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SENSORY-BASED LEARNING TO ENHANCE CONCENTRATION IN AUTISTIC CHILDREN

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ABSTRACT

Children with autism spectrum disorder (ASD) often struggle with concentration due to sensory processing challenges, affecting their learning and emotional regulation. This study aimed to examine the implementation of a sensory-based learning model to enhance concentration in children with ASD who also exhibit moderate intellectual disability. Conducted at SLB Harapan Bunda, Surabaya, Indonesia, the research applied a qualitative case study approach, collecting data through observation, interviews, and documentation between May and June 2025. Results show that structured sensory activities—including vestibular, proprioceptive, tactile, and motor exercises such as balance tasks, trampoline jumping, swing therapy, and coordination training—significantly improved attention span, emotional regulation, and classroom engagement. Concentration increased from 3–5 minutes to 15–20 minutes, and impulsive behaviors were reduced. These findings demonstrate that sensory-based learning effectively supports autistic children's readiness to learn and classroom participation. Successful implementation depends on teacher expertise, appropriate facilities, and collaboration with parents.

Keywords: sensory-based learning, autism spectrum disorder, concentration, moderate intellectual disability, sensory integration

1. INTRODUCTION

Children with autism spectrum disorder (ASD) often face significant challenges in sustaining attention, regulating emotions, and participating effectively in structured classroom activities. These difficulties are closely related to deficits in sensory processing, which influence how they perceive, interpret, and respond to stimuli from their environment. Sensory processing challenges frequently manifest as limited concentration, maladaptive behaviors, repetitive movements, and resistance to instructional routines, all of which impede academic progress and social development.

Sensory-based learning, grounded in Ayres' Sensory Integration Theory (1979) offers a promising approach to addressing these challenges. Sensory integration is a neurological process that enables the brain to organize and interpret sensory input—such as vestibular (balance and movement), proprioceptive (body awareness), and tactile (touch) stimuli—to produce appropriate functional responses. When this process is disrupted, children may exhibit sensory-seeking or sensory-avoidant behaviors, hyper- or hypo-responsiveness, and difficulties sustaining attention. By incorporating structured sensory input into the learning environment, sensory-based interventions aim to regulate the nervous system, improve readiness to learn, and

foster more adaptive behaviors.

Building on Ayres' foundational work, Dunn's Sensory Processing Framework (2001) further explains individual differences in sensory responsiveness. Dunn categorizes sensory processing patterns into four types; sensory seeking, sensory avoiding, sensory sensitivity, and low registration, each influencing how children react to stimuli and engage with their surroundings. For instance, children with sensory-seeking profiles may require more intense sensory input to achieve a state of alertness, whereas those with low registration may need more frequent and salient cues to remain attentive. Understanding these profiles is essential for designing interventions that align with the unique sensory needs of each child.

Existing research supports the effectiveness of sensory-based approaches in improving learning outcomes for children with ASD. Schaaf et al. (2014) demonstrated that targeted sensory interventions enhance attention span and reduce maladaptive behaviors, while Baranek (2002) highlighted their role in improving adaptive functioning and emotional regulation. Additionally, studies emphasize that vestibular and proprioceptive activities—such as swinging, balancing, and deep- pressure exercises—can significantly reduce anxiety and improve engagement in learning tasks. These findings underscore the importance of embedding sensory strategies within educational practices, particularly for students with dual diagnoses, such as ASD and moderate intellectual disability.

The ability to concentrate is a crucial foundation for academic success, yet many autistic children maintain focus for only short periods, often 3–5 minutes, before becoming distracted or engaging in self-stimulatory behaviors. Traditional classroom strategies frequently overlook the sensory roots of these behaviors, leading to limited effectiveness. Sensory-based learning, by contrast, targets the neurological mechanisms underlying attention and self-regulation, enabling children to engage more meaningfully in academic and social activities.

This study aims to examine the implementation of a structured sensory-based learning model to enhance concentration among children with ASD and moderate intellectual disability. Conducted as a qualitative case study at SLB Harapan Bunda in Surabaya, Indonesia, the research explores the design, execution, and outcomes of a classroom-based sensory intervention program. By documenting the processes and effects of sensory-based strategies, the study seeks to provide evidence-based insights for educators, therapists, and parents on how such interventions can improve focus, emotional regulation, and participation in learning. The findings are expected to advance understanding of sensory-based pedagogy as a core approach in special education and to inform the development of more responsive and individualized teaching practices.

2. METHODOLOGY

2.1 Research Design

This study employed a qualitative case study approach to explore the implementation of a sensory- based learning model and its impact on the concentration and classroom engagement of children with autism spectrum disorder (ASD). The qualitative design was chosen to gain an in-depth understanding of the phenomena within a real-life educational context, allowing for rich, detailed descriptions of individual experiences and behavioral changes (Yin, 2018; Creswell, 2014)). The case study approach was particularly appropriate given the study's focus on a single participant, enabling a holistic exploration of the intervention process, contextual

factors, and observed outcomes.

2.2 Research Site and Duration

The research was conducted at SLB Harapan Bunda, a special needs school in Surabaya, Indonesia, which provides educational services for children with diverse developmental needs. The study took place over a period of two months, from May to June 2025, during which structured sensory- based interventions were implemented as part of the student's daily classroom routine.

2.3 Participant

The subject of this study was one student aged 7–12 years diagnosed with autism spectrum disorder accompanied by moderate intellectual disability. The participant was selected using purposive sampling based on the following criteria: (1) identified difficulties in sustaining attention during learning tasks, (2) observable maladaptive behaviors (e.g., repetitive actions, withdrawal, or emotional dysregulation), and (3) recommendation from the classroom teacher for sensory-based intervention. Ethical considerations were observed throughout the research process, and informed consent was obtained from the child's parents prior to participation.

2.4 Research Focus

The study focused on examining:

a. The implementation process of the sensory-based learning model, including the planning, structure, and adaptation of activities.
b. The observed effects of sensory-based interventions on the child's concentration, emotional regulation, and classroom engagement.

2.5 Data Collection Techniques

Data were collected using three complementary methods to ensure depth and triangulation:

a. Participant Observation: The researcher conducted direct observations during sensory activities and classroom sessions, focusing on behavioral changes, engagement levels, attention span, and responses to stimuli. Observations were documented using structured field notes and behavioral checklists.
b. In-Depth Interviews: Semi-structured interviews were conducted with the classroom teacher and the child's parents to gather insights into behavioral changes, learning progress, and perceptions of the intervention's effectiveness.
c. Documentation: Supporting data were collected from photographs, session logs, progress records, and samples of the child's classroom work, providing additional evidence of behavioral and learning outcomes.

2.6 Data Analysis

Data were analyzed using Miles and Huberman's qualitative analysis framework (1994), which involves three key stages:

a. Data Reduction: Organizing and coding observational notes, interview transcripts, and documentation to identify recurring themes related to sensory processing, attention, and behavior.

b. Data Display: Presenting the categorized data in matrices and descriptive narratives to illustrate patterns and relationships.
c. Conclusion Drawing and Verification: Interpreting the findings by linking them to theoretical frameworks [7] and validating conclusions through data triangulation and member checking.

2.7 Data Trustworthiness

To ensure the validity and reliability of the findings, multiple strategies were employed:

a. Triangulation: Cross-verification of data from different sources (observations, interviews, documentation) and methods.
b. Member Checking: Confirmation of interpretations and findings with participants (teachers and parents) to ensure accuracy and credibility.
c. Prolonged Engagement and Persistent Observation: Multiple observation sessions were conducted over several weeks to capture consistent behavioral patterns.
d. Audit Trail: Detailed documentation of the research process, data collection instruments, and analysis procedures was maintained to support transparency and replicability.

3. RESULTS AND DISCUSSION

3.1 Concentration Improvement

The participant, referred to as **S**, was initially observed to demonstrate an attention span of only 3–5 minutes before disengaging from tasks. Frequent behaviors included daydreaming, running aimlessly, or engaging in repetitive actions such as touching objects and laughing to herself. Following the structured sensory-based intervention, S's concentration span increased significantly, averaging 15–20 minutes of sustained focus. This improvement was particularly evident during activities that required seated engagement, such as coloring or completing fine-motor tasks, which she was able to finish with minimal distraction.

The increase in focus duration supports Ayres' sensory integration theory, which posits that vestibular and proprioceptive inputs enhance neural regulation and readiness for learning. Sensory activities such as trampoline jumping, swinging, and balance training appeared to provide S with the necessary regulation to engage with academic tasks. Dunn's sensory processing framework also provides an explanation: S exhibited a **low registration** profile before intervention, failing to notice or respond to stimuli; however, after targeted sensory input, she was able to sustain attention and respond more effectively to instructional cues.

3.2 Emotional Regulation and Behavior Modification

Before the intervention, S frequently displayed emotional dysregulation, including crying, lying on the floor, or sudden outbursts of laughter that disrupted learning sessions. These maladaptive behaviors were often triggered by frustration or overstimulation in the classroom. After two weeks of routine sensory sessions, a noticeable reduction in such behaviors was observed. S demonstrated calmer affect, was more cooperative with teacher instructions, and displayed fewer signs of frustration when confronted with challenging tasks.

The teacher emphasized that activities involving **deep pressure (brushing and proprioceptive input)** contributed to stabilizing S's mood. For instance, after receiving deep

pressure input, she was more willing to sit calmly and transition into academic tasks. These findings align with Schaaf et al (2014), who demonstrated that sensory-based occupational therapy interventions improve both regulation and participation in children with autism.
The observed changes also correspond to Kranowitz's (2005) practical recommendations for sensory diets, where consistent sensory input throughout the day helps modulate arousal levels and reduce maladaptive behaviors.

3.3 Classroom Engagement and Task Performance

Improvements were not limited to attention span and emotional stability; classroom engagement also increased significantly. Prior to intervention, S often ignored teacher instructions, responding to less than 30% of verbal prompts. Following the intervention, her response rate improved to more than 70%, with observable increases in task completion and cooperation during group activities.

For example, S was able to remain seated for 15 minutes to complete a coloring task, whereas previously she had abandoned such tasks within 5 minutes. Similarly, when given motor tasks such as stringing beads or copying letters, she demonstrated improved persistence and accuracy.

The impact of vestibular and proprioceptive activities on engagement is supported by Baranek (2002), who found that structured sensory activities enhance adaptive classroom behaviors. By reducing the internal drive for repetitive self-stimulatory behaviors, sensory interventions freed cognitive and emotional resources for academic participation.

3.4 Teacher and Parent Perspectives

Interviews with the teacher highlighted that activity planning was guided by an **Individualized Education Plan (IEP)** and tailored to S's sensory profile. The teacher reported that S responded particularly well to vestibular activities such as swinging and trampolining, which served as preparatory activities before academic instruction. She emphasized that flexibility was key; when S resisted participation, she was given time to self-regulate rather than being forced.

Parents reported observable changes at home as well, noting that S was calmer, less restless, and more cooperative with daily routines. They expressed satisfaction with the intervention and confirmed their commitment to supporting sensory activities at home, such as trampoline play and tactile games.

Both teacher and parent perspectives underscore the importance of collaboration, echoing Dunn's (1997) assertion that sensory strategies must be embedded across contexts to be effective.

3.5 Theoretical Implications

The results reinforce several key theoretical frameworks. First, Ayres' sensory integration theory (1972, 1979) is supported by evidence that vestibular and proprioceptive stimulation improved S's neural regulation, leading to enhanced concentration and emotional balance. Second, Dunn's sensory processing framework (1997, 2001) is validated, as the intervention targeted S's **low registration and sensory-seeking behaviors**, enabling more adaptive responses. Third, alignment with Schaaf et al. (2014) and Kurniawan & Juvita (2019)

demonstrates that structured sensory interventions can be integrated into educational contexts to promote engagement and task persistence.

These findings contribute to the broader discourse on sensory-based pedagogy, highlighting that sensory activities are not merely therapeutic but also pedagogical tools that directly support learning readiness in autistic students with additional intellectual disabilities.

Table 1. Behavioral Indicators Before and After Intervention

Aspect	Before Intervention	After Intervention
Focus on tasks	3–5 minutes	15–20 minutes
Response to instruction	Low (<30%)	High (>70%)
Sensory behaviors	Frequent (repetitive, disruptive)	Rare (occasional, manageable)
Emotional regulation	Unstable (crying, lying down)	Stable (calmer, cooperative)

Table 2. Summary of 12 Sensory Activities and Indicators

Activity	Purpose	Key Indicators of Progress
Praxis imitation	Motor planning and sequencing	Ability to imitate gestures accurately
Obstacle course	Balance and gross motor coordination	Completion without falling/distraction
Balance beam (papan titian)	Vestibular focus and balance	Walks across without losing balance
Swing	Emotional regulation, calming effect	Sits calmly afterward, reduced agitation
Bilateral coordination	Synchronization of left-right movements	Completes cross-lateral movements
Proprioceptive ball activities	Body awareness, adaptive response	Maintains stability when pushed gently
Fine and gross motor tasks	Visual-motor integration, muscle strength	Accuracy in tracing, stringing beads
Reflex and response training	Adaptive reaction to position changes	Timely response to sudden movement
Attention with distraction	Sustained focus amid noise stimuli	Maintains focus despite minor disruptions
Trampoline exercises	Vestibular stimulation, focus, strength	Jumps rhythmically while naming colors
Rope/ladder climbing	Core strength, confidence, coordination	Climbs independently with minimal support
Jumping in hoops	Motor planning, visual focus	Jumps sequentially as instructed

Overall, the sensory-based learning model produced significant improvements in S's

concentration, emotional regulation, and classroom participation. The combination of structured sensory activities, individualized planning, and collaborative support from teachers and parents proved effective in addressing both sensory and behavioral challenges. The findings affirm that sensory-based approaches can serve as integral components of special education practice, supporting not only therapy goals but also pedagogical outcomes in children with autism spectrum disorder and intellectual disability.

4. CONCLUSIONS

4.1 Conclusion

This study demonstrated that the implementation of a sensory-based learning model can significantly enhance the concentration, emotional regulation, and classroom engagement of children with autism spectrum disorder (ASD), particularly those with co-occurring moderate intellectual disabilities. Through structured sensory interventions—including vestibular, proprioceptive, tactile, and motor activities—the participant, referred to as S, exhibited meaningful improvements in attention span, behavioral control, and learning readiness.

Prior to the intervention, S demonstrated limited focus (3–5 minutes), frequent maladaptive behaviors such as repetitive movements and emotional outbursts, and low responsiveness to instructional cues (<30%). After consistent participation in a two-month sensory-based program, S's attention span increased to 15–20 minutes, responsiveness to instructions improved to over 70%, and maladaptive sensory behaviors significantly declined. The participant also displayed enhanced emotional stability, a greater ability to complete structured tasks, and improved adaptability within the classroom environment.

The results strongly support the foundational theories of Ayres' Sensory Integration Theory (1972, 1979) and Dunn's Sensory Processing Framework (1997, 2001), which emphasize the critical role of sensory input—particularly vestibular, proprioceptive, and tactile stimulation—in fostering self- regulation and attention in children with sensory processing difficulties. Furthermore, these findings align with previous empirical research (e.g., Schaaf et al., 2014; Baranek, 2002) that demonstrates the efficacy of sensory interventions in improving functional engagement and learning outcomes among children with ASD.

Overall, this study highlights that sensory-based learning is not merely a supportive therapy but a fundamental pedagogical approach in special education settings. When systematically integrated into classroom routines, it can transform learning experiences, reduce maladaptive behaviors, and promote sustained engagement. However, successful implementation requires careful assessment of each child's sensory profile, individualized activity design, and consistent collaboration among educators, therapists, and families.

4.2 Suggestions

For Teachers and Schools:

- Schools should provide regular professional development for teachers and therapists to deepen their understanding of sensory integration principles, assessment methods, and classroom-based intervention strategies.
- Educational institutions should invest in dedicated sensory rooms or flexible learning spaces equipped with appropriate materials (e.g., swings, trampolines, balance boards) to support diverse sensory needs and optimize intervention effectiveness.

- Sensory-based approaches should be integrated into the daily curriculum and individualized education plans (IEPs) to ensure consistent stimulation and skill development across learning contexts.

For Parents and Families:

- Active parental involvement is essential for reinforcing progress at home. Parents are encouraged to incorporate simple sensory activities—such as light massage, play with textured materials, or mini-trampoline exercises—into daily routines.
- Regular communication between parents and educators is vital to ensure continuity of strategies and monitor the child's progress collaboratively.

For Future Researchers:

- Future studies should involve larger sample sizes and longer intervention periods to examine the long-term effects of sensory-based learning on various developmental domains, including social communication and adaptive functioning.
- Researchers should also develop standardized assessment instruments tailored to sensory integration outcomes to facilitate more precise and quantitative evaluations of intervention effectiveness**.**

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