

It is essential to include the evaluation of executive functions within early diagnostic protocols, as this allows for monitoring the initial indicators of the disorder and directing appropriate interventions.

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