Journal of Design and Built Environment
E-ISSN: 2232-1500 |Print ISSN: 1823-4208
https://ejournal.um.edu.my/index.php/jdbe
Volume 25, Issue 01, 2025, 01-16

Sensory Design Towards the Built Environment for Autism: An Assessment of the Physical Environment of the Selected Shopping Centers in Davao City Through Autism ASPECTSS Design Index

Joshua O. Mangmang [1] and Nurvin Zary E. Bustillo[1*]

[1] College of Architecture and Fine Arts Education, University of Mindanao, Philippines.

*Corresponding author: nurvin_bustillo@umindanao.edu.ph

Article Info:
Submission date: 26th March 2024
Acceptance date: 10th April 2025

Keywords:
Autism, Shopping Center, Sensory Design, Built Environment, ASPECTSS

Abstract

The rising number of individuals with autism spectrum disorder (ASD) highlights the need for more inclusive environments, yet ASD-friendly design remains underrepresented in architectural research. This study evaluates how well-selected shopping centers in Davao City accommodate individuals with ASD using the Autism ASPECTS Design Index. Through descriptive statistics and comparative analysis, the research compares three major malls—Abreeza Mall, Gaisano Mall of Davao, and SM City Ecoland. Abreeza Mall consistently scores the highest, while Gaisano and SM show varying performances. Statistical tests, including Kruskal-Wallis and ANOVA, confirm significant differences in overall performance and ASPECTSS scores. The Kruskal-Wallis Test indicates a statistically significant difference among the malls ($H = 11.890$, $df = 2$, $p = 0.003$). Likewise, ANOVA results show a significant effect of the shopping center on the ASPECTSS Design Index Score ($F(2, 177) = 12.660$, $p < .001$, $\eta^2 = 0.125$). Further analysis of Dunn's and Tukey's post hoc tests highlights differences between the malls. These findings emphasize the importance of creating sensory-friendly shopping environments for individuals with ASD.

1.0 INTRODUCTION

Chiarotti and Venerosi (2020) emphasize the substantial global variation in autism spectrum disorder (ASD) prevalence, reflecting its widespread recognition. Fombonne (2018) reports a consistent increase in ASD cases across various regions, potentially due to heightened awareness and environmental influences. Zeidan et al. (2022) underscore the critical role of early diagnosis in the rising prevalence of ASD, highlighting the necessity of early identification.

According to Wisevoter (2023)), the Philippines ranks 152nd globally in ASD prevalence, with a local rate of 81.80 per 10,000 children (Zauderer, 2022). Despite these statistics, Deala (2017) highlights the inadequacy of support and intervention for individuals with ASD, exposing a significant gap in services.

In Davao City, fostering an inclusive environment for individuals with ASD is paramount (City Government of Davao, 2023). Autism advocacy organizations, such as the Autism Society of the Philippines (ASP) - Davao Chapter and the Rainbow Intervention Center for Autism (RICAFI), advocate for government support in funding therapy, diagnostic evaluations, awareness programs, and employment opportunities for individuals with autism (Cortez, 2020). Implementing sensory-friendly design, accessibility measures, and community integration strategies can potentially enhance the well-being and social inclusion of individuals with ASD (Deala, 2017).

The characteristics of ASD vary among individuals; however, common challenges include difficulties in communication and social interactions, as well as the presence of restricted interests and repetitive behaviors (American Psychiatric Association, 2022). Many individuals with ASD also experience sensory processing disorders, which can result in hypersensitivity or hyposensitivity to external stimuli (Ghazali , Sakip, & Samsuddin, 2019). This condition can lead to feelings of distress and discomfort in unfamiliar or crowded environments, such as public transportation, educational institutions, and commercial establishments (Adjorlu, Hoeg, Serafin, & Mangano, 2017).

The study of ASD encompasses research on prevalence, defining characteristics, and contributing factors (Hirota & King, 2023). A systematic review indicates that global prevalence estimates range from 1.09 to 436 per 10,000 individuals, with a median prevalence of 100 per 10,000, influenced by geographic, ethnic, and socioeconomic variables. In the United States, prevalence rates among children aged 4 and 8 are reported at 1.70% and 1.85%, respectively, while European estimates range from 0.38% to 1.55%. The increasing prevalence of ASD is attributed to advancements in awareness, diagnostic methodologies, and service accessibility. Additionally, a significant proportion of individuals with ASD present co-occurring conditions, such as intellectual disabilities and mental health disorders, which further complicate their needs and required support structures. Collectively, the literature underscores the complexity of ASD as a multidimensional condition shaped by biological, social, and environmental determinants.

Active engagement with the environment is integral to social participation. However, individuals with ASD frequently encounter challenges in social interactions, spatial adaptation, and engagement in routine activities (Lamash, Klinger, & Josman, 2017). Hus Bal et al. (2015) identify a decline in the acquisition of daily living skills, particularly in domestic tasks such as meal preparation, shopping, and household safety, among adolescents with ASD. Integrating community-linked services and facilities, including commercial establishments, into urban design may facilitate greater inclusion and allow individuals with ASD to participate in societal interactions (Mostafa, 2018). Consequently, this study aims to evaluate the inclusivity of selected shopping centers in Davao City for individuals with ASD, utilizing the Autism ASPECTSS Design Index to assess overall performance.

1.1 Study Area

1.1.1 Site Selection Criteria

The selection of the study sites involved an evaluation of twelve prominent shopping centers in Davao City based on five key criteria: Size and Variety of Stores, Foot Traffic and Popularity, Amenities and Facilities, Accessibility and Location, and Community Impact and Engagement. Each criterion was assessed on a 5-point scale, with five indicating the highest performance.

The criteria were chosen for their relevance to the study's focus on sensory design integration and the impact of the built environment on individuals with autism spectrum disorder (ASD). The Size and Variety of Stores criterion was essential for understanding the complexity and diversity of sensory experiences within

large retail spaces. Foot Traffic and Popularity were critical for evaluating how busy environments influence sensory processing and spatial navigation. Amenities and Facilities were assessed for their role in providing comfort and respite, particularly for those with sensory sensitivities. Accessibility and Location considered physical accessibility and integration within the urban fabric, while Community Impact and Engagement evaluated the centers' contributions to the local community through programs and initiatives.

Scores were determined based on observational data, expert evaluations, and existing literature on retail environments. SM City Davao, Abreeza Mall, and Gaisano Mall of Davao emerged as the top-performing sites, excelling across multiple criteria. These centers, with their diverse retail offerings, high foot traffic, comprehensive amenities, strategic locations, and active community engagement, were selected as the study sites for their suitability in examining the sensory and spatial dynamics of shopping environments concerning the needs of individuals with ASD.

Table 1. Site Selection Analysis

Shopping Center	Size and Variety of Stores	Foot Traffic and Popularity	Amenities and Facilities	Accessibility and Location	Community Impact and Engagement	Total	Rank
Abreeza Mall	4	4	5	4	4	21	2
Aldevinco Shopping Center	3	3	2	3	3	14	7
Bangkerohan Public Market	3	3	2	3	2	13	8
Felcris Centrale	3	3	3	4	3	16	5
Gaisano Grand Mall	3	3	3	3	2	14	7
Gaisano Mall of Davao	4	4	4	4	3	19	3
Lachmi Shopping Mall	2	2	2	3	1	10	9
S&R Membership Shopping	3	3	3	3	2	14	7
SM City Davao	5	5	4	5	4	23	1
SM Lanang Premier	4	4	4	3	3	18	4
SM Savemore Bangkal	2	2	2	3	1	10	9
Victoria Plaza	3	3	3	4	2	15	6

1.1.2 SM City Ecoland

Situated within the geographical bounds of Ecoland, along Quimpo Boulevard in Davao City, Davao del Sur (with coordinates at 7.0497° N, 125.5883° E), stands SM City Ecoland. Occupying an expanse of 13.2 hectares (equivalent to 33 acres), the establishment has a total retail floor area spanning 125,143.00 square meters. SM City Ecoland, managed by SM Prime Holdings, is one of the major shopping centers in Davao City, offering a wide range of retail, dining, and entertainment options. The mall includes various sensory and spatial features, such as spacious walkways, multiple entry points, and designated areas for social and recreational activities. These features make it a significant subject for evaluating how well the built environment accommodates individuals with autism spectrum disorder (ASD). The mall's accessibility, presence of sensory-friendly spaces, and design considerations for crowd management are particularly relevant for assessing sensory design integration.

Figure 1. SM City Ecoland Vicinity Map (source: Google Map, 2023)

1.1.3 Abreeza Mall

The retail hub is at J.P. Laurel Ave, within the Poblacion District of Davao City, Davao del Sur. Its precise geographic coordinates are denoted as 7.0912° N and 125.6113° E. Nestled within a designated 4-hectare parcel of a larger 10-hectare commercial complex, this establishment encompasses a comprehensive retail floor expanse spanning 164,370.00 square meters. Abreeza Mall, a joint venture between Ayala Land and Anflocor under Accendo Commercial Corporation, is known for its upscale retail offerings and modern architectural design. The mall features open spaces, natural lighting, and a mix of indoor and outdoor environments that may provide a more sensory-friendly experience. Abreeza's design also includes quiet zones, clear signage, and well-organized spatial layouts, which are key elements in evaluating how well it caters to the needs of individuals with ASD. Its design and management practices reflect the mall's commitment to creating an inclusive environment.

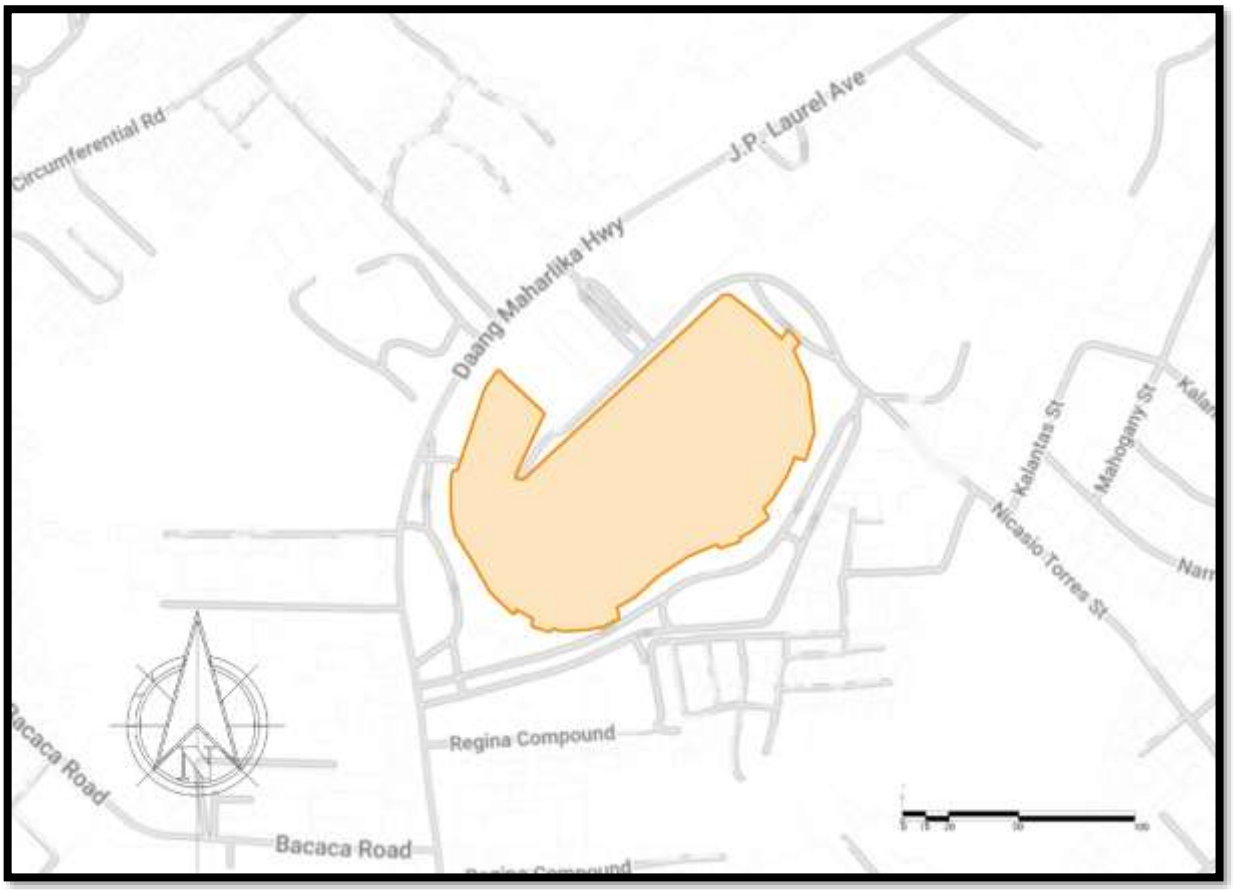

Figure 2. Abreeza Mall Vicinity Map (source: Google Map, 2023)

1.1.4 Gaisano Mall of Davao

Situated at J.P. Laurel Ave, Bajada, Davao City, Davao del Sur, with precise coordinates of 7.0780° N and 125.6137° E, the shopping center occupies a substantial expanse. This spatial distribution spans eight levels, covering an aggregate retail floor area of 240,605.00 square meters. Gaisano Mall of Davao, managed by DSG Sons Group, Inc., is one of the largest shopping centers in the city, known for its extensive retail area and diverse customer base. The mall's design includes multiple floors connected by elevators and escalators, wide corridors, and dedicated rest areas. These features are essential for assessing the sensory and spatial aspects of the built environment, particularly regarding accessibility and comfort for individuals with ASD. The mall's focus on providing various shopping experiences within a structured and compartmentalized space offers valuable insights for the study.

Figure 3. Gaisano Mall Davao Vicinity Map (source: Google Map, 2023)

2.0 LITERATURE REVIEW

2.1 Autism spectrum disorder environments

Autism Spectrum Disorder (ASD) is an umbrella term for various early-onset social communication deficiencies and repetitive sensory-motor disorders with a significant hereditary component and other causes (Lord, Elsabbagh, Baird, & Veenstra-Vanderweele, 2018). The diagnostic category comprises autistic disorder, Asperger Disorder (AD), and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS), with the latter two being less severe (Persico & Napolioni, 2013). Sensory processing difficulties are a common feature of ASD and are regarded as a prominent feature in clinical manifestations (Zachor & Ben-Itzchak, 2013). Firsthand and second-hand perspectives report the prevalence of sensory issues in autism spectrum disorder (ASD) (Robertson & Simmons, 2015).

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by sensory sensitivities, social communication challenges, and repetitive behaviors (Posar & Visconti, 2018). Mohamed and Almaz (2024) state that designing environments that cater to individuals with ASD requires a deep understanding of their unique sensory and spatial needs. Research highlights the significance of sensory-friendly design principles, such as minimizing auditory and visual distractions, incorporating predictable spatial layouts, and providing access to quiet zones (Mostafa, 2021). Studies suggest that ASD-friendly environments should be structured with clear wayfinding, reduced environmental stimuli, and adaptive lighting to mitigate sensory overload and enhance comfort (Leestma, 2015). These design strategies create supportive settings that accommodate the diverse needs of individuals on the spectrum, improving their ability to navigate and interact with their surroundings effectively.

Incorporating biophilic and multi-sensory design elements has also enhanced well-being in ASD-friendly spaces. Studies indicate that natural elements, such as greenery, water features, and natural lighting, can have calming effects, reducing anxiety and promoting emotional regulation among individuals with ASD (Haque, 2024). Similarly, tactile and proprioceptive design features, such as textured surfaces and enclosed retreat spaces, contribute to a more inclusive environment by offering sensory engagement and regulation opportunities (Gaudion, 2015). Moreover, the flexibility of spaces through modular or customizable designs

allows users to adjust their surroundings based on their comfort levels, fostering autonomy and reducing stress in learning, therapeutic, and residential settings.

Recent studies emphasize the role of universal and inclusive design in creating ASD-friendly environments across various settings, including schools, public spaces, and healthcare facilities. Designing for neurodiversity involves balancing sensory accommodations with social integration, ensuring that individuals with ASD can participate in communal activities and access individualized support (Sheykhmaleki, Agha Yazdanfar, Litkouhi, Nazarian, & Price, 2021). Emerging research advocates for participatory design approaches, where individuals with ASD and their caregivers contribute to the planning process to ensure that spaces reflect their lived experiences and needs (Nieman & Wood-Nartker, 2019). By incorporating evidence-based design strategies, ASD-friendly environments not only promote accessibility and comfort but also contribute to the broader goal of fostering inclusivity and social engagement in the built environment.

2.2 Differentiating the Environmental Needs of people with ASD

Research highlights key differences in the spatial and sensory needs of children and adults with autism spectrum disorder (ASD), emphasizing the necessity of age-responsive design. Studies on children with ASD focus on creating structured, predictable, and sensory-friendly environments that support learning, social interaction, and emotional regulation (Mostafa, 2020). In educational and therapeutic settings, children benefit from clear wayfinding, controlled stimuli, and designated sensory retreat spaces to prevent sensory overload (Pierce, 2019). Additionally, play areas with interactive and multi-sensory elements encourage engagement and development, while adjustable lighting and soundproofing help minimize environmental stressors (Ponting, 2024). These interventions are particularly crucial during early developmental stages, where sensory processing differences are more pronounced and can impact cognitive and social growth.

In contrast, studies on adults with ASD highlight the significance of autonomy, adaptability, and social integration in environmental design. Although sensory sensitivities continue into adulthood, numerous individuals cultivate coping strategies that necessitate flexible spaces instead of strictly regulated environments (Sinclair, 2010). Evidence highlights the necessity for ASD-friendly workplaces, public spaces, and residential environments that harmonize sensory accommodations with avenues for independent living and community engagement (Patel, 2022). Quiet zones, adjustable lighting, and access to nature remain essential. However, adult-oriented spaces also integrate design strategies that promote self-sufficiency, such as wayfinding systems with clear signage, flexible workstations, and private areas for stress management (Ribenfors, 2021). The transition from childhood to adulthood necessitates environments that evolve alongside changing needs, shifting from highly structured spaces to ones that foster personal agency and social belonging.

A study applicable to all individuals with ASD is warranted by the fundamental tenets of neurodiversity-affirming design, which prioritize adaptability and user-centered methodologies for all age demographics. Research indicates that environments conducive to Autism Spectrum Disorder (ASD) should incorporate flexible, inclusive elements that cater to diverse sensory profiles and developmental phases (Rivera, 2023). Since sensory sensitivities, cognitive processing styles, and social preferences vary significantly within the spectrum, creating universally supportive spaces—rather than strictly age-segregated designs—can ensure long-term usability and inclusivity (Mion, 2023). By implementing design elements that allow for personalization and gradual adjustments, spaces can effectively support children and adults with ASD, promoting comfort, functionality, and overall well-being throughout different life stages.

2.3 Inclusive Environment for People with Autism Spectrum Disorder

Creating inclusive environments for individuals with autism spectrum disorder (ASD) emphasizes the necessity of tailored educational settings that accommodate the unique needs of these individuals (Corkum, et al., 2014). Key studies highlight that inclusive learning environments should foster academic, social, emotional, and developmental growth by integrating specific characteristics such as structured routines, sensory-friendly designs, and supportive teaching practices (Debasu & Chekol, 2024). For instance, Thomasson's research outlines nine essential characteristics for effective inclusivity, advocating for environments that provide meaningful opportunities for engagement across various activities and curricula. Additionally, challenges remain, as educators often report feeling unprepared to meet the diverse needs of students with autism, indicating a gap in training and resources. The importance of sensory design is also underscored, with studies suggesting that environments should mitigate sensory overload through thoughtful architectural choices, such as appropriate lighting, acoustics, and spatial organization. Overall, the literature

calls for a collaborative approach involving educators, architects, and policymakers to create supportive, inclusive spaces that enhance the educational experiences of individuals with ASD.

One noticeable area for improvement in the government initiative is the inclusion of the interests of persons with developmental disabilities, which manifest as behavioral, communicative, and cognitive limitations, in addition to those with physical or mental issues (Koe, 2013). Architectural rules and standards have been created to guarantee that these people may live indoors and outdoors (Nagib & Williams, 2016). In particular, Simpson (Simpson, 2016) created a checklist for an autism-friendly environment, which outlines questions about existing design considerations for the sensory needs of people with an autism spectrum disorder. Mostafa (2014), on the other hand, has developed the autism ASPECTSS design index to assess specific built environments in its sensory design integration. Nevertheless, McAllister & Sloan (McAllister & Sloan, 2016) claimed that to be genuinely inclusive, it is crucial to provide persons with ASD, who are the best informed about the condition, the chance to offer input on the planning of our shared built environment whenever that is feasible. Notwithstanding their varied skills and unique capabilities, autistic persons must be allowed to integrate into society for healthy, fulfilling lives (Zwilling & Levy, 2022).

2.4 ASPECTSS Design Index

The ASPECTSS Design Index, developed by (Mostafa, Architecture for autism: Built environment performance in accordance to the autism ASPECTSS™ design index, 2020), is an evidence-based framework that offers a structured approach to designing environments that address the unique needs of individuals with autism spectrum disorder (ASD). This index comprises seven key criteria—Acoustics, Spatial Sequencing, Escape Spaces, Compartmentalization, Transition Spaces, Sensory Zoning, and Safety—each designed to mitigate the sensory and cognitive challenges commonly experienced by individuals with ASD. The ASPECTSS Design Index is integral in guiding architects, designers, and planners in creating spaces that are not only functional but also supportive and accommodating of individuals with autism.

2.5 Acoustics

The criterion of acoustics focuses on minimizing auditory stimuli that may be distressing for individuals with ASD. The goal is to create a sound environment that is comfortable and free from excessive noise, which can be a significant source of sensory overload. This involves strategically using sound-absorbing materials, noise control measures, and acoustic insulation to ensure minimal auditory distractions.

2.6 Spatial Sequencing

Spatial sequencing emphasizes the logical and predictable organization of spaces to align with the routines and activities of individuals with ASD (Mostafa, Architecture for autism: Autism aspectss™ in school design, 2014). This criterion significantly reduces anxiety and promotes a sense of security (Schweitzer, Gilpin, & Frampton, 2004). By arranging spaces clearly and consistently, with a predictable flow from one area to another, spatial sequencing supports the cognitive processing needs of individuals who may struggle with unexpected environmental changes or disruptions.

2.7 Escape Spaces

Escape spaces are designated areas within the built environment that provide a retreat for individuals experiencing sensory overload (Finnigan, 2024). These spaces are designed to be minimally stimulating and can be personalized to meet the specific sensory needs of the individual. The availability of escape spaces is crucial for allowing individuals with ASD to self-regulate and manage their sensory experiences in a controlled and secluded setting.

2.8 Compartmentalization

Compartmentalization involves dividing the environment into distinct, single-purpose areas that limit distractions and support focused engagement (Amouei, 2023). This criterion addresses the need for clear boundaries between activities, reducing sensory and cognitive overload by providing spaces for solitary use or limited interaction. Compartmentalization is essential for individuals who require structure and order to function effectively in their environment.

2.9 Transition Spaces

Transition spaces serve as intermediary zones that facilitate the movement between different areas or activities within the built environment (Boettger, 2014). These spaces help individuals with ASD recalibrate their sensory input as they transition from one setting to another. Transition spaces can range from simple, visually distinct corridors to fully equipped sensory rooms that prepare individuals for environmental changes. This criterion supports smooth transitions and reduces the stress of moving between different spaces.

2.10 Sensory Zoning

Sensory zoning categorizes the environment into areas with varying levels of sensory stimulation—high, moderate, and low (Mohamed & Almaz, 2024). This criterion allows individuals with ASD to select environments that align with their sensory preferences, reducing the risk of sensory overload. Sensory zoning is achieved by grouping spaces with similar sensory characteristics, providing users with options matching their needs and comfort levels.

2.11 Safety

Safety is a paramount consideration in the ASPECTSS Design Index (Mostafa, Architecture for autism: Autism aspectss™ in school design, 2014), particularly given the challenges individuals with ASD may face in recognizing and responding to environmental hazards. This criterion encompasses physical and psychological safety, ensuring the built environment is secure, predictable, and free from potential dangers. Safety measures include using secure exits, rounded edges on surfaces, clear wayfinding, and eliminating environmental risks that may not be immediately apparent to individuals with ASD.

3.0 METHOD

The research employed a comparative descriptive research design to evaluate and compare the performance of selected shopping centers in Davao City regarding sensory design integration and physical environment criteria, as assessed by the ASPECTSS Design Index.

3.1 Instruments

The study conducted a survey using the autism ASPECTSS Design Index questionnaires developed by Mostafa (2015), which were modified and contextualized to fit the specific conditions of the study. The survey included eight questions: one for each of the seven criteria at the level of the entire shopping center and a summative evaluation of the facility's overall performance. It evaluated performance using a ranking score, awarding five points for the best possible fulfillment of the criteria and one point for the absence of such fulfillment. Each criterion was equally weighted.

3.2 Participants

Participants in the study included two distinct groups: architecture students and parents/caregivers of individuals with ASD. Architecture students were selected as respondents to assess the built environment using the Autism ASPECTSS Design Index. These students completed courses such as Architectural Utilities 3, Professional Practice 1, and Design 5, equipping them with the necessary background to evaluate architectural elements, building design under relevant laws, and space planning in shopping centers. Additionally, parents and caregivers of individuals with autism spectrum disorder were chosen as respondents due to their direct experience managing the needs of these individuals in shopping centers.

The study selected a sample size of 30 participants from each group—architecture students and parents/caregivers—based on the recommendation that 30 respondents are sufficient for reliable subgroup analysis (Memon, et al., 2020). This size is adequate to ensure that statistical analyses are robust and meaningful. The study utilized convenience sampling for its practicality in recruiting readily accessible participants, considering the constraints of time and resources (Nikolopoulou, 2023). Although this approach facilitated efficient data collection, it introduced potential selection and self-selection biases that could affect generalizability. To mitigate these biases, the study implemented diverse recruitment strategies from various sources within the defined groups and applied standardized selection criteria to ensure that participants met the study's requirements.

3.3 Analysis

The study used descriptive and comparative statistical methods, supported by JASP software, to evaluate the built environment performance of shopping centers, focusing on sensory design for individuals with autism spectrum disorder (ASD). Descriptive statistics provided an overview of performance using mean and standard deviation, while ANOVA was used to identify significant differences between the centers. Post-hoc tests further pinpointed these differences. The Kruskal-Walli's test was also applied to manage non-normal data and unequal variances. This approach offered insights into the suitability of shopping centers for individuals with ASD and contributed to the discourse on inclusive design.

4.0 RESULTS

In evaluating the performance of shopping centers from the perspective of architecture students and parents/caregivers, a comprehensive set of criteria was considered, encompassing aspects such as acoustics, spatial sequencing, escape spaces, compartmentalization, transition spaces, sensory zoning, and safety. The analysis revealed notable variations in the ratings of architecture students and parents/caregivers assigned to different shopping centers across these criteria.

The overall shopping center performance was assessed through an ASPECTSS Index Score, reflecting the cumulative ratings for various aspects. While the means of overall shopping center performance were statistically compared, the assumptions of normality were found to be violated, leading to the adoption of the non-parametric Kruskal-Walli's test. The Kruskal-Walli's test is a non-parametric method used to compare medians across three or more groups when data is not normally distributed. The results of this test indicated a significant difference in overall performance among the selected shopping centers.

Dunn's post hoc comparisons further elucidated specific pairwise differences. Dunn's post hoc test is a non-parametric method used after a significant Kruskal-Walli's test to identify which specific group medians differ, adjusting p-values to control Type I errors in multiple comparisons. Abreeza was identified as having significantly higher overall performance than Gaisano, while no significant difference was found between Abreeza and SM. Gaisano exhibited significantly lower overall performance compared to SM.

Similar analyses were conducted for the ASPECTSS Design Index Score, which considered the criteria comprehensively. The analysis involved both parametric (ANOVA) and post hoc comparisons. ANOVA (Analysis of Variance) is a statistical method used to compare the means of three or more groups to determine if there are significant differences between them. The ANOVA results indicated a significant effect of the shopping center on the ASPECTSS Design Index Score. The Tukey method, or Tukey's Honestly Significant Difference (HSD) test, is a post hoc procedure used after an ANOVA to identify which specific group means are significantly different from each other. It controls Type I errors when making multiple comparisons by adjusting the significance level for each pairwise test. Post hoc comparisons, employing the Tukey method, highlighted that Abreeza had a significantly higher ASPECTSS Design Index Score than Gaisano and SM. At the same time, Gaisano and SM did not significantly differ.

In summary, the evaluation of shopping centers based on architectural criteria and user perceptions revealed nuanced differences in performance. Abreeza consistently stood out with higher scores, while Gaisano and SM exhibited variations in performance across different aspects. These findings contribute valuable insights for architects, designers, and stakeholders seeking to enhance shopping centers' user experience and design, particularly in the context of the identified architectural criteria.

Table 2. Comparison of Architecture Students and Parents/Caregivers Ratings on Various Aspects of Shopping Center Performance.

		Architecture Student			Parents and Caregivers		
	Performance	Abreeza Mall	Gaisano Mall of Davao	SM City Ecoland	Abreeza Mall	Gaisano Mall of Davao	SM City Ecoland
	Overall Shopping Center Performance	2.900	2.300	2.967	3.500	3.000	3.367
	Overall Shopping Center Performance Over 35	20.300	16.100	20.769	24.500	21.000	23.569
A	Acoustics	3.000	2.900	3.100	2.967	2.800	3.000
SP	Spatial Sequencing	3.433	3.233	3.600	3.200	2.567	3.167
E	Escape Spaces	2.633	2.000	1.933	3.567	2.700	2.433
C	Compartmentalization	3.300	3.133	3.100	3.733	2.367	2.933
T	Transition Spaces	3.067	2.700	2.800	3.133	2.400	2.933
S	Sensory Zoning	2.933	2.767	2.633	3.667	1.900	2.767
S	Safety	5.000	4.354	4.500	3.583	3.646	2.813
	ASPECTSS Index Score	23.366	21.087	21.666	23.850	18.380	20.046
	Index and Perceived Score Spread	-3.066	-4.987	-0.897	0.650	2.620	3.523
	Index: Perceived Score	0.869	0.764	0.959	1.027	1.143	1.176

Table 2 shows the ASPECTSS Design Index Score evaluation performance of three major shopping malls in Davao City—Abreeza Mall, Gaisano Mall of Davao, and SM City Ecoland—based on key architectural and spatial considerations from the perspectives of architecture students and parents/caregivers. Among architecture students, Abreeza Mall scored the highest (23.366), followed by SM City Ecoland (21.666) and Gaisano Mall (21.087). Parents and caregivers, however, rated Abreeza Mall highest (23.850), while SM City Ecoland (20.046) and Gaisano Mall (18.380) scored lower. Notably, students rated safety higher than parents, while parents emphasized spatial sequencing, compartmentalization, and sensory zoning more. The Index and Perceived Score Spread reveal that parents' perceptions aligned more closely with the ASPECTSS index, particularly at Abreeza Mall (1.027). In contrast, students' perceptions showed a wider gap, especially at Gaisano Mall (-4.987). Overall, the data suggests that while both groups recognize the strengths and weaknesses of each mall, their priorities in spatial design differ, with students focusing on safety and structure. At the same time, parents emphasize comfort and child-friendly spaces.

Table 3. Kruskal-Wallis Test

Factor	**Statistic**	**df**	**p**
Shopping Center	11.890	2	0.003

Table 4. Dunn's Post Hoc Comparisons - Shopping Center

Comparison	z	Wi	Wj	p	pbonf	pholm
Abreeza - Gaisano	3.006	99.658	72.550	0.003	0.008	0.008
Abreeza - SM	0.041	99.658	99.292	0.968	1.000	0.968
Gaisano - SM	-2.966	72.550	99.292	0.003	0.009	0.008

Table 5. ANOVA - ASPECTSS Index Score.

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Shopping Center	10.818	2	5.409	12.660	< .001	0.125
Residuals	75.620	177	0.427			

Note. Type III Sum of Squares.

Table 6. Post Hoc Comparisons - Shopping Center.

			95% CI for Mean Difference				
		Mean Difference	Lower	Upper	SE	t	p_{tukey}
Abreeza	Gaisano	0.597	0.315	0.879	0.119	5.005	< .001
	SM	0.353	0.071	0.635	0.119	2.956	0.010
Gaisano	SM	-0.244	-0.527	0.038	0.119	-2.048	0.104

Note. P-value and confidence intervals were adjusted to compare a family of three estimates (confidence intervals were corrected using the Tukey method).

Table 7. Statistical Comparison of ASPECTSS Index Scores Across Shopping Centers.

Shopping Center	ASPECTSS Index Score (Mean)	Statistical Significance
Abreeza Mall	**23.366**	$p < 0.001$
Gaisano Mall	21.087	$p = 0.009$
SM City Ecoland	21.666	$p = 0.010$

The ASPECTSS Index Score analysis reveals that Abreeza Mall has the highest mean score (23.366) among the three shopping centers, with a highly significant statistical value ($p < 0.001$), indicating a strong consistency in its spatial performance based on ASPECTSS criteria. Gaisano Mall of Davao follows with a lower score (21.087) and a significance level of $p = 0.009$, suggesting a moderate confidence level in its performance ranking. Meanwhile, SM City Ecoland scores 21.666, with $p = 0.010$, also indicating statistical significance but with slightly less confidence than Abreeza Mall. These findings suggest that Abreeza Mall is perceived as the most well-designed shopping center based on the ASPECTSS framework, with exceptionally reliable data supporting its superior spatial and architectural qualities.

5.0 DISCUSSION

This study evaluates the inclusivity of selected shopping centers in Davao City for individuals with ASD, considering the general ASD population rather than focusing solely on children or adults using the Autism ASPECTSS Design Index. The objectives are to assess differences in overall performance and ASPECTSS Design Index scores among the shopping centers and to develop guidelines for creating sensory-friendly environments. Key findings reveal that Abreeza Mall aligns most closely with the ASPECTSS Design Index, particularly in acoustics, spatial sequencing, and sensory zoning, followed by SM City Ecoland, with Gaisano Mall of Davao exhibiting lower performance.

This finding is consistent with Mostafa's (2015) study, which emphasized the significance of using subdued colors, minimizing distractions, and incorporating natural lighting. Additionally, the results indicated concerns related to spatial design and wayfinding, supporting the design recommendations proposed by Tola et al. (2021) to improve the ease of recognizing and navigating different activities, spaces, and sensory areas by implementing a simple and well-defined layout. Moreover, the reduction of noise emerged as a prominent issue from the findings, which reinforces the recommendations of Kanakri et al. (2017) to identify and eliminate sources of disruptive noise. This study emphasizes creating inclusive and sensory-friendly shopping environments for individuals with ASD. It highlights variations in perceptions among stakeholders and suggests the potential for developing design guidelines to enhance their experience and inclusion.

6.0 CONCLUSION AND RECOMMENDATION

The study highlights that Abreeza Mall excels in meeting the sensory and spatial needs of individuals with autism spectrum disorder (ASD). At the same time, SM City Ecoland shows moderate alignment, and Gaisano Mall of Davao scores the lowest. These findings suggest that shopping centers, particularly those with lower scores, should improve their design by incorporating better acoustics, clearer layouts, and sensory-friendly areas. Policymakers are encouraged to use these insights to develop guidelines for more inclusive design. Further research is needed to refine these practices and explore additional features to enhance accessibility for individuals with ASD.

The study underscores the need for sensory-friendly shopping environments for individuals with autism spectrum disorder (ASD) and suggests practical design recommendations. Key strategies include using sound-absorbing materials for better acoustics, implementing intuitive layouts with clear signage, creating sensory zones with varying stimulation levels, designing calming escape spaces, compartmentalizing areas for different activities, and facilitating smooth transitions between spaces. These approaches, demonstrated by successful implementations in various institutions, aim to enhance the shopping experience for individuals with ASD. Future research should build on these findings to refine inclusive design practices.

ACKNOWLEDGEMENT

i. **Sample size constraints** – The relatively small sample (30 architecture students and 30 parents/caregivers) may limit the generalizability of findings. Future research should increase the sample size to enhance statistical reliability.

ii. **Reliance on architecture students** – While architecture students are trained in spatial evaluation, their assessments may lack the lived experience of individuals with ASD. Including individuals with ASD in future studies would provide a more authentic perspective.

iii. **Lack of direct ASD participant input** – The study does not incorporate direct feedback from individuals with ASD, which may result in unintentional biases in evaluating sensory-friendly design features. Future studies should prioritize their inclusion.

iv. To enhance inclusive design for individuals with autism spectrum disorder (ASD) in shopping centers, future research should broaden the participant pool by including direct input from individuals with ASD, utilizing advanced data-gathering methods such as digital simulations and detailed interviews, and incorporating expert observations using design criteria checklists. Additionally, longitudinal studies should be conducted to assess the long-term impact of sensory-friendly design interventions. Research should also investigate a variety of shopping centers across different geographic and socioeconomic contexts to ensure that findings are widely applicable. These steps will improve the comprehensiveness of the research and contribute to developing practical, evidence-based design guidelines for creating more inclusive and sensory-friendly environments.

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