Descriptive Characteristics of Cognitive Impairment in Autistic Children (A Descriptive Study at Gilang Ramadhan School Band-GRSB)

Nailul Fauziah[1], Endang Sri Indrawati[2], Adi Dinardinata[3]

{nailulfauziah@lecturer.undip.ac.id[1], endang.sri.indrawati.esi@gmail.com[2], dinar.antz@gmail.com[3]}

Faculty of Psychology, Diponegoro University, Indonesia

Abstract. Children with Autism Spectrum Disorder (ASD) exhibit diverse cognitive challenges, particularly in attention and short-term memory. This study aims to describe the cognitive impairments of children with ASD at Gilang Ramadhan School Band (GRSB), focusing on attention and memory limitations. Using a descriptive qualitative approach, the research involved observations of ten autistic children and focus group discussions with their parents (10 parents) and therapists (2 therapists). Data were collected using an observation checklist measuring cognitive aspects such as attention, concentration, and memory, alongside interviews guided by cognitive ability frameworks. Data analysis included reduction and presentation of data from both observations and interviews. The findings indicate that children with ASD at GRSB face significant difficulties in attention, concentration, and memory retention. These impairments suggest that more specialized interventions are necessary to enhance their learning outcomes.

Keywords: cognitive impairments; autistic children; descriptive study

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1 Introduction

Autism is a term used to describe a pervasive developmental disorder in children that results in delays in cognition, language, behavior, communication, and social interaction. It affects both the physical and mental development of children [1]. According to the Centers for Disease Control and Prevention (CDC) in the United States, as of March 2014, the prevalence of autism was 1 in 68 children, with a higher incidence in boys (1 in 42) compared to girls (1 in 189) [2]. While definitive data for Indonesia is lacking, in 2010, estimates indicated an incidence and prevalence of autism spectrum disorder (ASD) at 2 new cases per 1,000 population per year and 10 cases per 1,000 population, respectively. With Indonesia's population at 237.5 million and a growth rate of 1.14%, it is estimated that there are approximately 2.4 million individuals with ASD in the country, with an annual increase of 500 new cases [3].

Autism is generally characterized as a developmental disorder involving impairments in communication, social interaction, and behavior. Research examining the motor and language abilities of 21 autistic children with speech delay and 18 without speech delay found that early language abilities were related to both simple and complex motor skills in individuals with ASD [4].

The primary challenges faced by autistic children include social/emotional disorders accompanied by cognitive and behavioral disturbances. Typically, children respond to stimuli in a listen-think-do pattern, but this sequence is disrupted in autistic children. They experience a lack of sensory integration, leading to improper processing and coordinated physical responses. This phenomenon, known as delayed learning behavior, manifests as atypical body movements. The "think" and "do" elements are almost absent or replaced by other behavioral actions [5].

Upon receiving a stimulus, the brain of an autistic child struggles with coding (capturing information), encoding (making sense of the information), integrating, and coordinating the received stimulus. This results in "unusual" and non-adaptive behaviors such as not responding when called, ignoring instructions, and engaging in repetitive and obsessive behaviors. Consequently, autistic children may exhibit flat (emotionless) responses to all stimuli or, conversely, overly emotional (uncontrolled) reactions [6].

These core issues present significant challenges for children with ASD and warrant further investigation into potential solutions. It is crucial to "connect" these children to improve their condition. Studies indicate that children with ASD are more likely to experience cognitive development issues. A neurological imaging study identified brain areas linked to physical, psychological, and learning processes [7]. Neuroimaging research has shown increased functional connectivity in the brains of children with ASD compared to neurotypical children, with hyperconnectivity observed at both the whole-brain and subsystem levels [8]. This underscores the importance of studying the brain and cognitive abilities in autistic children.

Cognitive impairments in autistic children pose challenges not only for the children themselves in learning and socialization but also for their parents and surroundings. This study focuses on the attention, concentration, and short-term memory abilities, which are critical components of an individual's cognitive skills. Autism spectrum disorder (ASD) is a neurodevelopmental condition affecting nearly 1 in 88 children, attributed to deviations in brain connectivity. The standard pattern of responding to stimuli—listen-think-do—is disrupted in autistic children, leading to various problems.

To activate cognitive functions, children must be in a very relaxed state [9]. Such a state facilitates comfort, allowing children to develop cognitive abilities and utilize their full potential. Cognitive development involves enhancing perception, attention, memory, thinking, concentration, focus, understanding of symbols, reasoning, and problem-solving [10]. This study examines the attention, concentration, and short-term memory abilities, which are integral to an individual's cognitive capabilities and support the learning process.

State of Art

Autistic children, despite their various limitations, have the potential to grow and develop. It is crucial for parents to provide effective services, care, and education for their autistic children as early as possible [11]. Research conducted between October and December 2013 on the treatment of 16 autistic children revealed that interventions such as speech therapy, play therapy (PECS), and behavioral therapy (ABA, DIR, Floortime) yielded positive outcomes [12]. Additionally, another study found that brain exercises positively influence the cognitive aspects of autistic children, including attention, focus, understanding, concentration, and short-term memory [13]. Furthermore, it was noted that autistic children, particularly those with Asperger's who exhibit relatively high intellectual abilities, benefit from having creative and supportive parents [14]. However, parents often face challenges in dealing with their autistic children, primarily due to communication difficulties [15].

Psychiatric and neurological disorders highlight the function of the "social brain." Behavioral disorders, such as those observed in autistic children, result from malfunctions in the social brain, which subsequently affect the cognitive brain and result in altered social behaviors [16]. Autism spectrum disorder (ASD) is characterized by impaired socialization, cognitive rigidity, and behavioral inflexibility. Research indicates that weak brain functions can contribute to the rigidity observed in social behaviors in ASD [17]. The cognitive abilities integral to the brain include attention, short-term memory, perception, and concentration [10].

Autistic children often experience difficulties in paying attention, concentrating, and persisting with tasks [18]. Moreover, it is explained that concentration significantly determines the effectiveness of a child's memory and learning process.

Autism, Attention, Concentration and Memory

Autism is a disorder that affects cognitive, emotional, behavioral, and social domains. Autistic children often exhibit a gradual decline in cognitive abilities. Symptoms of autism include disturbances in: (1) communication, such as delays or inability to speak; (2) social interaction; (3) behavior and play; (4) feelings and emotions; and (5) sensory-perceptual processing. The severity of autism, classified as moderate or severe, is often determined using the Childhood Autism Rating Scale (CARS) following a diagnosis [19].

In psychology, the concentration of attention is referred to as attention. Study explained that attention involves focusing the mind clearly and vividly on a number of simultaneous objects or thoughts [20]. Attention helps us select important information from our surroundings, preventing our brain from being overwhelmed with unlimited information. One characteristic of children with ASD is difficulty in stimulating attention, such as not responding to instructions, not looking when spoken to, or not looking up when their name is called [19].

Darmono [21] defines concentration as the effort required to direct mental activity towards specific experiences. Concentration is a state of mind activated by bodily sensations and is closely related to brain function [22]. Concentration involves focused attention on necessary information while ignoring irrelevant information [23]. Playing a drum instrument requires basic concentration skills, particularly the ostinato technique, which involves repetitive rhythms played with different limbs (right hand, left hand, right foot, and left foot). This technique, involving two-layer to four-layer ostinato, helps train primary concentration in autistic children [24].

Memory is a fundamental component of most cognitive processes. Short-term memory (STM) is characterized by limited storage and processing capacities, with a trade-off between the two [20]. STM typically holds about seven items, but the amount of information can be increased by chunking, or grouping information into meaningful units. For children with ASD, continuous training of short-term memory is essential to develop positive habits that can transition into long-term memory. The aim of this research is to determine the descriptive characteristics of the cognitive abilities possessed by autistic children.

2 Method

Study design

The qualitative-descriptive method is the approach taken in this study. Qualitative approach is used to examine natural environments in which data is gathered based on the perspectives of data sources rather than imposing interventions. This study was carried out in the school band Gilang Ramadhan. The qualitative method was selected in order to fully explore the viewpoints and experiences of the participants and to acquire a thorough grasp of the features of cognitive impairment in the children with autism under investigation. Using a descriptive qualitative methodology, this study concentrates on in-depth interviews and observations. The study involved 13 parents, guardians, teachers, and therapists in addition to 10 autistic children who served as the main subjects. Ethical considerations, such as obtaining informed consent and ensuring participants' confidentiality, were carefully followed throughout the research process. This design was chosen because it provides the flexibility to capture the uniqueness of each child's cognitive characteristics, making it suitable for the objectives of this study.

Participant

Purposive sampling was used in the study's participant selection process to make sure that each person met the precise requirements related to the study's goals. This study had 23 participants in all, including guardians, teachers, parents, therapists, and children with autism. Children between the ages of 5-10 who had been diagnosed with autism spectrum disorder met the inclusion criteria for participant selection. This made it possible for the participants to offer insightful commentary and advance knowledge of the study's subject. The selection of this age group was based on the developmental and behavioral focus of the study, as children within this range exhibit varying levels of cognitive and social skills that are crucial for the research analysis.

Instruments

The main tools used to investigate the experiences and behaviors of kids with autism spectrum disorder (ASD) were semi-structured interviews, observations, and document analysis. Initially, semi-structured interviews were carried out with the parents or guardians of the participants to obtain comprehensive understanding of the children's social behaviors, developmental history, and everyday obstacles. Open-ended questions from the interview guide allowed for freedom while guaranteeing that the main topics of interest were covered. The other method is direct observation, which was used to record interactions and behaviors in real time while participants were going about their everyday business or in educational environments. The children's focus, memory, and attention were recorded using an observation checklist.

Procedure

To ensure complete data collection and ethical standards compliance, the protocol for this investigation was implemented in multiple phases. The study was carried out over a period of [length], with each phase being meticulously planned to complement the goals of the investigation. Participants were gathered via getting in contact with GRSB school directly. Potential participants' parents or guardians were contacted and given comprehensive details about the study, including its goals, methods, and ethical considerations. Before the study began, informed consent was obtained from each participant's guardians. The participants' natural environments, including schools, were the sites of the observations. The children's relationships, behaviors, and reactions to different stimuli were the main topics of the observations. The parents or guardians of the participants were interviewed. The interview guide provides that the inquiries are pertinent to James's specified cognitive elements in the year of 2000. Every interview was completed and at a convenient time. After gathering the data, the field notes from the observations were examined and the interviews were transcribed.

Data Analysis

Data analysis was conducted using qualitative data analysis techniques, following the concepts provided by Miles and Huberman. According to Sugiyono [25], Miles and Huberman state that "activities in qualitative data analysis are carried out interactively and continuously at each stage of the research until its completion and data saturation. Activities in data analysis include data reduction, data display, and conclusion drawing/verification."

1. Reduction:
   According to Sugiyono [25], "reducing data means summarizing, selecting the main points, focusing on important aspects, and identifying themes and patterns." Data reduction is crucial for selecting relevant data. The reduced data were obtained through interviews, observations, and document studies.
2. Data Display:
   In qualitative research, data presentation is performed using short descriptions, charts, category relationships, flowcharts, and similar tools [25], According to Miles and Huberman, the most commonly used method for presenting data in qualitative research is narrative text. In this research, the data presented will primarily be in narrative text form, supplemented by charts.
3. Conclusion Drawing/Verification:
   The third step in this research involves drawing conclusions and verification. In qualitative research, conclusions are tentative and may change if strong supporting evidence is not found in subsequent stages of data collection. Drawing conclusions will address the research questions formulated at the beginning or reveal new findings. Findings can provide a clearer understanding or depiction of an object that was previously obscure. In this research, conclusions and data verification will be structured descriptively to answer the research questions [25].

3 Result

Data analysis

Table 1. Observation results of the cognitive abilities of children with ASD

Name	Age	Sex	Attention Level	Concentration Level	Memory
V	6 years 9 months	Female	low	high	low
J	6 years 5 months	Male	high	high	high
M	5 years	Male	high	high	high
A	10 years	Male	high	moderate	low
S	7 years	Male	high	high	low
H	7 years	Male	low	low	low
Hi	7 years 10 months	Male	moderate	high	low
K	5 years 2 months	Male	moderate	moderate	low
W	6 years 6 months	Male	moderate	low	low
N	5 years 5 months	Male	low	low	low

V shows a strong ability to grasp and understand task instructions quickly. However, his attention can easily be diverted by distractions, impacting his concentration. Despite this, he can maintain focus for extended periods depending on his mood. Occasionally, he engages in unconventional behaviors, such as using objects in unintended ways, like inserting a ballpoint pen into a sandal.

J, diagnosed with ASD at 1.5 years old, demonstrates a remarkable ability to comprehend and remember instructions. He responds promptly and accurately to commands, completing tasks as directed. While he generally has a good memory, he occasionally struggles with recalling the names of people he has recently met. His concentration span is notable, evidenced by his ability to complete complex puzzles without distraction.

M, diagnosed with speech delay and sensory spectrum issues, exhibits high levels of attention and concentration. He follows instructions attentively and executes them without being sidetracked by distractions. M's memory is strong; he quickly memorizes songs and can sing them accurately. However, he is sensitive to loud noises, such as crowd marches. M participates in rhythm therapy and other prescribed treatments to support his development.

A comprehends instructions well and responds appropriately to questions. He demonstrates prolonged concentration, often staying focused on tasks for extended periods. However, he occasionally misuses objects before properly following instructions, such as

kissing puzzle pieces before assembling them. A's memory skills are somewhat limited, particularly in accurately recalling verbal instructions.

S is deeply engaged with puzzles, which initially capture his attention. He comprehends and follows instructions well, successfully completing tasks such as assembling and disassembling puzzles. His concentration span is notable, evidenced by his ability to focus on intricate tasks like puzzle solving. However, he faces challenges in memory retention, particularly distinguishing between puzzle numbers like 6 and 9 and grasping color concepts.

H struggles to maintain attention on given instructions and frequently shifts to other activities. Despite assistance, he often fails to complete tasks as instructed. His attention is easily diverted by distractions or objects that attract his interest, such as playing with scissors. His concentration is brief and easily interrupted, leading him to shift focus frequently. H's memory capacity is limited, as evidenced by difficulty recalling instructions.

Hi demonstrates adequate attention to instructions and understands simple tasks well. Although he requires assistance, he can complete assigned tasks. His concentration is relatively sustained, although it wavers momentarily when distractions arise before returning to the task at hand. However, Hi's memory skills are weak, posing challenges in retaining information over time.

K comprehends instructions but struggles to execute tasks independently. He inconsistently follows through on given instructions, often needing repeated assistance to complete tasks. K's memory retention is limited, requiring frequent reminders and assistance for task completion. While his concentration can be sufficient, it is easily disrupted by surrounding objects that divert his attention, leading to engagement with objects not intended for their original purpose.

W has difficulty paying attention to instructions, often disregarding them altogether. His concentration is easily disrupted during activities, shifting focus to other objects of interest before returning to the initial task. Despite assistance, he struggles to complete tasks as instructed. According to his therapist, Winston shows a strong affinity for box-shaped objects like cardboard, frequently engaging with them in play. His memory capacity is somewhat deficient, impacting his ability to recall simple instructions promptly.

N struggles to pay attention to given instructions, which hinders his ability to comprehend and carry them out effectively. His responses to instructions are delayed, indicating a slower processing speed. N's attention and concentration are easily diverted by surrounding objects, particularly showing interest in non-toy items like rope and tupperware. Despite assistance, he struggles to complete tasks as instructed, highlighting challenges in task completion. His memory retention is also somewhat deficient.

4 Discussion

This study intended to describe each child's with ASD cognitive abilities. The findings demonstrate a varied range of talents and limitations among the individuals, underlining the complexity of ASD and its impact on cognitive functions.

Attention and Concentration

The individuals displayed various levels of attention and concentration. V had high task understanding and the capacity to focus for extended durations, yet his attention was quickly diverted by distractions. This conclusion is consistent with prior research, which demonstrates that while individuals with ASD may display high levels of focus in specific circumstances, their attention can be vulnerable to external interruptions [26].

J demonstrated strong memory retention and focus, scoring well on complicated tasks despite occasional difficulty with recent memories. This coincides with findings by Ozonoff et al. [27] that suggest some persons with ASD can thrive in tasks demanding sustained attention and memory when their interests are engaged.

In contrast, H and W struggled with maintaining attention and task completion. H's frequent shifts in focus and weak memory recall parallel difficulties seen in other research where ASD patients demonstrate challenges with task persistence and memory [28]. W's inclination to reject directions and focus on objects of interest also emphasizes common attention-related challenges in ASD [29].

Instruction Following and Memory

Participants like M and A demonstrated high adherence to instructions and recall skills, however M encountered difficulty with sensory sensitivities and A occasionally misused objects. The capacity of M to follow instructions attentively and recall songs confirms research demonstrating that children with ASD can have remarkable memory for specific sorts of information [30].

S and Hi also displayed strong instruction comprehension, while S struggled with memory retention related to puzzle numbers and color concepts. This is consistent with studies showing cognitive capabilities in ASD can coexist with specific deficiencies, such as issues with abstract concepts and memory [31].

N's and K's difficulties with task execution and memory retention highlight the broader obstacles many youngsters with ASD experience. N's delayed replies and distractibility, together with K's inconsistent task completion, resemble well-documented patterns of cognitive and attentional abnormalities in ASD [32].

Autistic children exhibit diverse cognitive abilities. Based on observations and interviews with children aged 6-10 attending therapy at Gilang Ramadhan Music School, their cognitive profiles vary significantly. Out of 10 children observed, 7 face difficulties in maintaining attention as per instructions. These challenges include behaviors such as not

following instructions directly and shifting attention to unrelated interests. Even when attention is briefly captured, it often quickly shifts to other stimuli that captivate the child's interest. Concentration refers to the duration a child can sustain attention on a task. It is crucial for absorbing new information and developing skills effectively.

These findings have various implications for educational and therapeutic methods. Personalizing therapies to address specific attention and memory difficulties can improve task performance and overall functioning. For instance, adding visual supports and avoiding distractions may help boost focus and task completion [33].

Future research should study how different forms of cognitive and sensory interventions impact attention and memory in ASD, and whether tailored solutions can support varying cognitive profiles within the spectrum more effectively.

5 Conclusion

The cognitive abilities of autistic children exhibit descriptive characteristics that indicate delayed development. Among the 10 subjects observed, only 2 children demonstrated cognitive abilities—such as attention, concentration, and memory—that were age-appropriate. In contrast, the remaining 8 children exhibited delays in these cognitive functions. These findings align with outcomes from Focus Group Discussions (FGDs) and interviews with therapists, which consistently highlight cognitive challenges among autistic children. These difficulties significantly impact their daily behaviors and functioning.

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