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Effectiveness of Sensory Integration Stimulation Implementation in Children with ADHD (Attention Deficit Hyperactivity Disorder)

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ABSTRACT

This study aims to analyze the effectiveness of implementing sensory integration stimulation for children with ADHD (hyperactivity) aged 4-6 years at TK Tahfidzul Qur'an Al Izzah Pekayon. The research employed a qualitative approach using a case study method. The research subjects consisted of five children. Data were collected through observation, interviews, and documentation. The implementation of sensory integration stimulation was conducted over four weeks and involved the development of proprioceptive, vestibular, tactile, visual, auditory, and olfactory senses through activities tailored to the children's needs. The results indicated that sensory integration stimulation effectively improved children's motor control, body balance, focus and concentration, emotional regulation, body awareness, and self-confidence. In addition, improvements were also observed in cognitive and basic language skills, such as understanding simple concepts, responding appropriately to questions, and showing increased curiosity toward the surrounding environment. These findings align with recent research proving the effectiveness of sensory integration interventions in children with ADHD.

1. Introduction

Early childhood education is a crucial phase in shaping children's cognitive, social, emotional, and spiritual development. Attention Deficit Hyperactivity Disorder (ADHD) is a neuropsychiatric developmental disorder characterized by difficulty concentrating, hyperactive behavior, and impulsive tendencies. The global prevalence of ADHD in school-age children reaches 5-8% (Danielson et al., 2024). In Indonesia, recent research indicates an increase in the number of identified ADHD cases in early childhood (Saputro & Nurbayani, 2023).

In the kindergarten environment, ADHD conditions present unique challenges. Children often experience difficulty following teacher instructions, maintaining attention in learning activities, exhibiting excessive restless behavior, and experiencing obstacles in peer interaction (DuPaul et al., 2020). Based on preliminary research conducted by researchers at Tahfidzul Qur'an Al Izzah Kindergarten, several children were found to show characteristics

of hyperactivity, such as difficulty sitting still during memorization activities, being easily distracted, and tending to move excessively.

One relevant approach in supporting children with ADHD is sensory integration stimulation. Sensory processing disorder is a prevalent issue in children with ADHD, where children experience difficulty receiving, organizing, and responding to sensory input adaptively (Ghanizadeh, 2020). Research shows that more than 60% of children with ADHD exhibit significant sensory processing disorder symptoms (McMahon et al., 2021). Sensory integration interventions have proven effective in improving motor function, attention, and occupational participation in children with ADHD (Schaaf et al., 2018).

The Sensory Integration theory developed by Ayres places three basic sensory systems at the core of integration: the tactile, vestibular, and proprioceptive systems. Recent studies prove that Ayres Sensory Integration (ASI) intervention positively affects motor skills and occupational participation in preschool children with ADHD (Jung et al., 2024). Randomized control trial research by Jeyanthi et al. (2025) shows that the combination of task-oriented aerobic exercise with sensory integration provides significant improvement in aerobic capacity, sensory profile, and attention in children with ADHD.

Research on sensory integration stimulation for children with ADHD in Indonesia is still relatively limited. A study by the UGM research team (Puspa & Hidayati, 2024) showed that multimodal intervention consisting of behavioral therapy, multisensory stimulation, and psychoeducation for parents and teachers effectively reduced off-task behavior and increased on-task behavior in children with ADHD and sensory disorders. Other research confirms that sensory integration therapy is effective in improving concentration and changing behavior in children with ADHD (Watari et al., 2021; Lukman, 2021).

Based on this background, this study aims to analyze the effectiveness of implementing sensory integration stimulation in children with ADHD (hyperactivity) at Tahfidzul Qur'an Al Izzah Kindergarten, as well as to identify the types of stimulation applied and their benefits for child development. The novelty of this research lies in examining sensory integration stimulation in a tahfidz-based educational setting involving six sensory systems in an integrated manner.

2. Method

This study used a qualitative approach with a case study method. This approach allows researchers to explore and describe phenomena occurring in the field in depth (Creswell & Poth, 2018). The research was conducted over 3 months from May to August 2025 at Tahfidzul Qur'an Al Izzah Kindergarten, located at Jl. Komplek Patal No. 65, Pekayon Jaya Village, South Bekasi District, Bekasi City.

The research subjects were children indicated/suspected of having ADHD (hyperactivity) at Tahfidzul Qur'an Al Izzah Kindergarten. These data were obtained based on screening results or initial observations carried out in collaboration with a psychologist. The number of subjects in this study was 5 children, in accordance with qualitative research recommendations for special populations (Yin, 2018).

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Table 1. Research Instrument Grid

Aspect	Indicator	Data Source	Data Collection Technique	Instrument
Initial Identification	ADHD characteristics in children	Children, teachers, psychologists	Observation, interviews, and documentation of screening results	ADHD identification checklist based on DSM-5 (American Psychiatric Association, 2013); interview guide
Stimulation Process	Types of stimulation: proprioceptive, vestibular, tactile, auditory, visual, and olfactory	Teachers and children	Participatory observation and documentation	Observation sheets and field notes adapted from sensory integration framework (Bundy & Lane, 2020)
Child Development	Motor control, attention/focus, emotional regulation, and body awareness	Teachers, parents, and children	Periodic observation and in-depth interviews	Observation guide and semi-structured interview guide (Miles, Huberman, & Saldaña, 2020)

Data sources in this study consisted of primary and secondary data. Primary data were obtained directly from the first source through interviews with teachers and parents. Secondary data were obtained through indirect sources such as books, activity sheets, and official school documents. Data collection techniques included participatory observation, in-depth interviews, and documentation (Flick, 2022). Data analysis in this study used an interactive model consisting of three activity flows: data condensation, data display, and conclusion drawing/verification (Miles et al., 2020). Data validity was examined through source triangulation, technique triangulation, member check, and audit trail (Lincoln & Guba, 2021).

3. Results and Discussion

Initial Identification of Children with ADHD Characteristics

Based on the research results conducted at Tahfidzul Qur'an Al Izzah Kindergarten Bekasi with research subjects being kindergarten children identified with ADHD (hyperactivity), the initial planning stage involved preliminary discussions with classroom teachers to discuss children's behavior during learning activities. Identification was carried out by teachers based on DSM-5 criteria adapted in the child ADHD identification table (American Psychiatric Association, 2013).

Table 2. Child ADHD Identification (Adapted from DSM-5 APA Criteria, 2013)

No	ADHD Child Characteristics	Occurred (✓)	Never Occurred (✓)	Notes
1	The child appears not to listen when spoken to directly	✓		
2	The child has difficulty concentrating	✓		
3	The child has difficulty remembering and following instructions	✓		
4	The child is often forgetful in daily activities	✓		
5	The child appears confused and easily overwhelmed	✓		
6	The child has difficulty starting tasks and often does not complete them	✓		
7	The child avoids tasks requiring sustained mental effort	✓		
8	The child often procrastinates when completing tasks	✓		
9	The child talks excessively	✓		
10	The child interrupts others' conversations	✓		
11	The child answers before questions are completed	✓		
12	The child has difficulty waiting for their turn	✓		
13	The child becomes bored easily	✓		
14	The child appears overly excited	✓		
15	The child often makes inappropriate noises	✓		
16	The child is constantly moving as if driven by a motor	✓		
17	The child often intrudes or disrupts others' activities or play	✓		
18	The child frequently leaves their seat during class	✓		
19	The child has difficulty sitting still	✓		
20	The child is very energetic and almost always moving	✓		
21	The child runs or climbs in inappropriate situations	✓		
22	The child has difficulty playing quietly	✓		
23	The child often loses personal belongings	✓		
24	The child frequently fidgets with hands or feet	✓		

Based on these observation results, researchers coordinated with teachers and the school principal to conduct interviews with parents. After obtaining screening results from the psychologist, several children were found to require more optimal sensory stimulation (Miller et al., 2021).

Table 3. List of Children Identified with ADHD and Required Stimulation (Lane et al., 2022)

No	Child's Name/ Initial	Identified Sensory Issues	Required Sensory Stimulation
1	A A W	Speech delay, cognitive difficulties, balance problems	Vestibular, proprioceptive, auditory
2	K D A Z	Excessive motor activity, hypersensitivity to smells	Vestibular, proprioceptive, olfactory
3	M F	Physical–motor difficulties, cognitive challenges	Vestibular, auditory, visual, tactile

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No	Child's Name/ Initial	Identified Sensory Issues	Required Sensory Stimulation
4	O D	Motor movement difficulties, cognitive and speech problems	Vestibular, proprioceptive, auditory, tactile
5	U A Q	Motor movement difficulties, cognitive and speech problems	Vestibular, proprioceptive, auditory, visual

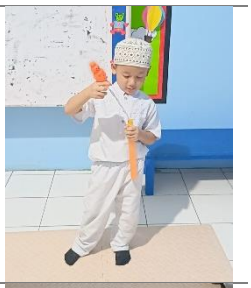
The obstacle encountered was the limited financial resources and time of parents for further therapy, so sensory integration stimulation could only be implemented at school (Dunst et al., 2019). This aligns with findings that parent-teacher collaboration is a key factor in intervention success (Friend & Bursuck, 2020).

Implementation of Sensory Integration Stimulation

The sensory stimulation conducted at Tahfidzul Qur'an Al Izzah Kindergarten referred to Ayres Sensory Integration principles (Schaaf & Mailloux, 2015) utilizing available tools or media at the school. Implementation was carried out over four weeks with a frequency of 3-4 times per week, in accordance with recent research recommendations (Parham et al., 2022).

Table 4. Implementation and Findings of Sensory Integration Stimulation (Roley et al., 2023)

Week	Activity Type	Type of Sensory Stimulation	Implementation Description	Research Findings	Documentation
I	Crawling and walking with added weight	Proprioceptive, Vestibular	Children crawl and walk while carrying light additional weight, accompanied by balance exercises.	Initially, children experienced coordination and balance difficulties. After repeated practice, hand–foot coordination and focus improved. This finding is consistent with Jung et al. (2024) regarding improvements in motor coordination.	
I	Directed dancing	Vestibular, Auditory	Children perform body movements following music rhythms and teacher instructions.	Children showed high enthusiasm. At first they had difficulty following the instructions, but gradually they were able to perform the movements independently.	
II	Sound detective	Auditory	Children listen to various sounds and identify or guess the source of the sounds played.	Initially, children had difficulty distinguishing sounds. However, after repeated practice, their focus and concentration	

Week	Activity Type	Type of Sensory Stimulation	Implementation Description	Research Findings	Documentation
				increased. This supports findings by Jeyanthi et al. (2025) regarding improvements in attention.	
II	Bubble play	Auditory, Visual, Tactile	Children blow soap bubbles and try to catch them using their hands.	Improvement was observed in visual tracking, eye–hand coordination, breath control, and both fine and gross motor skills.	
II	Rolling with blanket	Proprioceptive, Tactile	Children are gently rolled using a blanket and encouraged to get out of it independently.	Children appeared to feel safe, were able to recognize body boundaries, and showed improved sensory regulation (Grandin, 2020).	
III	Painting ice stones	Tactile, Visual, Fine Motor	Children paint ice stones while observing changes in shape and texture as the ice melts.	Children were highly enthusiastic. Hand–eye coordination improved, and creativity as well as sensory awareness developed.	
III	Balancing ball on plate	Vestibular, Visual, Proprioceptive	Children walk while balancing a ball on a plate without letting it fall.	Children demonstrated improved concentration, dynamic balance, and postural control (Kranowitz, 2020).	
III	Walking backward	Vestibular, Proprioceptive	Children walk backward following a straight line on the floor.	Initially, children were hesitant, but gradually they became more confident and focused while performing the activity.	
IV	Jumping from low height	Vestibular, Proprioceptive	Children jump from a low platform according	Children began to understand distance and body control. Balance improved	

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Week	Activity Type	Type of Sensory Stimulation	Implementation Description	Research Findings	Documentation
			to teacher instructions.	and postural stability increased. This finding supports Ali et al. (2024) regarding improvements in motor skills.	
IV	Shape guessing with eyes closed	Tactile, Visual–Spatial	Children guess the shapes of objects while their eyes are closed.	Children developed spatial awareness, sensory memory, and the ability to describe object characteristics.	
IV	Moving objects with feet	Proprioceptive, Vestibular	Children move objects using their feet without assistance from their hands.	Improvement was observed in sitting balance, focus, and leg muscle strength (Tejasvi & Kumar, 2024).	

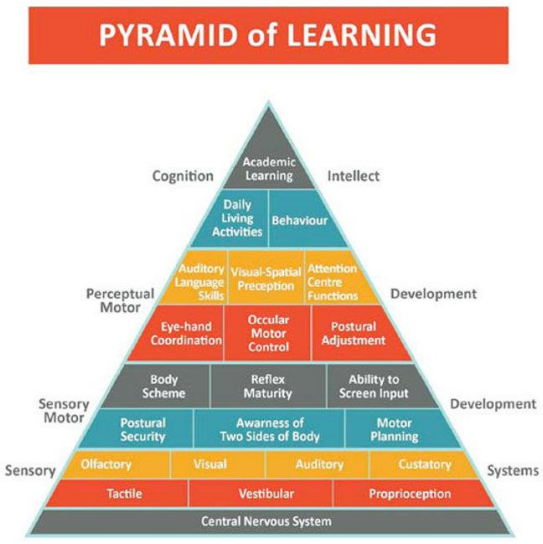

Figure 1. Learning Pyramid (Adapted from Williams & Shellenberger, 2020)

Activity Schedule Arrangement

The implementation of sensory integration stimulation was adjusted to the daily activity schedule at Tahfidzul Qur'an Al Izzah Kindergarten. Placing stimulation in core activities enables optimal integration in learning (Morrison, 2021).

Table 5. Schedule and Time Arrangement of Activities at Tahfidzul Qur'an Al Izzah Kindergarten

No.	Time	Activities
1	07:00–07:30	Student attendance and morning journaling activities
2	07:30–07:45	Lining up and preparation before entering the classroom
3	07:45–08:45	Morning *dhikr* and reading *Iqro'*
4	08:45–09:30	Worship habituation and *muroja'ah* (Qur'anic memorization review)
5	09:30–10:00	Snack time (break and eating together)
6	10:00–11:15	Core learning activities (basic skill development)
7	11:15–11:30	Recalling session and preparation for going home
8	11:30	Dismissal

Child Development After Stimulation

Based on the results of implementing sensory integration stimulation for four weeks, improvements were found in children's ability to maintain focus, regulate body balance, understand position and space, and control gross motor movements. These findings are consistent with recent randomized control trial results proving the effectiveness of sensory integration interventions (Pfeiffer et al., 2023).

Interview results with teachers confirmed these findings. Mrs. Najah Nabilah, Omar's homeroom teacher, stated: "The changes that occurred in Omar after the application of sensory integration stimulation, he was able to follow every teacher's instruction much better. He was also able to maintain focus better while learning." This aligns with the findings of Puspa & Hidayati (2024) regarding increased on-task behavior after multisensory intervention.

Mrs. Rini, Kaindra's parent, revealed: "*Alhamdulillah, now Kai is calmer when talked to. Usually when talked to, he would move his hands or feet, as if wanting to finish quickly. Now he can be slower, not in a hurry, and is willing to look into our eyes for a longer time*." This finding supports Watari et al. (2021) research on the effectiveness of sensory integration therapy in improving behavioral regulation.

Discussion

Based on the research results presented, the implementation of sensory integration stimulation showed improvement in children's focus, balance, motor control, and behavioral regulation abilities. This finding aligns with a recent randomized control trial study by Jeyanthi et al. (2025) which proved that task-oriented aerobic exercise combined with sensory integration provided significant improvement in aerobic capacity, sensory profile, and attention in children with ADHD. The study involved 42 children with ADHD and found significant differences between intervention and control groups ($p < 0.05$).

Findings in the first week showed that proprioceptive and vestibular sensory stimulation through crawling activities, walking with added weight, and directed dancing improved hand-foot movement coordination, balance, and children's focus. This is consistent with research by Jung et al. (2024) which found that Ayres Sensory Integration (ASI) intervention in preschool children with ADHD positively affected motor skills, particularly in manual

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coordination, body coordination, strength, and agility. This quasi-experimental study with 18 subjects proved significant improvement in the experimental group ($p < .05$).

In the second week, sound detective activities, bubble play, and rolling children with blankets showed improvement in children's ability to focus attention, recognize sensory stimuli, and regulate responses to stimuli. Research by the UGM research team (Puspa & Hidayati, 2024) on multimodal intervention in children with ADHD and sensory disorders found that multisensory stimulation effectively reduced off-task behavior and increased on-task behavior. This single case study with visual inspection analysis also showed decreased hyperactivity, impulsivity, and behavioral problems.

The blanket rolling activity provided deep pressure stimulation that can help improve sensory regulation and reduce hyperactive and impulsive behavior. A literature review by Ng (2023) confirmed that sensory integration helps in enhancing various aspects in children with ASD and ADHD, although more studies are still needed to prove its effectiveness scientifically. This review used a sensory integration development framework to explain the importance of "just-right" challenges in intervention.

Results from activities in the third week, such as painting ice stones, balancing balls on plates, and walking backward, showed improvement in eye-hand coordination, dynamic balance, and motor planning. A systematic review by Hodder, Cunfer, & Miller (2023) from Misericordia University found that sensory integration therapy provides interventions targeting seven senses and has been shown to help improve sensory integration, motor control, and executive function in children with ADHD. This review of 11 journal articles concluded that the implications of sensory integration interventions in therapy sessions would be beneficial for children with ADHD.

In the fourth week, activities such as jumping from low heights, shape guessing with eyes closed, and moving objects using feet showed improved spatial awareness, self-confidence, and children's ability to control behavior. Research by Tejasvi & Kumar (2024) developed a smart system to facilitate emotional regulation in neurodivergent children including ADHD. This study emphasized the importance of a sensory regulation system specifically designed for ADHD children's needs in regulating emotions and behavior through a reward-based system.

Research by Ali, Elsayed & Tawab (2024) on the impact of sensory and motor complementary programs in children with ADHD proved that the program was effective in reducing symptom severity. This study published in the Egyptian Journal of Health Care adds empirical evidence about the effectiveness of sensory and motor-based interventions in the ADHD population. These findings are consistent with our research results on decreased hyperactive behavior after intervention.

Ongoing research by Kaplan Kilic et al. (2024) at Hacettepe University, Turkey on the Effect of Ayres Sensory Integration Therapy in children with ADHD will make an important contribution to the literature. This randomized controlled trial study with 90 subjects examines the effect of ASI on sensory-motor, cognitive, behavioral skills, and social participation. Preliminary results indicate that children with ADHD experience difficulty perceiving and processing sensory stimuli, so interventions focusing on sensory-motor dimensions are essential.

Research by Mehrshahi & Mirzakhani Araghi (2025) on the effects of gradual reintroduction of architectural visual distractors on sensory profiles and visual attention in autistic children provides a new perspective on innovation in sensory integration therapy. Although focused on autism, these findings are relevant to the sensory integration approach in ADHD because both conditions often have comorbidity with sensory processing disorders. Sholeha et al. (2023) in their research at the Yamet Surabaya Child Development Clinic found a significant effect of sensory integration on gross motor changes in hyperactive children with a value of $p = 0.001$ ($p < 0.05$). This study strengthens evidence that sensory integration intervention is effective not only in clinical settings but also in educational settings.

Watari, Carmelita & Sasmithae (2021) in their research found that sensory integration therapy was effective in improving concentration and changing behavior in children with ADHD. Sensory integration is understood as a form of therapy that helps children process sensory input to respond to the environment more adaptively, including maintaining attention to tasks. Lukman (2021) in his research on the implementation of sensory integration therapy for hyperactive children emphasized the importance of parental involvement in intervention success. Children who received parental support at home showed more significant changes in behavioral regulation. The findings of this study confirm this, where children with actively involved parents showed more optimal development.

Azkiya (2021) in her research on sensorimotor play to improve concentration in children with ADHD found that interventions using various games involving physical activity could improve concentration, indicated by the ability to complete tasks, wait in line, and control voice. This study reinforces these findings by showing that structured sensory integration stimulation provides more targeted results. Bundy & Lane (2020) in the latest edition of the book Sensory Integration: Theory and Practice affirm that the vestibular and proprioceptive systems play a fundamental role in regulating posture, balance, and body awareness. Kranowitz (2020) in The Out-of-Sync Child third edition comprehensively explains the importance of early identification and appropriate intervention for children with sensory processing disorders. Grandin (2020) in her book The Way I See It explains that deep pressure stimulation works by activating the parasympathetic nervous system responsible for the body's relaxation response. Her personal experience as an individual with autism provides valuable insight into the importance of appropriate sensory input for emotional and behavioral regulation. Research by Dunst, Bruder, and Espe-Sherwindt (2019) on family capacity-building in early childhood intervention emphasizes that family involvement significantly increases program effectiveness. This is relevant to our research findings that parent-teacher collaboration is a key factor in intervention success.

Although most studies show positive results, there are several studies that have found non-significant results. A critical appraised topic by Buhrmeister, Laferriere & Wilson (2023) from Creighton University analyzed level I and II research on sensory-based interventions and found no significant evidence regarding school participation. This indicates that more research with strong methodology is still needed to prove the effectiveness of sensory integration interventions.

Based on the above discussion, it can be concluded that sensory integration stimulation carried out in a planned and sustainable manner positively impacts the development of focus,

balance, motor skills, and behavioral regulation in children. These findings support various recent studies stating that integrated sensory experiences are an important foundation in child development, particularly in children with special needs or developmental delays.

4. Conclusion

Based on the research results regarding the effectiveness of implementing sensory integration stimulation in children with ADHD (hyperactivity) aged 4-6 years at Tahfidzul Qur'an Al Izzah Kindergarten Pekayon, it can be concluded that the application of sensory integration stimulation proved effective in improving children's motor control ability and body balance. Sensory integration stimulation was able to improve children's focus and concentration during the learning process. There was an improvement in children's emotional and behavioral regulation abilities, where children who previously tended to be hyperactive and impulsive became calmer, able to control emotions, and showed more adaptive behavior. Sensory integration stimulation also helped improve children's body awareness and spatial perception, and positively impacted cognitive and language development. These findings are consistent with various recent studies proving the effectiveness of sensory integration interventions in children with ADHD.

This study recommends that sensory integration stimulation activities be systematically incorporated into the Daily Learning Implementation Plan (RPPH), and parents are advised to support the implementation of sensory integration stimulation at home. For future researchers, it is hoped that they can develop this study with a larger number of subjects, longer research duration, using a quasi-experimental design with a control group, as well as examining the application of sensory integration stimulation in other developmental aspects in accordance with recent research recommendations.

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