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RESPONDING TO THE GAP IN AUTISM THERAPY CENTER IN MEDAN THROUGH AN ASPECTSS-BASED DESIGN

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Abstract

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that affects communication, social interaction, and behavioral regulation. Effective intervention for children with ASD often involves structured behavioral therapy, which can be significantly improved through thoughtfully designed therapeutic environments. As one of the largest cities in Indonesia, Medan provides several existing therapy facilities; however, many of these spaces lack sensory-responsive and structured architectural planning, limiting their ability to support emotional regulation, focus, and behavioral development in children with ASD. A child-focused autism therapy center in Medan that adopts the ASPECTSS Autism Design Framework aims to create a sensory-safe, organized, and supportive environment that goes beyond basic functionality, actively contributing to therapeutic success. By strategically integrating architectural elements such as spatial sequencing, acoustics, lighting, material tactility, room configuration, and controlled sensory transitions, the design can create a calming yet developmentally responsive setting aligned with the unique needs of children with ASD.Through the application of an evidence-based design approach, the built environment becomes a therapeutic tool that enhances learning, comfort, engagement, and developmental outcomes, ultimately supporting a more holistic and effective intervention experience for children on the autism spectrum.

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1. Introduction

The neurological disorder known as autism spectrum disorder (ASD) has an impact on behavior, social interaction, and communication (WHO, 2021). It is believed that 1 in 127 people worldwide are disabled. An estimated 2.4 million youngsters in Indonesia have been reported to be autistic. Based on global prevalence statistics, an estimated 4,350 children in Medan, which has a population of 2.54 million and about 553,000 children, may have ASD, while the actual number could be higher owing to underreporting (UN, 2022).

Based on preliminary mapping, Medan has around 18 therapy centers. However, many facilities lack proper architectural planning that addresses sensory, spatial, and behavioral needs. According to research by Mostafa (2014) and Salmina (2024), children with ASD may find it difficult to focus, feel comfortable, and control their emotions in disorganized situations.

Beyond spatial issues, family involvement plays a crucial role. According to research, there is a substantial link between parenting styles and behavioral outcomes, and parent training significantly improves child development and family well-being (Purnamasari et al., 2020; Deb et al., 2020).Additionally, adaptive physical activity has been proven to improve motor skills, emotional stability, and social behavior; however, such facilities are limited in Medan (Bremer et al., 2016; Luo et al., 2024).

To address these gaps, our proposal adopts Mostafa's (2014) ASPECTSS autism design framework, integrating sensory-adaptive architecture, inclusive therapy programs, parent

training, and adapted sports spaces. Evidence-based therapies, such as Applied Behavior Analysis (ABA) is used to meet holistic and long-term developmental goals.

2. Literature Review

2.1 Therapy Center

A Therapy Center is a dedicated facility that provides developmental and rehabilitative services designed to support the cognitive, emotional, social, and physical growth of children with autism. According to the American Occupational Therapy Association (AOTA, 2021), effective therapy environments must support adaptive behavior, sensory regulation, and social interaction within a structured and safe setting.

2.2 Autism

The term *autism* originates from the Greek *autos* (self) and *ism* (a condition or state), describing individuals who tend to retreat into their own internal world (Suryana, 2014). Leo Kanner (1943) was the first to define autism as a developmental condition characterized by impaired social interaction, communication challenges, repetitive behaviors, and insistence on routine (Dawson & Castelloe, 2007).

Autores such as Handojo (2008) and Gayatri Pamoedji (2007) further emphasize autism as a complex neurodevelopmental disorder that appears early in childhood and affects communication, emotion, and social behavior.

Classification of Autism

According to Prasetyono (2008), autism belongs to the group of *Pervasive Developmental Disorders (PDD)*, consisting of:

1. Childhood Autism – Appears before age three; characterized by difficulties in communication, social interaction, and repetitive behavior.
2. PDD-NOS – A milder form with partial but not full diagnostic criteria.
3. Rett Syndrome – Primarily affects girls and involves regression after initially normal development.
4. Childhood Disintegrative Disorder – Marked by a sudden and severe loss of previously acquired skills.
5. Asperger Syndrome – Individuals have normal or high intelligence with significant social communication difficulties.

Causes of Autism

The exact cause of autism remains uncertain. However, several researchers (Gayatri Pamoedji, 2007; Prasetyono, 2008; Handojo, 2008) agree that autism is multifactorial, involving:

- Central nervous system abnormalities
- Genetic predisposition
- Exposure to heavy metals (mercury, lead)
- Prenatal complications
- Birth trauma or oxygen deprivation
- Exposure to toxins or food-related triggers post-birth

Thus, autism is regarded as a complex interaction between genetic and environmental factors.

Characteristics of Children with Autism

Based on Mirza Maulana (2009) and Handojo (2008), common autism characteristics

Table 1 Characteristic of Autism

Domain	Description
Communication	Echolalia, delayed speech, difficulty understanding meaning
Social Interaction	Avoiding eye contact, lack of interest in peers

Sensory Processing	Oversensitivity to sound or touch, unusual pain response
Play Behavior	Repetitive or non-imaginative play
Motor Behavior	Repetitive movements, insistence on routines
Emiotion & Behavior Regulation	Tantrums, aggressive outbursts, difficulty expressing emotions

Types of Autism Therapy

1. Medical-Based Therapy

These approaches address biological and neurological imbalances affecting behavior and regulation, including:

- Psychopharmacology (reducing hyperactivity, sleep disorders, aggression)
- Risperidone therapy (behavioral regulation and aggression control)
- Olanzapine therapy (stabilizing mood and sensory perception)
- Biomedical interventions (dietary adjustments, supplements, detoxification strategies)

2. Non-Medical Therapy

According to Aris Sudiyanto (2012), non-medical therapies strengthen functional, social, and sensory abilities, including:

- Social Stories
- Occupational Therapy
- Speech Therapy
- Music Therapy
- Visual Therapy
- Applied Behavioral Analysis (ABA)
- Snoezelen Multisensory Therapy
- Yoga Therapy
- Dolphin-Assisted Therapy

2.3 ASPECTSS Design

ASPECTSS™ is an evidence-based architectural framework developed by Magda Mostafa (2014) to support individuals with Autism Spectrum Disorder (ASD). The acronym represents seven core environmental design principles: **A**coustics – **S**patial Sequencing – **P**redictability & Escape Space – **E**nclosure/Compartmentalization – **T**ransition Zones – **S**ensory Zoning – **S**afety.

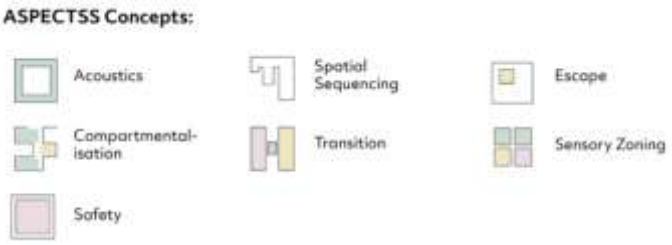

Figure 1 ASPECTSS Concepts

1. Acoustics

The Acoustics principle emphasizes the importance of controlling the sound environment to minimize background noise, reverberation, and echo—factors that can trigger stress, overstimulation, or difficulty maintaining focus among individuals with autism. Acoustic regulation must align with both the functional characteristics of each space and users' sensory thresholds. High-focus environments (such as learning rooms or therapy spaces) should be

placed within low-stimulus acoustic zones. However, to prevent the "greenhouse effect"—a condition in which users become overly dependent on silence and struggle in real-world environments—sound control should be implemented gradually, allowing individuals to transition from highly controlled spaces toward near-normal acoustic conditions over time.

Design Interventions for Acoustic Control

1. Master Planning Scale

Low-stimulation zones such as classrooms, libraries, therapy rooms, and residential spaces should be located away from high-noise generators (main roads, play courts, workshops, or sport facilities). Where external noise is unavoidable, mitigation strategies may include high-performance wall insulation, acoustical block systems, acoustic floor and wall layers, double-glazed windows, and soft barrier materials such as acoustic drapery.

2. Interior Scale – Macro Level

Large interior spaces can be categorized into three acoustic groups:

Table 2 Macro Level

Space Category	Example Uses	Accoustic Protection Priority
Low-stimulation zones	Libaries, therapy rooms, study rooms	Highest
High-stimulation zones	Cafeterias, multipurpose halls, lounges	Moderate (with optional personal strategies)
Transition Zones	Corridors, lobbies	Moderate to high depending on adjacency

Common design elements include:

- Acoustic wall panels (potentially multifunctional as display boards)
- Carpeted or acoustic vinyl flooring
- Ceilings with absorptive tiles, baffles, or suspended sound diffusing elements

3. Interior Scale – Micro Level

Within larger rooms, sensory retreat zones should be provided. These can take the form of:

- Enclosed or semi-enclosed acoustic pods for focused work or rest
- Mobile acoustic partitions, enabling flexible reconfiguration based on sensory demand

4. Spatial Geomatry & Configuration

Whether renovating or designing a new facility, spatial geometry must reduce echo and uncontrolled sound reflection. Strategies include:

- Avoiding parallel hard surfaces
- Introducing angle variations, partitions, or suspended panels to disrupt sound bounce patterns
- Designing ceiling height and room proportions according to the function and level of sensory stimulation required

5. Operational/User Level

For individual support, noise-cancelling headphones serve dual roles: they reduce sensory overload and also function as a social cue, signaling withdrawal or a need for reduced interaction, supporting autonomy and emotional regulation.

2. Spatial sequencing

Spatial sequencing is a design principle that organizes spaces in a clear, logical, and predictable order to support the needs of autistic individuals, particularly their preference for routine and consistency. By structuring spaces according to daily activities and sensory levels, it creates a smooth and understandable flow throughout the environment.

The main goal is to reduce anxiety by avoiding sudden changes and providing a sense of security. At the same time, it helps improve focus and comfort by guiding users through a clear movement pattern, allowing them to navigate spaces independently without confusion.

In practice, spatial sequencing often uses a one-way circulation system, supported by transition zones that help users gradually adjust between different activities or sensory intensities. This approach can be applied at different scales, from organizing shared interior spaces based on activity intensity, to arranging entire buildings or campuses from public to private zones.

A common model follows a sensory gradient, moving from active and social areas toward quieter and more private spaces. Importantly, the design should maintain continuous access throughout the sequence and include alternative routes, so users can bypass busy areas and reach calmer environments more directly when needed.

3. Escape Space (Sensory Retreat Room)

Escape spaces are dedicated areas designed to help autistic and neurodivergent individuals recover from sensory overload. They provide a safe environment for emotional and sensory regulation, reducing anxiety and supporting better focus and well-being.

These spaces should be sensorily neutral, with minimal stimuli and adjustable features to suit different needs. Key design aspects include strong acoustic control, soft or natural lighting, calm color palettes, and minimal visual clutter. They are typically small, accommodating around 1–5 users, and must be easily accessible while maintaining privacy.

Escape spaces can take various forms, such as enclosed pods, small quiet rooms, screened seating areas, or calm outdoor spots like gardens. Importantly, they are distributed throughout the environment and designed as a gradient—from more enclosed to more open settings—allowing users to gradually regulate their sensory experience and transition back to everyday activities without dependency.

4. Compartmentalization

Compartmentalization in ASPECTSS is the organization of space into clearly defined “sensory zones,” where each area has a single function and consistent sensory qualities. This helps autistic users easily understand how to use a space and what to expect, reducing confusion and anxiety.

Separation between zones does not always require walls; it can be achieved through subtle design strategies such as changes in color, material, lighting, or the use of vegetation. These elements create clear yet flexible boundaries that guide behavior and perception.

In outdoor settings, compartmentalization improves safety and clarity by separating different users (e.g., pedestrians, cyclists) through textures or soft barriers. In interiors like classrooms, it allows flexible learning zones with distinct visual cues.

Overall, this approach reduces sensory overload, enhances predictability, and gives users a greater sense of control over their environment.

5. Transition zones

Transition zones in ASPECTSS are spaces that help autistic individuals adjust when moving between areas with different sensory levels. They act as sensory buffers, allowing users to calm down or prepare before entering a new environment.

These zones should be placed wherever there is a shift in stimulation, such as from busy public areas to quieter learning spaces. For example, entrances to buildings can include neutral, calming areas to reduce stress from external sensory overload.

Transition spaces can take forms like shaded seating areas, softly lit spaces, or areas with natural elements such as plants and good airflow. Overall, they improve sensory flow, reduce stress, and support a more comfortable and inclusive environment.

6. Sensory zoning

Sensory zoning organizes spaces based on levels of stimulation rather than just function, grouping high- and low-stimulus areas with transition zones in between. This helps autistic users adjust gradually and reduces sensory overload.

It can be applied at different scales: separating active and quiet areas in shared spaces, dividing high- and low-stimulus rooms within buildings, and placing noisy facilities away from calm academic zones at the campus level. Overall, it creates a more comfortable, intuitive, and inclusive environment.

7. Safety

Safety in ASPECTSS focuses on both physical and psychological protection for autistic users. Materials should be durable and non-hazardous, such as non-slip flooring and rounded edges, while also considering sensory sensitivities.

Spaces should follow a clear hierarchy of access, from public to private, supported by appropriate security systems. At the same time, monitoring must balance safety and privacy—especially in retreat spaces—by providing features like emergency buttons and discreet communication access.

3. Method

Data collection in this study was conducted through a combination of literature review, digital surveys using Google Maps and Google Photos, case studies, and comparative studies in order to gather both theoretical and contextual references related to therapeutic architecture, autism facilities, and spatial design strategies. The data were then analyzed through building typology analysis covering space requirements, zoning, connectivity, and service capacity, as well as site analysis including building regulations, existing site conditions, and local climate factors to inform the design process.

4. Design Location

The site is located on Jalan Jenderal Besar A.H. Nasution, Harjosari II, Medan Amplas District, Medan City, North Sumatra. The land is currently vacant and covered with wild grass, shrubs, and several existing trees.The site is currently a vacant land covered with wild vegetation and grass, with relatively flat topography, making it easier for planning and construction. The land contour is minimal, requiring only slight leveling or filling.

The location has good accessibility and can be reached by public transportation, private vehicles, and pedestrians. Since Hikari Therapy Center targets middle to upper-income users, this site was selected as it is surrounded by middle to upper-class residential areas. The site is situated in a strategic area close to educational institutions, places of worship, and hospitals, making it suitable for an inclusive therapy and educational facility.Its proximity to universities, schools, and hospitals adds significant value, strengthening its role as a center for learning, therapy, and training for children with special needs, while also serving as a platform for inclusive community interaction.

Figure 2 Site Location

5.Conclusion

The lack of therapy facilities in Medan that truly consider the sensory needs of children with autism shows that architecture still has a big role to play in supporting their development. This study proposes the Hikari Therapy Center as a response to that issue by applying the ASPECTSS design approach.

The design focuses on creating spaces that are easy to understand, comfortable, and not overwhelming. By arranging spaces based on activity and sensory levels, and by providing elements such as quiet rooms, transition areas, and controlled sound environments, the center is expected to help users feel calmer and more focused during therapy.

The chosen site also supports this idea, as it is easy to access and surrounded by facilities like schools and hospitals. This makes the therapy center not only a place for treatment but also part of a wider support system for the community.

This study highlights the potential of architecture as an active contributor to therapy rather than merely a supporting backdrop. The Hikari Therapy Center demonstrates how thoughtful, sensory-oriented design can improve the quality of care and create more inclusive environments, while also providing valuable insights for future developments in autism-focused architecture.

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Hopefully, this article can provide meaningful contributions to the development of inclusive architectural design, particularly in creating therapeutic environments that are responsive to the needs of individuals with autism.

References

References use Vancouver style with numbering order as follow:

[1] World Health Organization. Autism spectrum disorders. Geneva: WHO; 2021.

[2] United Nations. World population prospects and autism prevalence estimates. New York: UN; 2022.

[3] Mostafa M. Architecture for autism: Autism ASPECTSS™ in school design. Int J Archit Res. 2014;8(1):143–158.

[4] Salmina D. Sensory-responsive design for autism therapy environments. J Archit Behav Stud. 2024;12(2):45–56.

[5] Purnamasari I, et al. Parenting style and behavioral outcomes in children with autism. J Child Dev. 2020;15(3):210–218.

[6] Deb S, et al. Parent training and its impact on autism intervention outcomes. Autism Res. 2020;13(5):789–798.

[7] Bremer E, Crozier M, Lloyd M. A systematic review of the behavioural outcomes following exercise interventions for children with autism spectrum disorder. Autism. 2016;20(8):899–915.

[8] Luo X, et al. Effects of adaptive physical activity on children with autism. Int J Dev Disabil. 2024;70(1):22–30.

[9] American Occupational Therapy Association. Occupational therapy practice guidelines for children and youth with autism. Bethesda: AOTA; 2021.

[10] Suryana D. Pendidikan anak berkebutuhan khusus. Jakarta: Prenada Media; 2014.
[11] Kanner L. Autistic disturbances of affective contact. Nerv Child. 1943;2:217–250.
[12] Dawson G, Castelloe P. Autism. In: Encyclopedia of cognitive science. New York: Wiley; 2007.
[13] Handojo Y. Autisme pada anak: Diagnosis dan penanganan. Jakarta: Bhuana Ilmu Populer; 2008.
[14] Pamoedji G. Autisme: Panduan praktis untuk orang tua. Jakarta: Gaya Favorit Press; 2007.
[15] Prasetyono D. Serba-serbi anak autis. Yogyakarta: Diva Press; 2008.
[16] Maulana M. Mengenal autisme dan penanganannya. Yogyakarta: Katahati; 2009.
[17] Sudiyanto A. Terapi non-medis pada anak autis. Surakarta: UNS Press; 2012.