

Color Design in Preschool Interior Spaces: A Comparative Analysis of Two Preschools in Ho Chi Minh City, Vietnam

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Abstract

As one of the crucial components of the microsystem system in human development, the educational environment plays a significant role in shaping young children's holistic development. Preschool interior space could be one of the most important places where children first interact in school life. Specifically, the interior space of preschool is the place where young children spend a lot of time in their lives surpassing the home environment. In Vietnam, research on preschool interior design, particularly in the context of color usage, remains limited despite there is high demand to build preschool buildings to adapt to the increasing number of young children going to kindergarten each year, such as in Ho Chi Minh City (HCMC). This paper explores color designs in preschool interiors in HCMC, Vietnam; aiming to propose colors that align with children's developmental needs and pedagogical practices. Through conducting the data from reviewing academic articles and papers, on-site observation case studies in both public preschool and private preschools, focus on interior classroom space, visual-spatial, and color comparative analysis, and utilizing Adobe's palette extractor for color palette, this paper explores the application of color design in preschool interior space. The findings suggest the potential benefits of using bright and cool tones for background colors, complemented by vibrant hues such as blue, red, yellow, or orange for accents in interior spaces. Aligning with pedagogical practices, the use of color can create stimulating environments that encourage children to explore and discover. Additionally, attention should be given to factors such as flooring materials, cultural context, and spatial functionality. The findings of this paper contribute to the limited academic resources on color space design in Vietnam, providing valuable insights for architects, interior designers, teachers, and educators to make informed decisions when designing preschool environments.

Keywords: color design, preschool interior space, children's development, pedagogy

1. Introduction

The theory of Bronfenbrenner about ecological development indicates that there are five distinct environmental systems in human development, including microsystem, mesosystem, ecosystem, macrosystem, and chronosystem (Santrock, 2000), the microsystem plays an important role in the immediate environment where young children spend most of their early time in enduring relationships, including home, neighborhood, school/daycare, and work. Which, environment of schools or daycare centers is a key educational factor in children's lives, where they are taught and nurtured to become a valuable part of future social labor source. In there, young children meet teachers as "second teachers" and interact with the school environment as "third teachers" (Reggio Emilia's pedagogy, cited in Terreni, 2019). From this point of view, the study focuses on the interior space of the educational environment, particularly in the design of preschool interior space.

The role of spatial design in preschool environments, particularly interior elements, is crucial for fostering children's development. Maxwell (2007) indicated that the design of the physical environment could foster a child's sense of competence and create learning and playing opportunities (Berris, R & Miller, E., 2011). Numerous previous studies have examined environmental elements within preschool children (Matthews, E., Lippman, 2020) (David, T.G., Weinstein, C.S., 1987); focusing on architecture and its landscape as "a social space" toward children's cognitive and physical development (Said, 2007); architectural design and spatial organization of preschool facilities have positive influences on children's development (D. Stankovic, A. Milojkovic, M. Tanić, 2006); culture determinants (Yalcin M., BOZDAYI A. M., ERTEK M. H., 2017); preschool plan space and children's cognitive development (Shaari, M.F., Zaiki, Y., Sh. Ahmad, S. and Ismail, 2021). However, research and analysis on color design in preschool environments and children, specifically in the context of interior space still be underestimated in contemporary research. Color is one of the crucial design vocabularies within interior space (D.K.Ching, 2018), and contributes to the aesthetic qualities of the early childhood education classroom (Read, Marilyn A., 2003). Although there is still some research on color (Read, 2019, 2023), there is a lack of in-depth studies focusing on color design within the practical interior design process.

Building on these frameworks, this research focuses on the underexplored context of Vietnam. In Vietnam, specifically in HCMC, there has been a significant increase in the number of kindergarten-aged children,

with approximately 10,000 new children enrolling each year (<https://tphcm.chinhphu.vn/>, 2024), bringing the total to around 340,746 children in childcare centers (<https://thanhnien.vn/>, 2024). During the school year of 2023-2024, around 3,469 child centers (including both private schools and public schools) were in this area. This growth leads to the high demand for constructing new childcare facilities or reconstructing existing spaces to accommodate children attending school (<https://www.nguoiduatin.vn/>, 2024). Despite this societal demand, research sources on the interior spaces of kindergartens in Vietnam, particularly focusing on color design, remain limited. Most existing studies on Vietnamese kindergarten space design, primarily address topics related to the general quality of kindergarten classrooms and the teacher's role or teacher-children interaction (Hoang, N., Holopainen, L., & Siekkinen, M., 2018), pedagogy (D. Thao, W. A. Boyd, 2012) (N. Sau, C. Phuong, H. Hoi, 2020) (Patricia A. Shaw, et al., 2021) (Tran, 2024); few studies on architectural design (J. Victoryana, I. A. Wirakusumah, I. Sudradjat, 2024) (Wang, 2016) with the same case study. Existing research on Vietnamese preschool environments mainly focuses on pedagogy and teacher-student interaction, overlooking the critical role of color design in fostering children's development. This gap highlights the urgent need for research on kindergarten interior design in Vietnam, particularly in the urban context of HCMC. Focusing on the unique and underexplored context of Vietnam, this study is based on international theories while addressing cultural and pedagogical factors.

Based on the above gaps, this study aims to explore color design for preschool interiors in HCMC, to propose colors that align with developmental and pedagogical needs. Through conducting the data from reviewing academic articles and papers, on-site observation case studies in both public preschool and private preschools, focus on interior classroom space, visual-spatial analysis, and color comparative analysis, and utilizing Adobe's palette extractor for the color palette, this paper explores the application of color in preschool. Findings reveal significant cultural and contextual factors influencing design preferences, with implications for enhancing cognitive and emotional development in children. The scope of the paper is this study focuses on two case studies—a public and a private preschool in HCMC—as representative examples of contrasting approaches to early childhood education in Vietnam. While the sample size is intentionally small, this scope allows for an in-depth comparative analysis, highlighting the influence of educational philosophies and institutional settings on color design in preschool interiors. Although the findings are exploratory, they provide valuable insights into the

role of color in preschool environments and establish a foundation for future research on a broader scale.

2. Materials and Methods

2.1 Literature Review

2.1.1 Color Design in Interior Architectural Space

Color is a special element with various meanings in human life. It carries significant symbolism and conveys many communicating messages to humans, expressing cultural differences, psychological effects, and human emotion (Meerwein, Rodeck, Mahnke, 2007). In interior architectural space, color plays an important role in human's spatial perception and human's spatial experience. The relationship and interplay of colors and space are extremely important. Cao (2019) indicates that color is the core element of architectural interior design as it creates beauty and enhances the value of space (Cao, 2019). More specifically, color can be used to change or affect *"room proportions, such as wide, narrow, high, and low. Here, the synesthetic (intermodal) quality of experience (light or heavy in terms of weight) plays a role. Bright colors are experienced as being light in weight, and dark colors are experienced as heavy"*. (Meerwein, Rodeck, Mahnke, 2007); the psychological effects of color in architectural space impact human behavior and space tolerance, with different colors influencing the duration of space tolerance (Ali Dehghanpisheh, Mahrok Rajabi, 2018). Using the same color on different areas in space such as walls, ceilings, or floors could bring different feelings to humans in space. Red is used on the floor bringing a sense of festive and majesty, on the wall is a sense of dominance, meanwhile, red on the ceiling can bring to feeling of obscuring and burdensome. Hence, to have color design properly in interior architectural space, it is essential to research and understand interrelated aspects such as the relationship of people to color in both physiological and psychological requirements; the relationship of color to spatial function, to space and its elements such as material and lighting in space; orientation and aesthetic qualities of space (Meerwein, Rodeck, Mahnke, 2007). Considering these points, it is essential to have a deep understanding of the role of color design on children's developmental needs, ensuring a proper selection of color usage for preschool interior spaces.

2.1.3 Color Design and Influences on Children

Behalf of the role of color in the educational environment, color designs enhance the spatial framework of institutions to stimulate and support learning and living processes, that *"foster identification and well-being,*

support individual and social processes of development, as well as pedagogical attitudes and actions". It is claimed that the learning process depends on an individual's previous knowledge, level of development, learning aptitude and abilities, as well as needs, interests, and motivations (Meerwein, Rodeck, Mahnke, 2007). Hence, to promote the learning process of preschoolers in their preschool space, it is essential to use color design to support children's development based on their needs, preferences, and emotions. Numerous pieces of research claimed the significant role of color design on young children, such as color can serve as a powerful tool for symbolic representation impact on children's cognitive development (Cameron, B. A. et al, 1993), the close connection of color preference and children language development (Pitch and Mullen, 2005), children's emotions as young children establish association between color and their preference (Terwogt and Hoeksma (1995) cited in (Mazlum, Ö., & Mazlum, F. S., 2019). Design space for children should be based on the children's color requirements to create positive influences.

There are several influences and relationships of color design on young children, including children's cooperative behavior, socio and emotion, cognition, and feeling about the place, which expresses through color perception and emotional responses, are summarized in Table 1. (Read, Marilyn A., 2003) pointed out that color would have a significant impact on children's cooperative behavior, colors that children like can bring positive influences on behavior than disliked colors (Hill M., 2011); enhancing the feeling of comfort, interest, and characteristic of place for children (Old, 1987). The color preferred by young children in the major of the previous study are red and purple, cool colors were preferred over warm colors (Read, M. A. et al, 2009); pink is the most and next is red and blue (R. Ghayouri, S. Ayat, 2020); red, pink, purple, blue and yellow (Mazlum, Ö., & Mazlum, F. S., 2019); bright colors (Qing, Discussion on the color design of kindergarten interior space, 2023) (Chris J. Boyatzis, Reenu Varghese, 2010) (S. Xiaoxian, W. Meicheng, 2021) with positive emotions and can evoke a sense of energy happiness and vibrancy. Meanwhile, the colors not much preferred are yellow and orange (warm colors) (Read, M. A. et al, 2009); brown and grey (Nicola J. Pitchford et al, 2010); dark colors linked to feelings of negativity and a sense of seriousness, mystery, or even sadness feelings of negativity and sense of seriousness, mystery, or even sadness (Qing, Discussion on the color design of kindergarten interior space, 2023); black, white, gray, brown (Mazlum, Ö., & Mazlum, F. S., 2019). On the other hand, bright and vibrant colors can evoke feelings

Color Perception and Emotional Responses in Children	Specific Colors	
Children's preferred colors	Red, Purple (Read, M. A. et al, 2009)	
	Pink, Red, Blue (R. Ghayouri, S. Ayat , 2020)	
	Red, Pink, Purple, Blue and Yellow (Mazlum, Ö., & Mazlum, F. S. , 2019)	
	Cool colors (Read, M. A. et al, 2009)	
Children's dislike colors	Bright colors (Qing, 2023) (Chris J. Boyatzis, Reenu Varghese, 2010) (S. Xiaoxian, W. Meicheng, 2021)	
	Yellow, Orange (Read, M. A. et al, 2009)	
	Brown, Grey (Nicola J. Pitchford et al, 2010)	
	Black, White, Grey, Brown (Mazlum, Ö., & Mazlum, F. S. , 2019).	
Influence of color on children's emotion	Cool colors	Promote a sense of tranquility and relaxation (Olds, 1987) Light green and light blue color for calm down and pay attention in the classroom (C. X. Thung, H. Ahmad, 2022)
	Warm colors	High energy and engagement (Olds, 1987)
	Bright colors	Feeling warm and excited (Qing, Discussion on the color design of kindergarten interior space, 2023) Positive emotions, Sense of energy happiness, and vibrancy Sense of space, complemented by furniture and decorations (S. Xiaoxian, W. Meicheng, 2021)
	Dark colors	Feelings of negativity and a sense of seriousness, mystery, or even sadness (Qing, Discussion on the color design of kindergarten interior space, 2023)

Table 1. The relationship between color design and young children. Source: By author

of warm and excitement (Qing, 2023), it is recommended that light green, light blue, and other cool colors with low brightness should preferred used in preschool spaces to bring the feeling of stable and refresh, promoting calmness and relaxation. Warm colors encourage high energy and engagement, while cool colors promote a sense of tranquility and relaxation (Olds, 1987). High saturation tones like red, yellow, and blue can be used to emphasize the main entrance and space division, creating a vibrant atmosphere. Light or wooden colors can be incorporated to enhance the sense of space, complemented by furniture and decorations (S. Xiaoxian, W. Meicheng, 2021). The ideal colors to create a sense of calm and peace are blue and green (Thung, C. X., & Ahmad, H., 2022). Colors that children like can positively affect their behavior, while colors they dislike can have a negative impact (Hill C. , 2011).

The literature reviews highlight conflicting findings regarding children's color preferences for yellow, with studies showing both preference (Mazlum, Ö., & Mazlum, F. S., 2019) and aversion (Read, M. A. et al, 2009).

In conclusion, color, as an important visual element in interior architectural space, can impact dramatically on children's sensory experiences through space interaction. Influences of colors on children could be changed by different factors such as different age stages, gender, and culture. So, color, in the design environment, would be not stand-alone. It will be impacted by various factors, not only physical factors such as lighting, furniture, material & texture, but also social factors such as seasonal elements, personal colors, culture, and temperature.

To have a deep understanding of the role and influence of color design on young children is an essential step in interior design strategy for preschool environments. It is essential to pay attention to the interactions of color with other spatial elements, also, to have a whole view of influences to develop a holistic interior

design. In the educational environment, preschool is a place for play, learning, and community for young children 3 to 6 years old. To facilitate the development of sensory perception as a basis for emotions, cognition, and thought, for activity and creativity, and independent, responsible, and social actions (Meerwein, Rodeck, Mahnke, 2007), that is the overarching aims not only for educators but also for designers.

2.1.2 Color Design and Early Childhood Education

Several studies explore the relationship between color and pedagogy in early educational childhood environments. For example, color is used as the coding material in categorization and sequencing in the Montessori approach, supporting the learner's cognitive development (B. Saha, A. Adhikari, 2023). In Reggio Emilia's education, it is one of the key elements in creating aesthetically pleasing and stimulating space (Terreni, 2019). Similarly, it is an important element that should be integral to Waldorf schools' architecture and design, evolving in each classroom to reflect the progression of grades (Mezentseva., 2019), suggested that "warmer, reddish colors" for first-grade, "cooler, bluish colors" for sixth-grade; or concept of color psychology in kindergarten classroom (C. X. Thung, H. Ahmad, 2022). Not only that, it is claimed color has been shown to reduce distractions and positively influence students' behavior (AlShabanah, 2014); enhance classroom environment for optimal experience for young children (Read M. , 2019); foster children's interaction and exploration in learning environment (A. Ranka, K. Doshi, S. Parmar, 2022); support for preschool children's cognitive development (N, A., Joneurairatana, E., Sirivesmas, V., 2024). Furthermore, color enriches the activity areas, including physical activity in the classroom: book reading, looking and sharing, and singing/rhyming activities, for children with sensory experiences and inspiration (Read M. A., 2023).

Importantly, (Terreni, 2019) emphasizes that color – as one of the elements in the concept of aesthetics – reflects the social and cultural aspects of the individual educational contexts. This reflection contributes to generating an overall sense of attractiveness and beauty within early childhood center environments, especially, Terreni (2019) studied a Vietnam preschool as a case study about the aesthetic of the preschool environment rooted in Vietnamese culture, traditions, and values. In the Vietnamese national curriculum, it is emphasized that educational methods should create opportunities for children to experience and explore their surroundings in diverse ways, catering to their needs and interests under

the motto, "play while learning, learn by playing" (01/VBHN-BGDĐT, 2021). Therefore, the spatial environment plays a crucial role in supporting these educational methods, and color – as one of the elements in the spatial environment, also plays an important role.

In conclusion, the above studies collectively suggest that color is a critical element in early childhood educational spaces. It not only enhances pedagogy and supports children's learning processes but also reflects the unique social and cultural dimensions of educational contexts. This underscores the importance of carefully considering spatial color in the interior design of educational environments for children.

2.3 Research methodology

Based on the above literature review, to examine color design applications for preschool interiors in HCMC, and propose palettes that align with developmental and pedagogical needs. To achieve this, spatial analysis was conducted in preschool environments, focusing on interior classroom space. The criteria for selecting preschools were derived from the literature, emphasizing the need for diversity in pedagogy, representation of both public and private education systems, and institutional prominence in the kindergarten sector in HCMC, including location in key districts of HCMC; selection of public preschool (national curriculum) and private preschool (international curriculum), educational quality and contributions to early childhood education. Among the contacted preschools, two institutions granted access for on-site observation and taking photos in the classroom interior space for visual analysis.

Case study 1: The public preschool, namely the Hoa Lan Preschool (HLP), HCMC, located in Go Vap District-one of the three most populous districts in Ho Chi Minh City, known for its rapid urbanization (govap.hochiminhcity.gov.vn, 2019). Hoa Lan Preschool has been recognized for meeting level 2 education quality standards by the People's Committee of Ho Chi Minh City, as per Decision No. 2816/QĐ-UBND (<http://congbao.hochiminhcity.gov.vn>, 2015), including its funding structure, design constraints, and adherence to government standards. This public preschool implements the national curriculum, designed by the Ministry of Education and Training (MOET) and the Department of Education and Training (DET) (Hang, 2019), which focuses on two main themes: teacher-initiated and child-initiated actions (Hang, 2019). The curriculum supports five developmental domains for children aged under six years: cognitive, language and literacy, physical, aesthetic, and social-emotional. These

domains are nurtured through the discovery and exploration of the surrounding environment, which serves as a supportive tool (01/VBHN-BGDĐT, 2021).

Case study 2: The private preschool, namely the Creative Kiddo Bilingual Preschool (CKBP), HCMC, is located in PhuNhuan District, a densely populated area considered the center of HCMC (aetoancau.vn, 2022). This preschool is well-established in the kindergarten sector in HCMC, with 7 campuses across the city (<http://creativekiddo.edu.vn/>, n.d.). Its pedagogy incorporates multiple curriculums (<http://creativekiddo.edu.vn/>, n.d.), including Sandford Harmony, with Montessori and Steam are popular private educational methodologies in Vietnam (Mira C. D et al, 2022) (www.vietnam.vn, 2024). Additionally, it integrates elements of the national curriculum, making this preschool a representative example of trends in private early childhood education. Since its establishment until now, Creative Kiddo Bilingual Preschool - has always carried the mission of providing 5 main principles in the concept of upbringing (<https://mamnontresangtao.edu.vn>, n.d.), including building positive relationships and interactions between children and teachers is the foundation for successful learning; social-emotional competence is a key factor in academic success; play activities must be designed purposefully to complement learning; physical environment affects the type and quality of learning; the coordination between school and family enhances the quality of children's development and learning.

Onsite observation and visual analysis in two preschools in HCMC were conducted to collect data. To ensure consistency and comparability, standardized parameters were applied during the observations. Both preschools were studied during morning sessions, focusing on classrooms designed for children aged 3–6. The functions of these classrooms were similar, accommodating key daily activities such as studying and sleeping.

The Adobe palette extractor was used to identify dominant hues, and tonal variations within each classroom. By utilizing Adobe's palette extractor (Color, n.d.), the color mood of two preschools is crafted through fine-tuned color extraction, each preset adjusts the color palette to reflect the overall color scheme for the interior preschool classroom spaces. The color palettes were further analyzed through a comparative analysis board, highlighting the similarities and differences in color selection and interior design strategies between the two pedagogical approaches.

2.3.1 On-site observation, visual analysis, color palette analysis

Case study 1: Public Preschool – Hoa Lan Preschool (HLP), Go Vap District, HCMC, VN

From a general vision, it is easy to see the dense application of blue color in façade walls in the whole preschool space, with red and yellow accent colors on the grid of columns and decorative points on the wall (Figure 1). The exterior color scheme is also reflected in the interior space. Along the corridor of the classrooms, blue is used also the outside wall of each classroom. It creates two layers of blue among the façade and corridor walls (Figure 2). The tone of beige color comes from the color of the finishing material, including tile flooring and wood cabinet, light grey metal doors. More specifically, white tile ceramic walls, light wood, and bright cabinets.

In the classroom space (Figure 3), light blues are on columns and top walls, blue curtains, and colorful decorative walls with various hand drawings. Blue on the walls and grey on the floor. The colors of furniture are quite varied and do not follow a unified color scheme, such as pink garbage, blue tables, red chairs, red and blue shelves, wooden shelves (brown, red, blue), grey wooden floors, and white ceilings. It is easy to recognize that blue is overused in HLP, not only in the interior space of the classroom but also in the exterior space, and corridor space.

Following this, using the photos of the interior design of the classroom, Adobe's palette extractor was used to generate the color palette for the interior space design in HLP (Figure 4). The data in Figure 4 indicate that the main colors used in the interior space of a classroom in this preschool are tones of blue, green, and yellow. Most of the colors used in this preschool are vibrant, and create strong visual stimulation, particularly on the walls and ceiling. The grey tones in bright, muted, and deep color bars are derived from the flooring material. The outstanding colors in this space are tones of yellow, light green, and red.

Figure 1. The view of the façade and outdoor playground of HoaLan preschool. Source: By author



Figure 2. Color design in the corridor area of the preschool. Source: By author



Figure 3. Interior design of Pre-Classrooms space. Source: By author

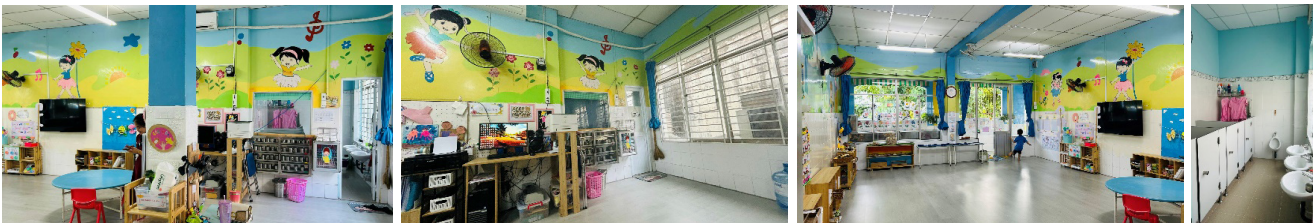


Figure 4. Color Palette of Pre-Classrooms space in HLP, dominated by vibrant blue, green, and yellow tones. By Author



Colorful					
Bright					
Muted					
Deep					
Dark					

Case study 2: Private Preschool - Creative Kiddo Bilingual Preschool (CKBP), Phu Nhuan District, HCMC, VN

The campus of CKBP is analyzed in this paper is the campus located at the center area of HCMC, and specially was renovated from an old villa. Consequently, the overall interior space of this campus is quite limited, including a too-small playground on the ground floor with a small main lobby (Figure 5). Hence, it is necessary to use color effectively in this space, sight application can help to expand the space or to make space brighter of make space or vice versa, space becomes smaller and more confining.

In interior architectural space, white and beige colors are used as background colors in CKBP, and mallard hue and strong blue are colors as accent colors in façade, playgrounds, and decorative items. It is a highlight to see the color of natural wood flooring and furnishing with the tone of yellow-brown is the main color in the whole space. Blue, green, little red, orange, and dark brown could be used as decorative items to make space more interesting in some places (Figure 5, 6).

There is a clear and unified color in the classroom space. White on walls and ceiling, beige on rugs, and natural wood on tile flooring and wood furniture (chairs, tables, and shelves). The color of wood dominates the majority of space so the color of the whole interior classroom space with beige, light brown, and yellow. The mallard hue, as an accent color, occupying about 10% of the space, is applied as lines on the floor or in functional rooms to serve as color coding for children's visual perception.

Following this, using the photo's focus on classroom space, Adobe's palette extractor was used to generate the color palette for the interior space design in CKBP (Figure 8). The data in Figure 8 indicates that the main colors used in the interior space of a classroom in CKBP are tones of blue, yellow-green, and brown. The blue could be seen as a key color in high saturation, and the background color is tones of brown. The outstanding colors in this space are tones of yellow, light blue, and red.



Figure 5. Color design in main lobbies of Creative Kiddo Bilingual Preschool.
Source: By author

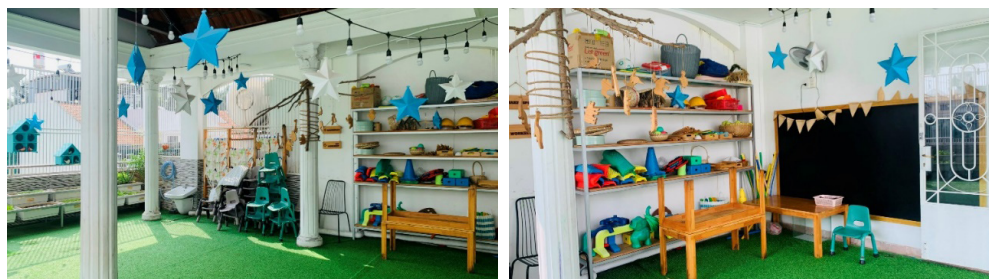
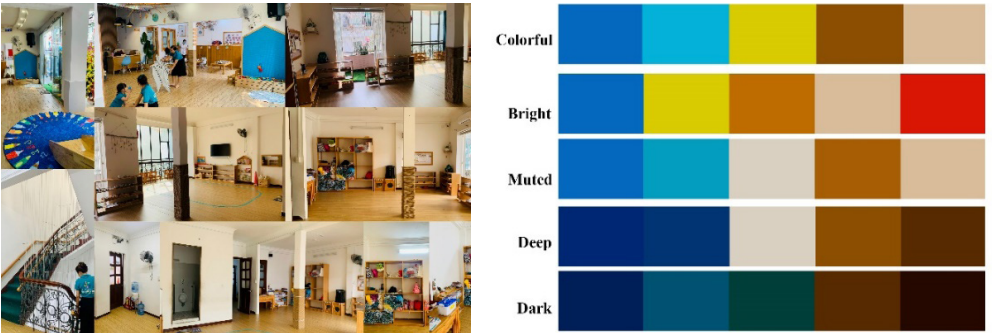


Figure 6. Design of playground on the rooftop of preschool.
Source: By author

Figure 7. Interior design of Pre-Classrooms space. Source: By Author



Figure 8. Color Palette of Pre-Classrooms space in CKBP, featuring muted wood tones and light green. Source: By Author



2.3.3 Comparative Analysis Board

To conduct a comprehensive analysis of color design in preschool space, a comparative analysis board is performed below between HLP and CKBP to examine the differences in color design. The color palettes are relied on Adobe’s palette extractor automatically analyzes the dominant hues in photographs of the preschool interiors and provides data on three key attributes: saturation – the intensity of color which affect its ability to stimulate or clam, brightness – the lightness or darkness of a hue, influencing spatula perception and mood, contrast – the visual difference between colors, impacting the clarity and harmony of a space.

The generated data was categorized and visually compared to identify color variation used between two preschools. Comparing the color palettes of the two preschools reveals that both incorporate tones of blue and yellow in their spaces, prominent colors are blue, yellow, and red with less dominant colors coming from the flooring materials—grey in HLP and natural brown wood in CKBP. The primary difference lies in the overall color theme: HLP’s palette is more vibrant, while CKBP’s color scheme appears deeper, with blue being particularly strong and prominent compared to other colors in the space.

Color Design in Preschool Space		Public preschool The Hoa Lan Preschool	Private preschool The Creative Kiddo Preschool
Pedagogy		National curriculum	Private curriculum
Overall Main Color		Blue, Grey, Yellow	Wooden color (Tone of yellow and brown)
Prominent Color		Strong Blue, little Yellow, Yellow-Green Red	Green-blue in tone of mallard hue, strong Blue Few red
Color in Preschool Classroom	Background color	Difficult to determine	White/Beige
	Main color	Vibrant Blue, Colorful Decoration	Wooden color (warm tone of wood)
	Accent color	Pink, Red, Yellow	Green-Blue, Green, Yellow Red
Color in Functional Classroom	Background color	Blue	Beige
	Main color	Blue	Brown natural wooden
	Accent color	Colorful	Color of Study Material
Color of Furniture		Red, Yellow, Green	Natural Wooden Color
Color of Finishing Material		The floor color is predominantly grey	The floor and furniture feature natural wood tones
Color and Outdoor Environment		Tree, Plan	Tree, Plan

Table 2. The comparative analysis board of color selection among Hoa Lan Preschool and Creative Kiddo Bilingual Preschool. By Author

Color palettes and color analysis boards show distinct patterns between the two preschools: vibrant blues are predominant in the public preschool (HLP), while muted wood tones dominate the private preschool (CKBP). Light green and beige, common to both spaces, align with the theories of children’s preferred colors (Read, 2009; Qing, 2023; Xiaoxian, 2021). Additionally, the design of the two preschools avoid the use of dark colors, black, or excessive white, which aligns with theories of children’s dislike of colors and their potential negative influence on children’s emotions (Table 1). HLP employs strong contrasts to define spatial divisions, whereas CKBP uses subtle transitions to create a cohesive aesthetic. Both preschools incorporate similar hues—blue, yellow, green, and red—as prominent colors, which align with findings by Read (2023) and Thung and Ahmad (2022) on their effectiveness in stimulating attention and cognitive engagement in young children. However, CKBP features a more unified and minimal color scheme, with fewer selections and a stronger emphasis on natural tones compared to HLP’s varied and vibrant palette.

3. Results

The analysis reveals that the color schemes in both preschools align with children’s preferred colors, as highlighted in the literature—namely bright, cool colors, particularly vibrant blue and blue-green shades, red – can impact positively on children’s behavior as in literature review mentions. Both preschools prominently use blue and green in their spaces—colors ideal for creating a sense of calm and peace, as noted by Thung and Ahmad (2022). Consistent with previous studies, these preschools also utilize high-saturation tones, such as blue and yellow, to emphasize entrances and define spatial divisions, fostering a vibrant atmosphere, stimulate cognitive activity and attention, consistent with findings by Read (2009). Color palettes and photo boards of two preschool suggest that the background color could be cool and bright color, with color of floor material; in while, strong vibrant color could be used as prominent color such as blue, or red.

Color selection in both spaces creates a sense of attractiveness through vibrant colors in the spaces reflecting the literature on the relationship between color and

pedagogy, which emphasizes that preschool spatial design should stimulate children's exploration and discovery. The appropriate color design can support children's emotional and cognitive development through visual stimuli. Although both preschools apply two different pedagogical approaches, their color scheme shares similarities in the main colors. This suggests that the key focus may lie in using color to create a stimulating environment that encourages children to explore and discover, rather than aligning colors strictly with a specific curriculum.

A significant difference between the two preschools lies in the color proportions and saturation. The same hue with varying saturation levels can result in distinct color themes, influencing the emotional and cognitive responses of children. The findings of the color scheme suggested that the color of the finishing material plays an important role in interior space design. Such as the floor color in both preschool environments is outstanding in the color theme. It highlights the importance of selecting neutral or balanced tones for floors, as they set the visual foundation that influences overall color perception. Interestingly, while previous studies mentioned that colors like yellow and orange, brown—identified as less favorable for children (Read et al., 2009) (Mazlum, Ö., & Mazlum, F. S., 2019) —are still used, albeit minimally, especially brown as the color of wood natural material is overly dominant in CKBP's design, this reflects an aesthetic preference but may not align with children's color preferences. This discrepancy suggests that cultural or regional differences may influence the meaning and preference for certain colors.

4. Discussions

This study demonstrates that color design in preschool environments is shaped by multiple factors, including children's preferences, educational approach, functional space, and cultural context. As a consequence, the finding suggests some key considerations for color design in preschool environment. Color usage should be informed by children's psychological and physiological responses, as supported by the literature. Which color young children prefer or children dislike the color, which creates positive and negative emotions, should be considered in design, such as bright colors are preferred than dark colors which bring to sense of negative feeling.

Additionally, the findings align with previous pedagogical theories regarding the role of the physical environment in creating stimulating spaces that encourage children to discover and explore, both national curriculum and international curricula. Hence, color

usage should play a significant role in fostering such environments, rather than being strictly tied to a specific curriculum, work in harmony with other design elements in space. The interaction between colors within interior space, particularly the color of finishing materials, could play a critical role in creating a cohesive design. Results emphasize that the color of floor finishing materials significantly influences the overall color scheme of the space.

Finally, cultural and regional differences influence color symbolism and usage, highlighting the importance of contextual sensitivity in design. Some colors that are disliked in one culture may be preferred in another, underscoring the need to consider culture when using color in the design. Such as in Vietnam, a country rich in cultural traditions, colors such as red or yellow carry deep cultural associations that are prominently used during the Lunar New Year, symbolizing luck and happiness. Hence, suggestions for actionable steps in the design of future interior designers and educators should consider the cultural and regional meanings of colors in creating preschool environments. This approach can enhance the emotional and cognitive experience of children through fostering stronger connection between environment and its end-users.

5. Conclusion

Designing an appropriate color scheme for preschool environments is a complex task requiring careful consideration of children's psychological, physiological, pedagogical practices, and cultural needs. This study highlights the importance of aligning color choices with children's preferences (such as tones of blue, yellow, and green) while considering cultural contexts. The proposed color palette for preschool is that using color tones brings positive emotions such as cool, bright, and warm colors, and limitations in using dark colors. It is necessary to pay attention to spatial factors such as flooring materials which occupy a large average in interior space. Colors should be used to create stimulating environments that align with pedagogical approaches in both national and international curricula, supporting children's developmental needs through exploration and discovery to enhance their learning process. It is important to design with a deep understanding of cultural context with color usage.

This study is limited by its small sample size, which constrains the generalizability of the findings. The two selected preschools—a prominent public institution and a private preschool adopting multiple educational method—

offer contrasting perspectives that align with the study's aim to explore how educational and institutional contexts influence interior color design. Future research should expand upon this study by incorporating more empirical investigations, collecting data from a larger sample of preschools, observation of direct input from children's interaction, qualitative insights from teachers, or the impact of other spatial elements, such as lighting, location, temperature, or cultural context. Future studies should develop with more empirical studies to test the proposed framework, particularly across diverse specific cultural and educational contexts.

In conclusion, the findings of this paper contribute to the limited academic resources on color space design in Vietnam, providing valuable insights for architects, interior designers, teachers, and educators to make informed decisions when designing preschool environments. As well as the study highlights the critical role of color design in supporting children within interior preschool spaces.

CRediT Authorship Contribution Statement

An AguyenThiTam: Software, Validation, Formal analysis, Investigation, Data curation, Writing-original draft, Writing-review and editing and Visualization.

Eakachat Joneurairatnan: Conceptualization, Methodology/Study design, Supervision and Project administration. Veerawat Sirivesmas: Resources, Writing-review and editing, Supervision and Project administration.



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