

BEHAVIORAL ARCHITECTURE FOR EARLY CHILDHOOD DEVELOPMENT: A CASE STUDY OF A KINDERGARTEN IN BATAM

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Informasi Naskah

Diterima: 25/09/2025; Disetujui terbit: 20/11/2025; Diterbitkan: 02/12/2025;

<http://journal.uib.ac.id/index.php/jad>

ABSTRACT

Early childhood represents a golden phase of human development, characterized by rapid growth across physical and motor, cognitive, language, social, and moral domains. While research on the influence of physical and non-physical environments on child development continues to expand, limited attention has been given to the systematic application of behavioral architecture in early childhood education settings that potentially support early childhood development. This study addresses this gap by examining the implementation of behavioral architecture principles at Christian Kalam Kudus 2 Kindergarten in Batam City, Indonesia. Using a qualitative approach that combined literature review, field observation, and semi-structured interviews. The study points out the implementation of five key elements of behavioral architecture that contribute to developmental outcomes. Spatial function and furniture (including their arrangement) emerged as the most influential factors, whereas spatial size and form, colour, and environmental conditions (sound, temperature, and lighting) provided partial contributions. Several design shortcomings were also identified, notably thermal discomfort and insufficient artificial lighting. Overall, the study emphasizes that kindergartens are not merely functional spaces but active agents in shaping behavior, learning processes, and development of young children through behavioral architecture that responds to user needs and environmental conditions.

Keywords: behavioral architecture, early childhood development, Kindergarten, Batam

ABSTRAK

Masa kanak-kanak awal merupakan fase krusial dalam perkembangan manusia yang ditandai oleh percepatan pertumbuhan pada ranah fisik dan motorik, kognitif, bahasa, sosial, dan moral. Meskipun kajian mengenai pengaruh lingkungan fisik dan nonfisik terhadap perkembangan anak terus berkembang, perhatian terhadap penerapan arsitektur perilaku secara sistematis dalam lingkungan pendidikan anak usia dini yang berpotensi mendukung perkembangan anak usia dini masih terbatas. Studi ini mengisi kesenjangan tersebut dengan mengkaji penerapan prinsip-prinsip arsitektur perilaku di TK Kristen Kalam Kudus 2, Kota Batam, Indonesia. Menggunakan pendekatan kualitatif yang mengkombinasikan tinjauan pustaka, observasi lapangan, dan wawancara semi-terstruktur. Studi ini mengidentifikasi penerapan lima elemen utama arsitektur perilaku yang berkontribusi terhadap dukungan perkembangan anak. Fungsi ruang dan furnitur (beserta konfigurasi penataannya) menjadi faktor paling dominan, sedangkan ukuran dan bentuk ruang, warna, serta kondisi lingkungan (suara, temperatur, dan pencahayaan) menunjukkan kontribusi parsial. Temuan juga mengungkap sejumlah kekurangan desain, khususnya ketidaknyamanan termal dan kekurangan pencahayaan buatan. Secara keseluruhan, studi ini menegaskan bahwa taman kanak-kanak tidak hanya berfungsi sebagai wadah aktivitas, tetapi sebagai agen aktif yang membentuk perilaku, proses belajar, dan perkembangan anak usia dini melalui arsitektur perilaku yang responsif terhadap kebutuhan pengguna dan kondisi lingkungan.

Kata kunci: arsitektur perilaku, perkembangan anak usia dini, Taman Kanak-Kanak, Batam

1. Introduction

Children experience a profoundly significant developmental period from the prenatal stage through to six years of age. During this crucial time, they are exceptionally receptive to various forms of stimulation and information, simultaneously beginning to influence their surroundings. This formative process progressively shapes a child's character and personality, heavily influenced by their learning

experiences, education, and upbringing. Therefore, parents play a vital role in providing a suitable education and a supportive environment during this golden period to ensure children develop in line with desired values and aspirations. This golden period of early childhood is marked by rapid and impactful developmental progress across physical, cognitive, social, and emotional domains, making early childhood education strategically fundamental for establishing essential skills that will underpin long-term growth (Matthews & Lippman, 2020). Education during these years focuses on diverse forms of stimulation and nurturing for children aged 0 to 6, aiming to support their optimal and holistic development (Widyawati et al., 2024).

Prior research on children's environment consistently demonstrates the significant impact of both physical and non-physical settings on early childhood behavior and holistic development. The physical setting, encompassing elements like space design, access to nature, adequate lighting, and furniture arrangement, directly influences a child's cognitive, social, and motor skills (Aguspriyanti et al., 2024; Pinassang et al., 2024). Conversely, inadequate physical environments, such as noisy or overcrowded spaces, can impede learning and well-being. Failure to maintain thermal comfort can undermine children's focus and engagement in learning tasks (Tan et al., 2023). Equally crucial is that the non-physical environment, which includes the quality of caregiver-child interactions, peer interactions, and social dynamics, can influence how children interact with and attached to the built environment (Aguspriyanti et al., 2025).

In the context of educational environment, high-quality programs, characterized by supportive and stimulating activities, are shown to foster superior language, problem-solving, and socio-emotional development. Both environmental dimensions are therefore fundamental for healthy early childhood development, with lasting implications for children's academic and social trajectories. It is therefore crucial to consider children's behavior when designing early childhood education facilities, enabling them to learn through play. The benefits of play are well-documented scientifically, demonstrating substantial contributions to the development of motor coordination, cognitive abilities, imaginative capacity, language acquisition, interpersonal communication skills, as well as the emergence of leadership potential from an early age (Maisarah & Hadinugroho, 2024).

Despite this growing body of evidence, a critical gap remains in understanding how behavioral architecture can be systematically applied to early childhood education facilities. Hence, this study aims to examine how the physical environment of a kindergarten in Batam City, a rapidly expanding industrial city in Indonesia's Riau Islands Province, can support their pupils' development. Batam's large working population generates substantial demand for childcare, yet its urban development trends frequently restrict kindergartens' access to green spaces, natural light, and adequate supporting facilities. These circumstances underscore the urgency of developing evidence-based design strategies. By investigating how behavioral architecture can be applied in such a context, this study contributes empirical insights into how architectural elements may be optimally integrated to create environments that align with young children's developmental needs. Ultimately, it highlights how kindergarten spaces can move beyond functional education facilities to serve as foundational environments that nurture children's long-term growth and well-being.

2. Literature Review

Behavioral Architecture

As (Haryadi & Setiawan, 2024) suggested, the physical variables that influence human behavior include space's function, size and form, furniture and its arrangement, colour, sound, temperature, and lighting. Firstly, the most significant aspect of space's influence on human behavior is its function and utilization. The physical design of a space incorporates variables that affect the behavior of its occupants. Secondly, the size and shape of a space should be appropriate for the function it is intended to

accommodate. Dimensions that are excessively large or small will impact the psychology of the users. Spaces can be permanent and fixed or flexible, depending on the activities they are designed for. Thirdly, the layout of furniture should be tailored to the nature of the activities taking place within space. The selection of furniture can also influence activities and regulate user behavior, encompassing the choice of furniture type, materials, and arrangement. An excessive amount of furniture can make a room feel smaller. Symmetrical furniture arrangements can convey a rigid and formal impression, whereas asymmetrical arrangements tend to create a more dynamic and less formal atmosphere. Fourthly, colour plays a crucial role in establishing the ambiance of a room. The influence of colour extends beyond creating a warm or cool atmosphere. It can also affect the overall quality of space. Fifthly, excessively loud and disruptive noise can interfere with a person's activities, leading to discomfort and reduced performance. Room temperature can significantly impact user comfort. Overly hot rooms can create a stuffy and cramped feeling, potentially increasing aggressive behavior, while excessively cold rooms can lower concentration and impair optimal performance. Similarly, overly bright lighting is detrimental to the eyes and can cause visual discomfort for users.

Meanwhile, (Weinstein & David in Satya et al., 2022) emphasized that the principles of behavioral architecture that must be considered include the ability to connect people to their environment, accommodate activities by providing comfort for occupants, consider users' conditions and behaviors, and meet aesthetic values, including composition and beauty of form. Architectural design should be easily perceived through the five senses or the user's imagination. The forms presented must be clear and transparent, with appropriate scale and proportion, as well as aesthetics that provide a pleasant experience for the users. Moreover, buildings should offer physical, psychological, and physiological comfort to their occupants. Physical comfort relates to environmental conditions such as appropriate temperature, while psychological comfort fosters a sense of calmness and enjoyment. Designs should also take into account the conditions and behaviors of users to ensure that the building functions effectively according to their needs. Likewise, beauty in architecture consists of several key elements, namely unity, which combines elements into a harmonious whole; balance, which maintains visual distribution; proportion, which adjusts size according to the user's scale; and rhythm, created by the repetition of design elements such as lines or shapes.

Early Childhood Development

Early childhood encompasses the period from birth to approximately eight years of age (0-8 years). According to Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System, Article 1 Paragraph 14, early childhood education is defined as a nurturing effort aimed at children from birth up to the age of six years, implemented through the provision of educational stimulation to aid physical and spiritual growth and development, thereby preparing children for further education (Pemerintah Pusat Indonesia, 2003).

According to Piaget as cited in (Satya et al., 2022), the theory of cognitive development posits how children construct their understanding of the world through active interaction with their environment, comprising four distinct periods: First period, sensorimotor intelligence (approximately 0-2 Years): Infants organize their physical action schemes, such as sucking, grasping, and hitting. Second period, pre-operational thought (2-7 Years), children learn to think using symbols. Third period, concrete operational thought (7-11 Years), children develop the ability to think systematically. Fourth period, formal operational thought (11 Years-Adulthood), individuals develop systematic thinking skills based on purely abstract and hypothetical designs.

Furthermore, (Hurlock, 1980) highlighted that the development of early childhood can be outlined into five key stages. First, physical and motor development: physical growth during the period of approximately age 4 is slow and relatively

balanced. Children experience a greater increase in weight than in height. Weight gain occurs due to the increasing size of the skeletal system, muscles, and the dimensions of several other body parts. Second, cognitive development: children's thinking gradually develops during this phase. The imaginative and egocentric thought processes of the previous stage evolve towards more concrete, rational, and objective thinking. Children's memory becomes very strong, placing them firmly in a learning stage. Third, language development: important aspects of language development include perception, comprehension, adaptation, imitation, and expression. Children must learn to understand all these processes, attempt to imitate, and then try to express their desires and feelings. Language development in children encompasses phonological development, vocabulary growth, the development of word meaning, the development of sentence construction, and pragmatic development. Fourth, social development: children begin to form closer relationships with individuals beyond their immediate family members. The expansion of a child's social environment exposes them to external influences. Children will also encounter teachers as influential figures. Fifth, moral development: moral development occurs gradually, step by step. There are three main stages in this growth: the amoral stage (lacking a sense of right or wrong), the conventional stage (children accept values and morals from parents and society), and the autonomous stage (children make their own choices freely).

3. Methods

A qualitative descriptive approach was employed in this study to examine the application of behavioral architecture in early childhood education settings through a case study of a kindergarten in Batam City. This method was selected because it enables the production of detailed, context-specific data in the form of written descriptions, spoken information, and observed behaviors. It is particularly appropriate for portraying social and environmental phenomena as they naturally occur (Creswell & Creswell, 2022), allowing for an in-depth exploration of how architectural elements support children's developmental processes.

Data collection involved two main stages: (1) literature review and (2) field observation and semi-structured interview. The literature review encompassed analyzing secondary sources related to behavioral architecture and early childhood development. This stage provided the theoretical foundation and generated conceptual framework (see Figure 1) that guided the empirical investigation. The primary data were obtained through field observation and semi-structured interview at Christian Kalam Kudus 2 Kindergarten, located in Batam City. This school was selected purposively due to its current design incorporating several elements of behavioral architecture, making it relevant to the study focus.

Field observation was conducted on Friday, 2 May 2025, from 07.30 to 16.00 WIB, encompassing a full day of school activities. The observation focused on the physical environment as well as the ways in which daily routines and user interactions within the kindergarten setting contributed to the stimulation of early childhood development. Data were systematically documented through detailed field notes and photographic evidence, ensuring comprehensive coverage of relevant phenomena. In parallel, semi-structured interviews with teachers were conducted to validate and enrich the observational findings, offering insights into perceptions of the physical environment's role in supporting children's growth and learning. The data were subsequently analyzed using a descriptive-qualitative approach, whereby observational and interview findings were organized, categorized, and interpreted in light of behavioral architecture principles.

To enhance the validity and trustworthiness of the findings, methodological triangulation was employed by integrating data from the literature review, field observations, and interviews. Triangulation allowed the phenomenon under investigation to be examined from multiple perspectives, thereby strengthening the credibility, reliability, and overall rigour of the study (Creswell & Creswell, 2022).

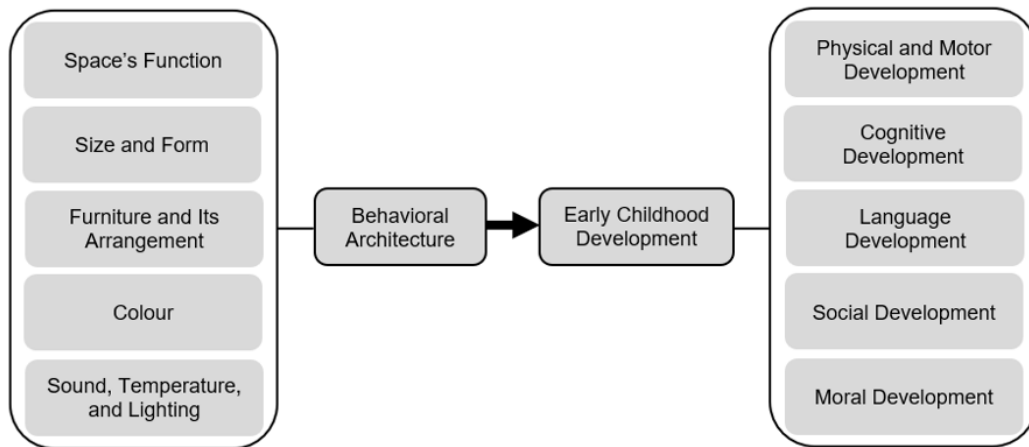


Figure 1. Conceptual Framework
Source: (Author, 2025)

4. Results and Discussion

According to the field observation and interviews, the kindergarten implements a well-structured daily schedule that is carefully aligned with the developmental needs of early childhood. The sequence of activities is consistently organized, beginning with child drop-off and health checks, followed by focused learning sessions, such as reading and writing, physical activities (including exercise sessions and swimming), and periods of free play. This structured routine not only establishes a stable and predictable rhythm for the children but also fosters the development of discipline, orderliness, and independence.

Table 1. Implementation of Behavioral Architecture at Christian Kalam Kudus 2 Kindergarten and Its Contribution to Early Childhood Development

No	Behavioral Architecture Element	Implementation in Kindergarten	Predominantly Supported Developmental Domain(s)
1	Space's function	Varied spatial and functional areas (classroom, sensory play area, play lab, block room, play pretend room, music room, reading corner, library, fitness area, swimming pool, playground, flexible open space, canteen)	Physical and motor; cognitive; language; social; moral
2	Size and form	Standard ceiling height, rectangular layout, dimensions adequate for circulation and movement	Physical and motor; cognitive; language; social
3	Furniture and its arrangements	Child-scaled, varied geometric forms with rounded edges; varied textures; interactive elements; flexible; movable; often placed along walls	Physical and motor; cognitive; language; social; moral
4	Colour	Primary colours on furniture; softer tones on walls for balance	Cognitive; language; social
5	Sound, temperature, lighting	Quiet atmosphere; often controlled temperature; predominantly natural lighting	Cognitive

Source: Author, 2025

The integration of behavioral architecture principles was evident in several aspects of the school environment. Table 1 summarizes the overall implementation of behavioral architecture at Christian Kalam Kudus 2 Kindergarten and underscores its contribution to key domains of early childhood development, as identified through field observations and semi-structured interviews. Building on this overview, a more detailed analysis of how behavioral architecture principles are applied within specific

spatial settings of identified key spatial and functional areas, and their role in supporting different aspects of children's development, is presented in the subsequent discussion.

Classroom

The classroom, as the primary environment for literacy and other structured learning activities, plays a central role in shaping cognitive development. The incorporation of child-scaled, rounded furniture and circle seating arrangements facilitates mobility, fosters peer interaction, and enhances task engagement (see Figure 2). Teachers noted that children remain more attentive and less fatigued during lessons while adapt quickly to routines due to clear spatial organization. The colour scheme (primary colours on furniture contrasted with softer wall tones) creates visual stimulation while maintaining balance. Such design strategies align with studies emphasizing the value of size, form, and colour in supporting attention and learning in early childhood environments (Barrett et al., 2015). As reported, pedagogical approaches are also spatially reinforced, as grouping students according to literacy proficiency allows differentiated instruction, thereby addressing diverse developmental needs. Nevertheless, certain limitations undermine the learning environment. On overcast days, insufficient artificial lighting reduced visual comfort and hindered concentration, underscoring the critical role of lighting in cognitive performance and well-being. Conversely, teachers' reports on quietness and controlled temperature highlight the importance of acoustic and thermal comfort in sustaining focus.

Sensory Play Area (Sand and Water Sensory)

The sensory play area functions as a space for targeted sensory stimulation, fostering physical growth, fine motor skills, and cognitive development. Similar to (Matthews & Lippman, 2020)'s findings, its compact yet open layout offers legibility that accommodates multiple children while maintaining accessibility and safety. As observed, child-scaled furniture encouraging independence and collaboration (see Figure 2). Bright accents on play objects provide stimulation, while softer tones on surfaces ensure visual balance. Acoustic control and sound-absorbing materials reduce auditory distractions, and temperature is regulated for comfort. Natural light is prioritized and supplemented with adjustable artificial lighting to sustain visibility. Teachers reported that through varied textures, shapes, and interactive elements, the space invites exploration, creativity, and peer interaction, refining dexterity and hand-eye coordination while enhancing social-emotional development.



Figure 2. (a) Classroom, (b) Sand and Water Sensory Play Area
Source: (Author, 2025)

Play Lab

The play lab functions as an interactive learning space equipped with LEGO, building blocks, and drawing tools that foster creativity and problem-solving. As observed, its child-scaled dimensions and open rectangular form provide sufficient

circulation, supporting both individual and group exploration (see Figure 3). Teachers suggested that flexible, movable furniture allows varied arrangements for different activities, while storage units keep materials accessible. Bright colours on play materials stimulate engagement, complemented by softer wall tones to maintain balance. Natural lighting enhances visibility and creates a welcoming atmosphere, though excessive solar exposure at midday raises indoor temperatures, reducing comfort and concentration. Ventilation, shading, or reflective materials are therefore needed to improve thermal conditions. According to (Lim et al., 2017), adequate ventilation and lighting control can boost students' academic performance. Acoustic control and a generally quiet setting further sustain focus. In line with behavioral architecture principles, the play lab supports exploratory, independent, and social play in a comfortable, stimulating environment.

Block Area

The block area functions as a key space for developing fine motor skills, creativity, and logical reasoning through constructive play. While (Matthews & Lippman, 2020) assert that movable furniture offer diverse defined activities, this learning space with open layout provide more freedom of movement and accommodates both individual and group varied activities (see Figure 3). Teachers noted that child-scaled, sturdy shelving keeps blocks visible and easily accessible, encouraging independence and safe use. The furniture arrangement maximizes central play areas, supporting collaboration and sustained focus. Natural colours and wooden textures create a calming yet stimulating environment, reducing visual overload while enhancing sensory engagement. Acoustic quietness and regulated temperature further promote concentration. Adequate natural lighting highlights the tactile and spatial qualities of the blocks, while artificial lighting ensures continuity on cloudy days.



Figure 3. (a) Play Lab Area, (b) Block Area
Source: (Author, 2025)

Pretend Play Area

The pretend play area encourages children to engage in role-playing activities such as acting as a doctor, shopkeeper, or teacher (see Figure 4). As reported by teachers, these imaginative scenarios are vital for fostering social skills, language development, and moral understanding, as children learn to express emotions, interact with peers, and comprehend social rules and norms. This result add more empirical evidence regarding the positive influence of pretend play on social skills (Smits-van der Nat et al., 2024). The space is thoughtfully designed to replicate real-life environments on a child-friendly scale, incorporating visual and tactile elements that are easily recognizable and stimulate the imagination. This design approach aligns with behavioral architecture principles by creating an environment that supports

cognitive and social engagement through purposeful spatial organization and sensory cues, thereby enhancing the overall developmental experience for young learners.

Music Room

The music room functions as a key environment for fostering creativity and emotional development through sensory and expressive experiences. Children engage in singing, playing basic instruments, and listening to rhythmic patterns, activities that build auditory recognition, pattern awareness, and emotional expression. The rectangular, child-scaled layout accommodates small groups, supporting collaboration and collective music-making while still allowing space for individual exploration (see Figure 4). In alignment with prior study (Matthews & Lippman, 2020), teachers suggested that furniture and instruments are arranged flexibly, enabling easy access and encouraging interaction, which is similar with the condition in play lab and block area. Bright yet balanced colours and tactile musical elements enhance sensory engagement, while acoustic treatments ensure sound clarity without overstimulation. Controlled temperature and natural light create a comfortable setting, complemented by artificial lighting for varied activities. Consistent with behavioral architecture principles, the design integrates acoustics, scale, and spatial flexibility to enrich musical experiences, promote self-regulation, and nurture social communication and teamwork.

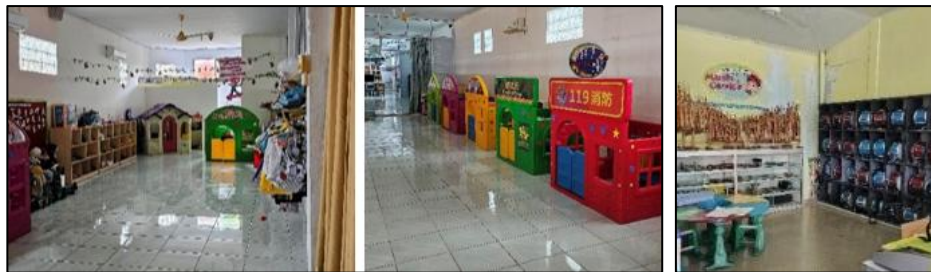


Figure 4. (a) Play Pretend Area, (b) Music Room
Source: (Author, 2025)

Reading Corner

The reading corner serves as a dedicated early literacy space that fosters children's cognitive and language development. Designed with child-scaled seating, appropriately sized bookshelves, and ample natural lighting, this area creates a comfortable and inviting environment conducive to focused reading (see Figure 5). As (Lim et al., 2017) highlight, lighting control from the form, size, and position of windows can improve young children's readability and focus. In line with behavioral architecture principles, the spatial arrangement and sensory elements are carefully considered to enhance engagement and concentration. According to teachers, early reading activities in this setting significantly contribute to the development of imagination, vocabulary comprehension, and attentive listening skills, all of which are essential foundations for lifelong learning.

Library

The library functions as a more comprehensive literacy support space compared to the reading corner. Within this area, children have access to a wider and more varied collection of books, which can be read aloud by teachers or explored independently by the children themselves. According to the teachers, this facility directly fosters the development of language skills and cognitive growth. The design incorporates low, easily accessible shelving, a quiet atmosphere, and efficient circulation paths, all of which contribute to creating a comfortable and inviting environment for young learners (see Figure 5). Whilst (Matthews & Lippman, 2020) highlight how the use of varied bright colours improve legibility, this study demonstrates how it can attract young learners to engage with the environment. Such thoughtful spatial arrangements align with behavioral architecture principles, aiming to encourage sustained engagement and positive learning behaviors.



Figure 5. (a) Reading Corner Located in the Hallway, (b) Library
Source: (Author, 2025)

Fitness Area

The fitness area is purposefully designed to stimulate the physical development and gross motor skills of young children. It facilitates activities such as jumping, crawling, and balancing (see Figure 6). This focused physical activities are essential for strengthening gross motor coordination, body fitness, and sensory modulation (Fu et al., 2022). Teachers highlighted that this space encourages active physical participation, helping children to build stamina and develop healthy movement habits. Additionally, the area supports the cultivation of discipline through structured yet flexible play opportunities, allowing children to explore their physical capabilities safely. In accordance with behavioral architecture principles, the environment is thoughtfully arranged to motivate engagement and movement, providing varied textures, levels, and equipment that respond to children's developmental needs. Such design considerations not only enhance physical growth but also support behavioral patterns that promote confidence, independence, and social interaction.

Swimming Pool

The swimming pool functions as an essential space for fostering both motor and sensory development in young children (see Figure 6). Teachers affirmed that engaging in water play activities helps to build muscle strength, enhance balance, and improve coordination through dynamic, full-body movement. The sensory experience of water also stimulates tactile awareness and encourages children to explore different physical sensations in a safe and controlled environment. Prior study also found that swimming enhance foundational movement skills (Sinclair & Roscoe, 2023). Beyond physical benefits, the pool serves as a social learning space where children are introduced to important behavioral norms such as taking turns, sharing space, and following safety rules. This fosters early development of cooperation, communication, and social interaction skills. Incorporating behavioral architecture principles, the design of the pool area emphasises safety, accessibility, and sensory richness, creating an environment that supports holistic development, physically, cognitively, and socially, through active, enjoyable play.



Figure 6. (a) Fitness Area, (b) Swimming Pool
Source: (Author, 2025)

Playground

The playground is designed as an open, proportionate space that allows children to move freely, practice gross motor skills, and build spatial awareness. Its scale supports active play such as running, climbing, and balancing, fostering confidence in

physical abilities (see Figure 7). Child-scaled equipment and accessible layouts enable independent use while promoting safety, as observed and reported by teachers. Bright, contrasting colours and varied surface textures provide visual and tactile stimulation, sustaining engagement and enhancing sensory perception (Matthews & Lippman, 2020). The openness of the layout encourages imaginative exploration and spontaneous social play, where children interact, collaborate, and develop interpersonal skills. While primarily outdoors, the design integrates behavioral architecture principles by combining scale, colour, and texture to create a stimulating yet secure environment. In this way, the playground functions not only as a recreational area but also as a learning setting that supports physical, cognitive, social, and emotional development through play.

Flexible Open Space

The open space area within the kindergarten functions as both a transitional zone and an unrestricted play environment, enabling children to move freely and engage in spontaneous activities beyond the confines of structured programmes (see Figure 7). Teachers reported that this area is instrumental in fostering the development of gross motor skills, as children are encouraged to run, jump, and explore their physical capabilities. They rightly added that this multifunctional space supports social development by providing opportunities for peer interaction, cooperative play, and the cultivation of essential communication skills. By facilitating unstructured movement and social engagement, this space aligns with behavioral architecture principles aimed at creating environments that nurture holistic early childhood development.

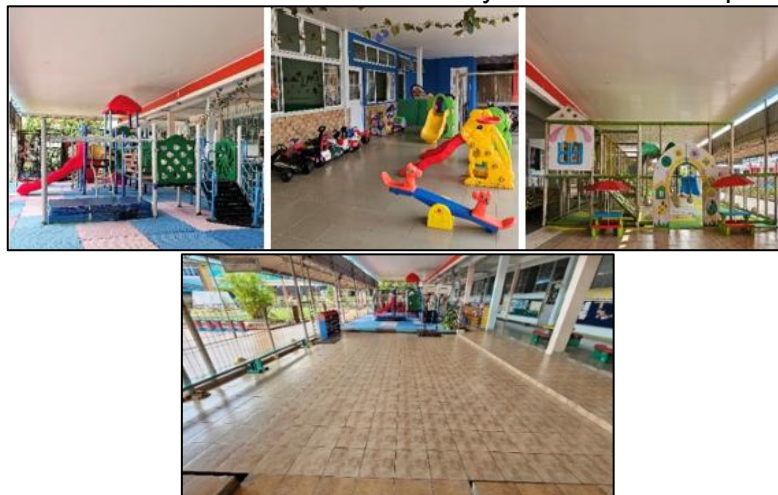


Figure 7. (a) Playground, (b) Flexible Open Space Area
Source: (Author, 2025)

Canteen

The canteen functions not only as a designated dining space but also frequently hosts cooking classes, providing children with hands-on opportunities to engage in simple cooking activities (see Figure 8). Teachers noted that these practical sessions play a vital role in nurturing cognitive development, enhancing fine motor skills, and promoting social interaction. Through exposure to various ingredients and participation in group tasks, children learn important concepts related to food, collaboration, and self-reliance. Similar with the other rooms, the canteen is thoughtfully designed with furniture scaled appropriately for young children and an arrangement that encourages fluid movement and social engagement (Matthews & Lippman, 2020). This multifunctional setup allows the space to be flexible and responsive to the diverse activities that support holistic child development.



Figure 8. Canteen
Source: (Author, 2025)

5. Conclusion

This case study provides a thorough understanding of how the implementation of behavioral architecture in kindergarten design can effectively support early childhood development. By shaping spatial environments that are child-scaled, sensory-rich, safe, engaging, and socially responsive, the five elements of behavioral architecture (spatial function; size and form; furniture and its arrangement; colour; sound, temperature, and lighting) positively influence the physical and motor, cognitive, language, social, and moral domains of development. The findings indicate that, among these elements, spatial function and furniture (including their arrangements) emerged as the strongest contributors. Varied spatial and functional areas enable diverse pedagogical opportunities that support all domains of development. Likewise, furniture that are child-scaled, legible, flexible, movable, and well-arranged encourages autonomy, exploration, learning engagement, and social interaction, promoting holistic developmental gains. The remaining elements also offer meaningful, though more partial, contributions. Balanced colour schemes enhance engagement and attention while avoiding overstimulation. This affects positively on cognitive, language, and social development. Appropriate spatial size and form can stimulate physical and motor, cognitive, language, and social skills through improved mobility, social interaction, and effective learning experiences, while the regulation of sound, temperature, and lighting improves comfort and concentration, enabling children to learn more effectively.

Nevertheless, several critical design shortcomings were identified in the observed kindergarten, including thermal discomfort and inadequate artificial lighting in certain rooms. These issues underscore the need for enhanced passive environmental strategies and more robust lighting systems, while remain prioritizing access to natural daylight. Addressing these issues would improve comfort, safety, and usability, thereby strengthening the alignment between architectural design and developmental outcomes. Although the study offers valuable insights, it is limited to a single case in Batam City, which restricts the generalisability of its conclusions. Future research may involve multiple kindergarten settings across diverse socio-cultural and urban contexts to validate and extend the findings. Comparative and longitudinal studies would also be beneficial for examining how behavioral architecture interventions influence children's developmental trajectories over time.

Ultimately, the study affirms that kindergarten are not merely functional spaces but active agents in shaping behavior, learning processes, and development of young children. It is suggested that, by strategically applying behavioral architecture principles, early childhood education facilities can be more effective in supporting holistic development and contribute to stronger foundations for children's long-term well-being and success.

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