



INTERIOR DESIGN GUIDELINES: DEVELOPMENT OF LEARNING SPACE FOR
CHILDREN IN VIETNAMESE PRESCHOOL



By
Mrs. Nguyen Thi Tam AN

A Thesis Submitted in Partial Fulfillment of the Requirements
for Doctor of Philosophy Design Arts (International Program)

Silpakorn University

Academic Year 2024

Copyright of Silpakorn University

-



วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต
ศิลปะการออกแบบ แบบ 1.2 (หลักสูตรนานาชาติ)
มหาวิทยาลัยศิลปากร
ปีการศึกษา 2567
ลิขสิทธิ์ของมหาวิทยาลัยศิลปากร

INTERIOR DESIGN GUIDELINES: DEVELOPMENT OF LEARNING SPACE
FOR CHILDREN IN VIETNAMESE PRESCHOOL



A Thesis Submitted in Partial Fulfillment of the Requirements
for Doctor of Philosophy Design Arts (International Program)

Academic Year 2024

Copyright of Silpakorn University

Title	INTERIOR DESIGN GUIDELINES: DEVELOPMENT OF LEARNING SPACE FOR CHILDREN IN VIETNAMESE PRESCHOOL
By	Mrs. Nguyen Thi Tam AN
Field of Study	Design Arts (International Program)
Advisor	Professor Dr. Eakachat Joneurairatana
Co advisor	Assistant Professor Dr. Veerawat Sirivesmas

Faculty of Decorative Arts, Silpakorn University in Partial Fulfillment of the
Requirements for the Doctor of Philosophy

..... Dean of Faculty of Decorative
(Associate Professor Arwin Intrungsi) Arts

Approved by

..... Chair person
(Professor Dr. Carolyn Barnes)

..... Advisor
(Professor Dr. Eakachat Joneurairatana)

..... Co advisor
(Assistant Professor Dr. Veerawat Sirivesmas)

..... Committee
(Dr. Rueanglada Punyalikhit)

..... Committee
(Assistant Professor Dr. Jirawat Vongphantuset)

630430003 : Major Design Arts (International Program)

Keyword : preschool learning space, children's development, interior spatial layers, pedagogy, design guidelines

Mrs. Nguyen Thi Tam AN : INTERIOR DESIGN GUIDELINES:
DEVELOPMENT OF LEARNING SPACE FOR CHILDREN IN VIETNAMESE
PRESCHOOL Thesis advisor : Professor Dr. Eakachat Joneurairatana

As one of four important elements of human development, school plays an important role in children's holistic growth. Preschool children spend most of their time in the indoor environment compared to other environments, especially, in the classroom where they learn through discovering and exploring the surrounding environment. Interior learning space, therefore, exerts a significant impact on children's development, include physical – cognitive – socio-emotional, and designers should be aware of the importance of interior spatial layers for preschool children. The primary aims of this study are to find out which main domains play a role in the interior design of learning spaces for preschool children; to develop a theoretical model for designing preschool classroom interiors by clarifying the seven spatial layers; to implement the concept of the 7 interior spatial layers in a learning preschool space that support children's development and learning through effective pedagogy; and to propose design guidelines for the 7 spatial levels. Within the scope of the study, the thesis book focuses on preschool children aged 3 to 6 years old and the interior of the classroom to conduct an in-depth analysis. The research methodology of this paper uses qualitative methods, including a literature review from academic books, journals, case studies, and related websites. It conducts the following three main steps: first, design thinking—visiting the site and analyzing five preschools in Ho Chi Minh City, followed by a comparative analysis of classroom interior design in public and private preschools; second, the design process—through the analysis of a specific preschool focused on the selected pedagogy and conducting a survey questionnaire to understand the perspectives of stakeholders related to the research theory; and third, design evaluation—through a workshop and in-depth interviews to develop the theoretical framework, following interior design guidelines and using the 7 Layers Wheel to deepen understanding of preschool learning spaces. Findings of research are theory of designed physical learning space as “educational-tool” and classroom as “micro-spatial factor” in preschool space. theoretical model design for preschool learning space and concept of “7 spatial

collaborative layers” as well as the framework of “7 spatial collaborative layers” and feeling scale for interior space of preschool classroom. the interior design guidelines book for who want to design children learning space. The outcomes of this study offer valuable insights not only for interior designers, architects, educators, preschool teachers, but also for parents or whom care about children space, providing them with a deeper understanding of the design priorities for the physical classroom environment of young children. These findings serve as invaluable tools for analyzing project-specific requirements and prioritizing design elements within budgetary and contextual constraints.



ACKNOWLEDGEMENTS

This book owes its existence to the unwavering support, guidance, and encouragement of numerous individuals. I extend my deepest gratitude to my first professor, Professor Dr. Eakachat Joneurairat, whose insights and expertise have been instrumental throughout the development of this work. I am also sincerely thankful to my second professor, Asst. Prof. Dr. Veerawat Sirivesmas, for his invaluable advice during the research process. I express my heartfelt appreciation to Khun Malinee Wigran for her assistance with ethical documentation and her immense kindness and support. Additionally, I am grateful to Professor Dr. Supawinee Charungkiattikul for her steadfast guidance and insightful feedback throughout my research journey.

A special acknowledgment is due to my professors, colleagues, and close friends in the Doctor of Philosophy in Design Arts program at the Faculty of Decorative Arts, Silpakorn University (SU) in Bangkok, Thailand, as well as those from the University of Architecture (UAH) in Ho Chi Minh City, Vietnam. Their creativity and passion have inspired and challenged me significantly, influencing the development of these guidelines.

I am profoundly thankful to the many educators and caregivers who shared their experiences and provided invaluable feedback, enabling me to grasp the complexities of designing spaces that genuinely cater to children's needs. I also extend my gratitude to the preschool educators who graciously allowed me to conduct onsite data collection for my thesis and to all participants who generously dedicated their time to complete surveys and engage in in-depth interviews—this work would not have been possible without your contributions.

To my dear friend Linh, a PhD candidate, who understands me deeply and has always supported me with invaluable advice during our long, late-night conversations. Thank you for sharing my traumas, worries, and thoughts throughout this research journey.

To my sister's team in UAH, who listen to me and cheer me up every day. Thank you for always believing in me, even without reason.

To my family—my mother, who gives me motivation in enhancing my knowledge; my young sister, who encourages me with positive energy should believe in myself ; my husband, who understands my passion and provides continuous support; and my children,

Tin and Min, who are the inspiration behind my research and the motivation that keeps me going, even in moments when I feel like giving up —thank you for your unwavering belief in me and for the support and patience that enabled me to complete this project.

Lastly, I wish to acknowledge myself for maintaining faith in my ability to persevere through challenging times when life's demands felt overwhelming. From navigating online studies during the early days of the COVID-19 pandemic to managing pregnancy midway through this journey, I remained committed to progressing with a sincere heart, believing in the transformative power of knowledge.

This book stands as a testament not only to my efforts but also to the collective contributions of all those mentioned above.

Nguyen Thi Tam AN



TABLE OF CONTENTS

	Page
ABSTRACT.....	D
ACKNOWLEDGEMENTS.....	F
TABLE OF CONTENTS	H
LIST OF TABLES.....	N
LIST OF FIGURES.....	P
CHAPTER 1 INTRODUCTION	22
1.1 Significance of Research.....	22
1.2 Statement of Problem.....	26
1.3 Research Questions	29
1.4 Research Objectives.....	30
1.5 Scope of the Research.....	31
1.6 Research Framework.....	33
1.7 Conceptual Research	34
1.8 Research Methodology.....	35
1.9 Research Outcome.....	36
1.10 Definition of Terms.....	36
1.11 The Relationship between Research Objectives (RO), Research Questions (RQ), Research Methodology (RM), and Research Outcomes (ROC).....	38
CHAPTER 2 A. THEORY CHAPTER.....	40
2.1 Theoretical Framework	41
2.1.1 Bronfenbrenner’s model of the ecology of human development	41
2.1.2 Theory of child development.....	43
2.1.2.1 Physical development	44

2.1.2.3 Socio-emotional development	53
2.1.3 Interior design for preschool learning space	58
2.1.3.1 Roles and Impact of Interior Design of Physical Learning Environment	58
2.1.3.2 The structure of the physical learning environment.....	60
2.1.3.3 General requirements for the interior design of preschool learning space.....	67
B. LITERATURE REVIEW	71
2.2 Children's Developmental Needs and the Classroom Space.....	71
2.2.1 Children's physical developmental needs and the classroom interior design	74
2.2.2 The Children's Cognitive Developmental Needs and Classroom Interior Design	76
2.2.3 The socio-emotional developmental needs of children and the design of classrooms	79
2.2.4 The 21st-century children and design requirements for space	81
2.3 Pedagogy of early childhood, child development and classroom space design	85
2.3.1 Pedagogy: curriculum, teaching methods, teacher's needs and classroom design	85
2.3.2 The relationship between children, and teachers, Peers, and the interior classroom space	89
2.4 Conceptualization of 7 Interior Spatial Layers in the classroom space	94
2.4.1 The spatial collaborative layers in the interior space.....	95
2.4.2 The 7 interior spatial layers, the feelings scale and the preschool children	101
2.5 Preschool Children and the 7 Interior Collaborative Layers in Classroom Space	104

2.5.1 Seven interior spatial design layers in classroom space	104
2.5.1.1 Spatial Function	104
2.5.1.2 Spatial Form.....	113
2.5.1.3 Spatial Order.....	123
2.5.1.4 Spatial Color	132
2.2.1.5 Spatial Material	147
2.5.1.6 Spatial furniture.....	158
2.5.1.7 Spatial environment.....	163
2.6 Summary	169
CHAPTER 3 RESEARCH METHODOLOGY.....	171
3.1 Phase I - Design thinking	172
3.1.1 Site 5 preschools in Ho Chi Minh City	173
3.1.1.1. The City's May 19th Preschool, HCMC, Vietnam.....	173
3.1.1.2. The Le Thi Rieng Preschool, HCMC, Vietnam.....	176
3.1.1.3. The Hoa Lan Preschool, HCMC, Vietnam.....	180
3.1.1.4. The Creative Kiddo Preschool (CKP), HCMC, Vietnam.....	184
3.1.1.5. The Maitri Montessori Kindergarten, HCMC, Vietnam.....	187
3.1.2 Comparative analysis of classroom interiors in public and private preschools	189
3.2 Phase II – Design Process.....	189
3.2.1 Analysis 3 specific campuses of a private Montessori preschool	189
3.2.1.1 The campus is in 461- 463 Ha Huy Giap Street, Thanh Xuan Ward, District 12, HCMC	190
3.2.1.2 The campus locates in 230 Street TL13, Ward Thanh Lộc, District 12, HCMC	194

3.2.1.3 The campus is in 22/4 Pho Quang Street, Ward 9, Phu Nhuan District, HCMC	195
3.2.2 Questionnaire	199
3.2.2.1 Data and results of questionnaire	199
3.3 Phase III – Design Evaluation	214
3.3.1 Workshop: Exploring how to apply “feeling scale” in designing interior preschool space following the theory of “seven spatial collaborative layers”	215
3.3.1.1 Preparation	215
3.3.1.2. Process of workshop	216
3.3.1.3 Thought and feedback of participants	219
3.3.2.1 Transcription and familiarization with the in-depth interview	221
3.3.2.2 Analysis of the Results	229
3.4 Summary Findings	232
CHAPTER 4 DESIGN DEVELOPMENT	235
4.1 Research Results	236
4.1.1 Results of Design Thinking Phase	236
4.1.2 Results of Design Process	239
4.1.3 Results of Design Evaluation	242
4.2 Theoretical Conceptual Framework for Interior Design of the Preschool Learning Space	244
4.2.1 Theoretical conceptual framework of “educational-tool” with “7 layers”	244
4.2.2 The 7 Interior Spatial Layers and the Feeling Scale in Learning Interior Classroom Space	249
4.2.2.1 Spatial function	251
4.2.2.2 Spatial form	254

4.2.2.4 Spatial color	260
4.2.2.5 Spatial Material & Texture	263
4.2.2.6 Spatial furniture	266
4.2.2.7 Spatial environment	270
4.3 Design Guidelines for the 7 Collaborative Layers in the Interior Space of the Preschool Classroom.....	273
4.3.1 Spatial function	274
4.3.2 Spatial form	279
4.3.3 Spatial order	280
4.3.4 Spatial color	282
4.3.5 Spatial, Material & Texture	284
4.2.6 Spatial Furniture.....	286
4.3.7 Spatial Environment.....	288
4.4 Designs development	291
4.4.1 Interior Guidelines Book.....	292
4.3.1.1 Designing process	292
4.4.2 The feelings wheel tool of seven spatial interior layer.....	299
4.3.3 “Come to Unlock” Exhibition	302
CHAPTER 5 CONCLUSION AND DISCUSSION	306
5.1 Discussion	307
5.2 Conclusion	314
5.3 Limitation	316
5.4 Concluding thoughts	317
5.5 Recommendation	318
APPENDIX.....	319

REFERENCES	320
------------------	-----

VITA.....	336
-----------	-----



LIST OF TABLES

	Page
Table 1: The summarized number of figures on research related to the interior preschool design and preschool children in Vietnam.....	29
Table 2: The relationship between Research Objective (RO), Research Questions (RQ), Research Methodology (RM), and Research Outcomes (ROC).	39
Table 3: Indicators for the Physical Development of Children	45
Table 4: Process of Children's Cognitive Development.....	50
Table 5: The stage of children's cognitive development.....	51
Table 6: Indicators of Children's Cognitive Development	52
Table 7: Indicators of Children's Socio-Emotional Development.....	54
Table 8: Claims about the role of the physical learning environment for children.....	60
Table 9: Requirements for the characteristics of interior spaces for young children.....	69
Table 10: Layers of Longevity of Building Components	94
Table 11: Functional zones in the interior space of the classroom.....	111
Table 12: Types of Lines and their Character	117
Table 13: Types of Shape and their Characters.....	120
Table 14: Types of Form and their Characters.....	122
Table 15: Identify of color.	134
Table 16: Characteristic of color and it influences on human	136
Table 17: Summary of children's color preferences and non-preferences.....	139
Table 18: Characteristics of Different Group of Material	149
Table 19: Selection Criteria for Finish Material in Interior Spaces	151
Table 20: The Type of Finish Material in Preschool Classroom Space	157
Table 21: Children's Furniture Measurements	162

Table 22: Core-furniture and Sub-furniture in the Interior Space Classroom	163
Table 24: Analysis of the Results in Survey Questionnaire	231
Table 25: Categorize the Main components of Spatial Function Layers according to the Feeling Scale.....	253
Table 26: Categorize the Main Components of Spatial Form Layers according to the Feeling Scale.....	256
Table 27: Categorize the Main Components of Spatial Order Layers according to the Feeling Scale.....	259
Table 28: Categorize the Main Components of Spatial Color Layers according to the Feeling Scale.....	262
Table 29: Categorize the Main Components of Spatial Material & Texture Layers according to the Feeling.....	265
Table 30: Categorize the Main Components of Spatial Furniture Layers according to the Feeling Scale.....	269
Table 31: Categorize the Main Components of Spatial Environment Layers according to the Feeling Scale.....	272
Table 32: Relationship between children's development – requirements – interior design of space	313

LIST OF FIGURES

	Page
Figure 1: Theoretical Research Framework of the Study	22
Figure 2: The reality condition of organization the playing-learning space in Ho Chi Minh City	24
Figure 3: Theoretical research framework of the study	33
Figure 4: Theoretical mode design focus of the study.....	34
Figure 5: The research process with the methodology of primary research in five chapters of the dissertation.....	35
Figure 6: The Theoretical Framework.....	40
Figure 8: Bronfenbrenner’s ecological theory of development. Adapted from Santrock, 2000.....	42
Figure 9: Process of Human Development.....	44
Figure 10: Structure of Piaget’s theory about Children’s cognitive development	47
Figure 11: Key Components of Socio-emotional Child Development	57
Figure 12: The model of the main components of the learning environment	62
Figure 13: Design model of “7 spatial layers” of Design of Learning Space	65
Figure 14: Theoretical conceptual framework for the design of interior spaces for preschool classrooms.....	66
Figure 15: Characteristics of children’s developmental needs and the influence of classroom interior design	73
Figure 16: A large space can help children to walk more easily. An interior of a preschool classroom at HoaLan Preschool, HCMC, VN.....	75
Figure 17: Four main themes of the 21st-century children.....	81
Figure 18: Television and children in a preschool classroom in HCMC, Vietnam.	83

Figure 19: The preschool children at Stiegel Elementary School learn the alphabet with the Letters Alive program, in which the pictures on the letter cards come to life.....	83
Figure 20: The model of the relationship of design – pedagogy and resources in the learning space	87
Figure 28: Study corners in a preschool classroom is set by teachers in HoaLan Public Preschool, Go Vap, HCMC, VN.	90
Figure 29: Differences in furniture arrangements in classroom space based on teaching and learning plan.....	92
Figure 30: Teacher-organized study activities demonstrate social interaction between children and their peers in public preschools in HCMC, Vietnam	93
Figure 31: The basic compositional theory of design is traditionally divided into the elements and principles of design.	97
Figure 32: Model of the “7 interior spatial layers” in a preschool classroom space	100
Figure 33: Gingerbread person with an emotional level.....	102
Figure 34: The feeling scale with 7 interior spatial layers in a board and in a wheel	104
Figure 35: The key components in Spatial Function Layer.	104
Figure 36: The main elements of density.....	105
Figure 37: The design for active and quiet areas.....	110
Figure 38: An example of organizing objects in the classroom can also help children’s understanding of the space.....	111
Figure 39: The main elements of the Spatial Form.....	113
Figure 40: The main elements in spatial order	123
Figure 41: The size chart of young children.....	125
Figure 42: Measurement of development of children from 2, 5 – 6 years old.....	127
Figure 43: Introducing variety	129
Figure 44: Arrangement in space combines rhythm and emphasis	130

Figure 45: The main elements in the spatial color layer	132
Figure 46: Matrix of color in design.....	133
Figure 47: The relative colors of yellow brown	135
Figure 48: The interactive collaborative relationship of spatial color and the remaining six spatial layers and users in the classroom environment	143
Figure 49: Anthropometric information of preschool children in sitting and standing posture	160
Figure 50: The main element of spatial environment layer	164
Figure 51: A decorative corner in the classroom bring a unified sense of each class	166
Figure 52: My Montessori Garden Preschool” in Ha Long, Quang Ninh, Vietnam.....	167
Figure 53: My Montessori Garden Preschool” in Ha Long, Quang Ninh, Vietnam.....	168
Figure 54: The façade of The City 19thMay, District 1, HCMC.....	173
Figure 55: The design of stair, lobby, and corridor of classrooms	174
Figure 56: Interior space of corridor where has the information board, children’s cabinet, and The interior design of the preschool classroom	175
Figure 57: The façade of The Le Thi Rieng Preschool, District 1, HCMC	176
Figure 58: Outdoor and Indoor area in the center area of preschool.....	177
Figure 59: In the 1st option of the U-shaped space layout, the children sit on a chair and follow the plan of the U-shape so that the teacher can easily teach and guide them.	
Figure 60: The 2nd option of space design for a specific group with a table and chair group.....	178
Figure 61: The interior design of the corridor as a connecting element with the classrooms for personal discussions - Interior design of a characteristic preschool classroom in the LTR preschool	179
Figure 62: The façade of The Hoa Lan Preschool, District 1, HCMC.....	180
Figure 63: The design of outdoor play-yard in Hoalan preschool.	181

Figure 64: The corridor follows the classrooms and the L-shaped floor plan of the preschool	181
Figure 65: Interior design of a signature preschool classroom in Hoalan Preschool, GV, HCMC	182
Figure 66: Corridor area – as a social area where teachers – children – parents meet and discuss before and after classes	183
Figure 67: Cluttered corners in preschool classrooms make the space appear smaller and hinder children's movement around the space.....	183
Figure 68: The outdoor and indoor play yard on the ground floor	185
Figure 69: The stairs and lobby before classroom are too small.	185
Figure 70: The setting of ground floor for eating time of young children.....	185
Figure 71: The rooftop is renovated to outdoor school yard for children in CKP preschool.....	185
Figure 72: Interior design of signature preschool classroom in CSC.....	186
Figure 73: The indoor play yard in Maitri kindergarten.....	187
Figure 74: The Maitri kindergarten floor layout	187
Figure 75: Interior design of the area for 1-3 years old children.....	188
Figure 76: The area for 4-6 years old children.....	188
Figure 77: Interior design in Maitri preschool, HCMC.....	189
Figure 78: Outdoor space of CCP preschool.....	191
Figure 79: Main lobby and office rooms on the ground floor, CCP Preschool.....	191
Figure 80: Interior space of CKP preschool classroom.	192
Figure 81: Interior design of pre-classroom, toilet space.....	193
Figure 82: Outdoor playground of the campus	194
Figure 83: Interior space of the preschool classroom and art classroom.....	195
Figure 84: Outdoor playground on the ground floor.....	195

Figure 85: Indoor playground, ground floor.....	195
Figure 86: Design of interior space of CKP Preschool, Pho Quang Campus, HCMC.	196
Figure 87: Design of workshop's poster and feeling wheel tool.....	215
Figure 88: Workshop.....	217
Figure 89: Results of the “Feeling scale” boards	217
Figure 91: Theoretical Conceptual Framework for Interior Preschool Classroom Space with three main domains	245
Figure 92: The model of children's development with developmental needs	247
Figure 93: The conceptual model of characteristic of interior learning space.	247
Figure 94: The developed model with the 7 Interior Spatial Layers and the Feeling Scale in Learning Interior Classroom Space	250
Figure 95: The main components of spatial function layers and their relationship.....	251
Figure 96: The main components of spatial form layers and their relationship	254
Figure 97: The main components of spatial order layers and their relationship	257
Figure 98: The main components of spatial function layers and their relationship.....	260
Figure 99: The main components of spatial material & texture layers and their relationship	263
Figure 100: The main components of spatial furniture layers and their relationship ...	267
Figure 101: The main components of spatial environment layers and their relationship	270
Figure 102: Structure and Color Analysis for 7 Spatial Layers.	291
Figure 103: Drafts of Cover book of Interior Design Guidelines book.....	295
Figure 104: Design pages in IDG Book (see IDG book for more detail)	299
Figure 105: Prototype of Feeling Wheel of 7 Spatial Layers.....	300
Figure 106: Prototype of The 7 Interior Spatial Layers Boards.....	300
Figure 107: The inter-layer features of the Feeling wheel of 7 spatial layer	301

Figure 108: Floor plan of Exhibition and concept for Exhibition. By Author.....	304
Figure 109: Design of The 7 Interior Spatial Layers Boards _ Option 1	304
Figure 110: Design of The 7 Interior Spatial Layers Boards _ Option 2	305



CHAPTER 1

INTRODUCTION

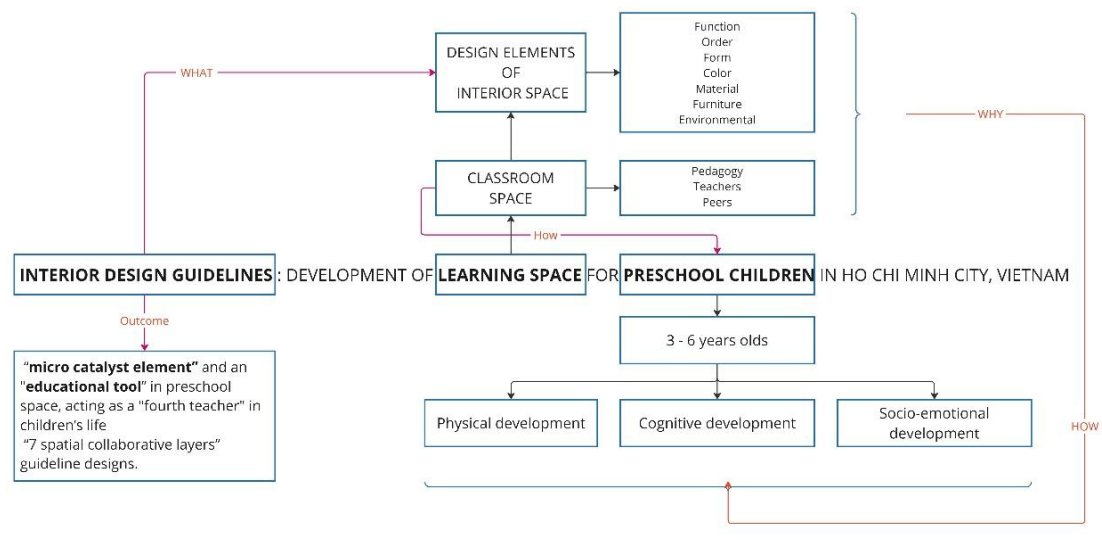


Figure 1: Theoretical Research Framework of the Study

1.1 Significance of Research

The foundations of a successful society are laid in early childhood development. In addition to the home environment - the first environment in which children interact - the school environment is also important for young children's lives. About one or two years later, the school environment has a significant impact on children's growth and development in life. In today's world, school has become the most important place of learning and practice for most children, overtaking the influence of the home environment. Children spend more than 8 hours a day at school, from kindergarten and preschool (0-5 years) to elementary school (6-10 years), secondary school (11-14 years) and high school (15-18 years). As a result, the important role that the early childhood educational environment plays in the holistic development of young children is increasingly recognized today. In particular, previous studies have shown that the period of early childhood is important for

human growth, human perception of the world and human interactions because environmental factors can shape them into good or bad individuals (Bronfenbrenner's theory, 1986). The preschool environment helps to foster young children's development by providing opportunities for exploration, reflection, experimentation, interaction, and learning (Santrock, 2000). The school environment is the "third teacher" in the lives of young children (Reggio Emilia concept). Therefore, the design of the learning environment plays an important role in the development process of children, not only in physical development, but also in cognitive and socio-emotional development, which are crucial factors for children to become good human beings and good workers for society in the future, especially in the context of the new century. Therefore, it is important and necessary to develop a deep understanding of how the preschool learning environment affects young children and to establish guidelines for designing preschool learning spaces that promote children's holistic development.

In recent years, the need for more preschool spaces for young children in Vietnam has increased as children need to learn more and more (nhandan.vn, 2022). In the official dispatch 4216/BGDĐT-GDMN of the Ministry of Education and Training (MOET, 2022), instructions were given to strengthen the planning and allocation of land resources for the construction of schools and kindergartens, especially in densely populated areas, industrial parks and export zones. In addition, this official document calls for the educational goal for preschools in Vietnam to be "building a child-centered preschool in 2021-2025", more specifically, the main goal for 2022-2023 is "building a green, safe and friendly preschool" (MOET, 2022). In this document (4216/BGDĐT-GDMN), the Ministry claims that *"The indoor and outdoor physical environments within the classroom should be designed to facilitate play, learning, and learning through play, taking into consideration the specific conditions of the setting"*, and *"Encourage children to be active in different ways; create conditions where children can easily choose and use things, objects and toys for*

practice and experience (Ministry of Education and Training, "Building a Child-Centered Preschool" in 2021 - 2025, 2021)."

This has led to the need to increase the number of pre-school buildings in Vietnam to meet the growing needs of the young generation of children. It is important to focus not only on the quantity of kindergartens/preschools, but also on the quality, especially the quality of design, particularly in the interior spaces where young children spend a lot of time. Architecture and interior design play an important role in creating a good preschool environment for young children. However, preschool interior design strategies in Vietnam are underestimated as they are only guided by general guidelines on size and requirements (Nguyen Hoang Lien, 2005). (Hanh, 2018) discussed the current status of the design of play and learning spaces in preschools in Ho Chi Minh City and showed that the reasons for the poor conditions (Figure 1) lie in the learning and play spaces in the preschool environment.

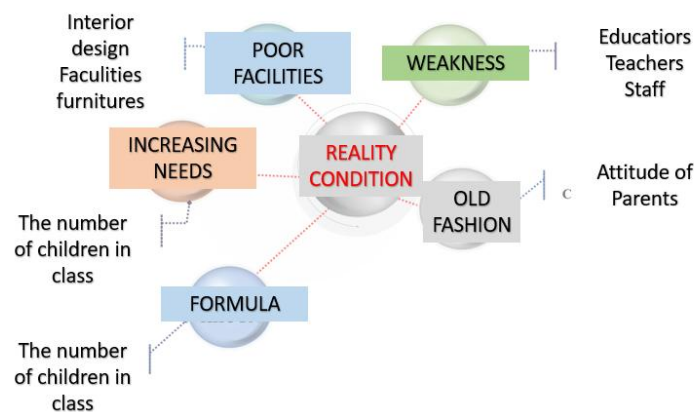


Figure 2: The reality condition of organization the playing-learning space in Ho Chi Minh City

The amount of investment in design depends on government funding (for public schools) or funds provided by private investors (for private schools). The level of investment in design depends on state funding in the case of public schools and on funds provided by private investors in the case of private schools. In reality, this means that most preschool interiors in Vietnam tend to be individualistic and inconsistent in design. The value and extent of the design depends on the skills and

experience of the designers or architects, who primarily reflect the needs and preferences of adults. What are the differences in the interior design of learning spaces for different ages of children? It is obvious that the Vietnamese Ministry of Education and Training sets the main goal of “building a child-centered preschool”, which leads to the need to conduct more and more research on a learning environment that meets the specific changes and requirements of the future generation of young children. It is precisely for this reason that the author has decided to tackle this complicated topic. It serves as the basis for the author’s research, which explores the relationship between children, their development and learning environments, with a particular focus on the interior design of preschool classrooms. This research identifies the interior space in preschools as a "micro-element" that contributes significantly to the holistic development of children and acts as a "fourth teacher" that promotes the formation of good habits in children”. The main objective of the research is to identify the most important areas in the interior design of learning spaces in preschools by examining the characteristics of the developmental needs of preschool children (3-6 years old) and identifying the relationship between interior design and young children. Next, we develop a theoretical model for the interior design of learning spaces for preschool children and introduce the concept of 7 spatial levels. Finally, we propose guidelines for the design of the 7 spatial levels. These guidelines will serve as a valuable resource for interior design in Vietnamese preschools. Educators, architects, interior designers and even parents who want to create conducive learning spaces for their children at home can refer to the design concepts and guidelines outlined in my study. In this way, they can analyze the specific requirements of their projects and prioritize the design elements according to the available budget and special conditions, while maintaining design standards that are aligned with children's needs and growth.

1.2 Statement of Problem

It is worth noting that previous research has focused mainly on architectural elements (Said, 2007), elements and designed windows in low stimulation environments while favoring activity materials and décor in high stimulation settings (Read, 2010), spatial understanding (Clement, 2019), the importance of varied scales, nature exposure, and interactive spaces (A. Rigolon, M. Alloway, 2011) and the role of the teacher (Tutrang Nguyen et al, 2020). Some others have also focused predominantly on design elements in the anteroom (Francis D.K. Ching, Corky Binggeli, 2018), children's furniture design (Haiyan Duan, Wuliji, 2009) and children's toy design (M. Honauer, P. Moorthy, E. Hornecker, 2019). In contrast, research into the interrelationship between the three components: Learning space, child development and pedagogy has been underestimated. Ferguson (Ferguson et al., 2013) also agrees that in reviewing the current state of evidence on the physical environment and child development, little work has documented the impact of environmental conditions on the development of children growing up in other low-income countries. Previous studies, while mentioning the role of the physical environment on children's cognitive and socio-emotional development, focus primarily on the size of schools and classrooms, the quality of building infrastructure, and the availability of key materials and learning resources. This was the first research gap that emerged when the author searched for international academic sources on spatial design and preschool children. Moreover, while there are existing studies on children's development, research on the interior design of children's learning spaces and the role of early childhood education pedagogy is limited. Integrating these aspects into a unified context to examine their combined influence on children, particularly within the Vietnamese context, remains underexplored.

Secondly, in Vietnam, the design of spaces for children is an interesting topic, especially learning spaces for preschool children. However, there is a notable lack of relevant research documents, especially in the field of interior design. An academic search for "principle of interior spatial design for children", the keyword "kindergarten"

or “preschool” yielded only 10 academic results on Google in Vietnamese. A similar search with the keyword “interior preschool spatial design” on the well-known architecture and design websites “tapchikientruc.com” in the Vietnamese platform yielded just **3 articles** on the topic. A search on “kienviet.net” with the same keywords also yielded about **4 results**. In contrast, a search in the library of the University of Architecture Ho Chi Minh City (UAH.edu.vn) with the keyword “preschool” yielded only **40 results**, including about 3 dissertations on this topic. Among them, the author found 2 to 3 papers dealing with children's spatial design, most of which were student projects. In the available results, most of the research focuses on architecture, playground design, product design or children's health. Unfortunately, research in the field of interior design in the Vietnamese context for children's learning environments or specific spaces has been significantly neglected. This is a significant disproportion when you consider that in Ho Chi Minh City alone, according to the Department of Soccer Education and the Ministry of Education and Training, there were 465 non-public soccer pitches, 844 private and public schools and 1,582 independent class associations by the end of the 2021-2022 school year (<https://giaoducthoidai.vn>, 2022). Moving to 2023 and 2024, the preschool enrollment is expected to increase by 7,932 students (<https://tphcm.chinhphu.vn/>, 2024). To accommodate this growth, the city plans to build 48,672 new classrooms. However, if these classrooms are built without careful consideration of design quality, it could negatively affect the development of many children. This data highlighted the urgent need for society, educators, and designers to collaborate and take responsibility in creating better learning environments. It reveals a discrepancy between the pace of construction and the level of research. It is clear that the existing research on this topic is insufficient to meet the growing demands of preschool construction.

Additionally, In Vietnam, there are two main types of preschool systems: public preschools and private preschools. Private preschools can apply one of the above pedagogies from international pedagogy in combination with the national curriculum, which depends on the vision and management of the preschool. Public preschools

follow the national curriculum. Pedagogy of private kindergartens apply the international curriculum (see Appendix E for detailed information) such as Montessori, Waldorf schools, Reggio Emilia pedagogy. Meanwhile, public kindergartens in Vietnam applied the national curriculum (see Appendix G for detailed information), could combine with others international curriculum which depend on what they toward on. The difference in educational philosophy, along with other factors such as location, premises, budget, management orientation, government regulations, and culture, lead to variations in the interior architectural design of each preschool. These differences are often more pronounced in classroom interior design than in the overall building architecture. Variations in pedagogy, curriculum, and teaching methods are reflected in the classroom layout, spatial organization, and the choice of materials, colors, décor, and furniture.

Not only that, the limitations in research on this topic raise a voice for the need to conduct further studies in this area. This research gap in relation to interior spatial design for young children in Vietnam is the main motivation for this current research (see Table 1). To address these gaps, this study aims to explore the multi-faceted relationship between the elements of interior design in learning spaces and children's development and learning, provide a new perspective on the role of interior design in early childhood education, and establish clear guidelines for the interior design of future children's facilities.

Table 1: The summarized number of figures on research related to the interior preschool design and preschool children in Vietnam.			
RESEARCH ON INTERIOR DESIGN FOR PRESCHOOL CHILDREN IN VIETNAM			CURRENT STATUS OF KINDERGARTEN CONSTRUCTION
Platform	Keywords	Number of Results	
Google	principle of interior spatial preschool design for children	Around 10 -15 academic online post	465 non-public football fields
			844 private and public schools,

tapchikientruc.com	interior preschool spatial design	Around 3 related articles	1,582 independent class groups
kienviet.net		Around 4 related articles	
The library of the University of Architecture Ho Chi Minh City	"preschool design"	a mere 40 results were found, with around 3 bachelor graduated research studies covering this topic.	
Survey numbers to date August 2023			(the number was counted to the end of the 2021-2022 school year)

Table 1: The summarized number of figures on research related to the interior preschool design and preschool children in Vietnam.

1.3 Research Questions

The primary assumption underlying Bronfenbrenner's theory (1974) is that school is one of the factors in the microsystem of child development. In conjunction with Piaget's theory (1951), the importance of the physical environment to children's cognitive development is discussed, as well as the role of the physical environment as the child's "third teacher," alongside the classroom teacher and the child's parents (Wenger 1998, cited in Maxwell, 2018). This necessitates the following

Research Questions:

1. What are the key interior elements and spatial levels in preschool classrooms that address the physical, socioemotional and cognitive developmental needs of children?
2. How can interior design guidelines be developed and adapted to optimize classroom environments for preschool education in Vietnam

1.4 Research Objectives

1- **To find out** which main domains play a role in the interior design of learning spaces for preschool children. The sub-objective is to investigate the interrelationships and influences between the design of the physical interior of the classroom, the spatial levels, the pedagogy and the developmental needs of the children.

2- **To develop** a theoretical model for the design of the interior space of preschool classrooms by clarifying the important interior spatial levels that are crucial for the design of a physical learning space to promote children's learning and play and to support children's developmental needs during the preschool period; **To Implement** the concept of the 7 interior spatial levels in designing a learning space for preschool; **To propose** design guidelines for the 7 spatial levels. Within the scope of the study, the dissertation focuses on preschool children aged 3 to 6 years old and the interior of the classroom to conduct an in-depth analysis.

The main objective of this research is to discover the most important areas in the interior design process for preschool learning spaces. A sub-objective is to explore the relationships and influences between classroom interior design, spatial layers, pedagogy and children's developmental needs. Chapter 2 is a literature review based on prominent theories, including Bronfenbrenner's theory of human development, child development, including Piaget's theory of children's cognitive development, and theories of children's socio-emotional development. Combine with the theory of interior design for the preschool learning space and preschool pedagogy. Conduct, critically analyze, reflect on, and summarize the core values of the literature review to discover the critical components of children's developmental needs to focus on and nurture during the preschool years. It then explores the relationship between these developmental components and spatial elements in indoor environments to discover how spatial elements can promote and support these developmental themes in children.

Chapter 3 is about research methodology. The research methodology of this paper uses qualitative methods, including a literature review from academic books, journals, case studies, and related websites. It conducts the following three main steps: first, design thinking—visiting the site and analyzing five preschools in Ho Chi Minh City, followed by a comparative analysis of classroom interior design in public and private preschools; second, the design process—through the analysis of a specific preschool focused on the selected pedagogy and conducting a survey questionnaire to understand the perspectives of stakeholders related to the research theory; and third, design evaluation—through a workshop and in-depth interviews to develop the theoretical framework, following interior design guidelines and using the 7 Layers Wheel to deepen understanding of preschool learning spaces.

Chapter 4 is about the design development through develop design and application the interior design guidelines book and the 7 layers – feeling wheel in practice.

Chapter 5 is discussion, conclusion, limitation and suggestion for future research.

1.5 Scope of the Research

The objective of this research is to examine the physical learning space in the preschool environment, focusing on the interior space of the classroom. The physical learning space is one of the components of the physical learning environment. Physical learning environments include objective learning environments (space, materials, furniture) and subjective learning environments (teachers, peers, curriculum) (Organization, 2019). The interior of the classroom is the most important target for the design guidelines. Second, the subjective research of this study refers to preschool children aged 3 to about 5.6 years old in Ho Chi Minh City, one of the largest cities in Vietnam. Preschool children are 36 months and older, not in kindergarten (GSA, 2003); (<https://educationdestinationasia.com/>, 2023). The Vietnamese education system includes 12 years of basic education, with kindergarten (from birth to 3 years old), preschool (3-6 years old) (MOET, 2022). Third, the specific preschools selected for the main analysis include public preschools and private

preschools to compare and analyze the design of the interior spaces. The private preschools mainly use Montessori pedagogy in combination with other pedagogies. The reason for choosing the Montessori preschool as a case study for analysis in this study is that Montessori education is the largest alternative education approach in the world, with an estimated 15,763 schools in 2022 in 154 countries, including Vietnam. This number significantly exceeds the estimates of schools implementing other educational approaches, such as the International Baccalaureate (IB) with 3,000 schools, Waldorf with 1,857 schools and Reggio Emilia-inspired schools with 1,200 schools (Mira C. D et al, 2022). These results illustrate the broad applicability of Montessori education in different countries and cultures, both in the present and in the future.

The selection criteria for preschools were based on existing literature, highlighting the importance of pedagogical diversity, representation from both public and private education systems, and the institutions' significance in HCMC's kindergarten sector. Key factors included their locations in major districts, the inclusion of public preschools following the national curriculum and private preschools following an international curriculum, as well as their educational quality and contributions to early childhood education. Out of the preschools contacted, five granted permission for on-site observation and classroom photography for visual analysis.

- The public preschools include three preschools:
 - + The City 19th May Preschool, District 1, HCMC, VN;
 - + Le Thi Rieng Preschool, District 1, HCMC;
 - + Hoa Lan Preschool, Go Vap District, HCMC, VN.
- The private preschools include two preschools:
 - + The Creative Kiddo Bilingual Preschool (Trường Mầm non trẻ sáng tạo) with 3 locations in different districts, HCMC, VN.
 - + The Maitri Kindergraten, District 2, HCMC, VN

Although the term “preschool” is like the term “kindergarten,” the author has used the term “preschool” in this study to refer to the age of the subject research. In the Vietnamese education system, children aged three to six enter preschool, also known as pre-primary school (educationdestinationasia, 2023).

“Preschool covers the first three years of education; between the ages of three and six. Preschools can be state-run or private and children attend them until they enter elementary school at the age of six. Although preschool is not yet compulsory across Vietnam, the Ministry of Education and Training (MOET) aims for all Vietnamese children to attend preschool at the age of five to ensure they are ready for school” (educationdestinationasia, 2023)

1.6 Research Framework

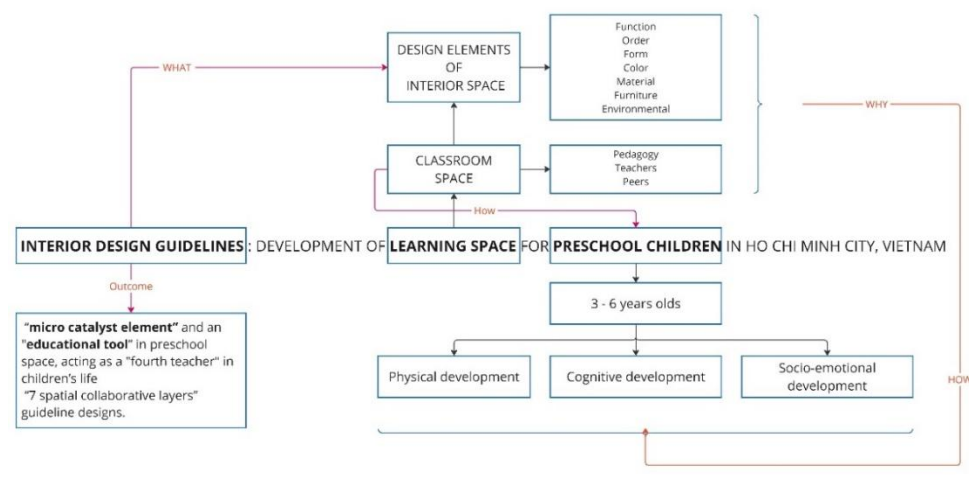


Figure 3: Theoretical research framework of the study

The research framework for this thesis has been developed to provide a structured approach to analyzing the interior design of preschool classrooms. It is intended as a guide to explore how different spatial elements impact on children's developmental needs. The framework focuses on three key areas: child development, pedagogy and spatial levels in the context of preschool classroom interiors. By integrating these areas into a coherent model, the framework aims to explore the '7 spatial layers'

with feeling the scale and suggesting design guidelines. This structured approach will provide a comprehensive understanding of how interior design can enhance the learning environment for young children.

1.7 Conceptual Research

The research aims to discover the relationship between children's developmental needs, the physical learning space and teaching methods. To achieve this, it draws on several theoretical frameworks: Bronfenbrenner's ecological systems theory of human development, Piaget's cognitive development theory, theories of children's physical and socio-emotional development, theories on the layers of interior space, theories addressing the relationship between human and space, interior design principles for learning environments, and pedagogical principles related to teaching methods & learning methods in early children education. Together, these theories provide a comprehensive framework to guide data collection and analysis, connecting developmental psychology, spatial design, and pedagogy.

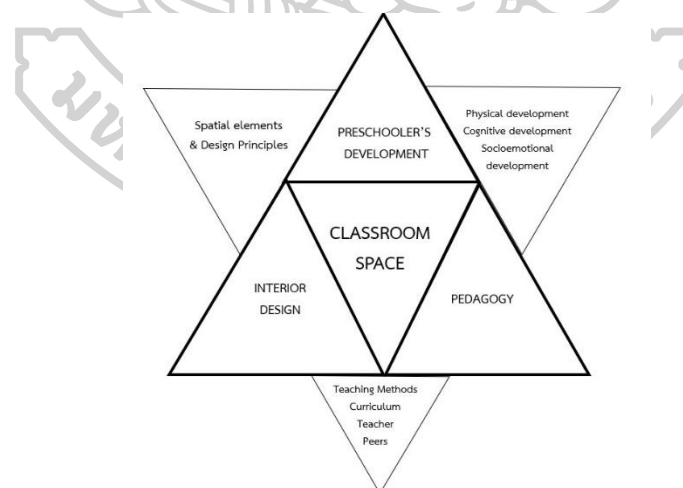


Figure 4: Theoretical model design focus of the study

Bronfenbrenner's theory highlights the significant role of the school as a microsystem for the overall development of children. Piaget's perspective emphasizes the

influence of physical learning spaces on children's cognitive development, as well as the interaction with the environment as an important factor in cognitive development. Biological maturation takes place over an extended period (Oaklet, 2004). In addition, the philosophy of pedagogy can influence the organization and setup of the classroom. Taking these theoretical perspectives into account, the study attempts to uncover the links between children's development, the physical learning environment and classroom practice. Based on the findings, the study develops design guidelines for creating optimal indoor learning spaces for preschool children.

1.8 Research Methodology

The research methodology of this research is a mixed method that includes quantitative and qualitative methods. The research plan includes various stages of literature review, data analysis and iterative replication of the process, and mixed methods, including quantitative methods (questionnaire) and qualitative methods (on-site analysis, visual analysis, photography, observation, comparative analysis board, pilot study, in-depth interview).

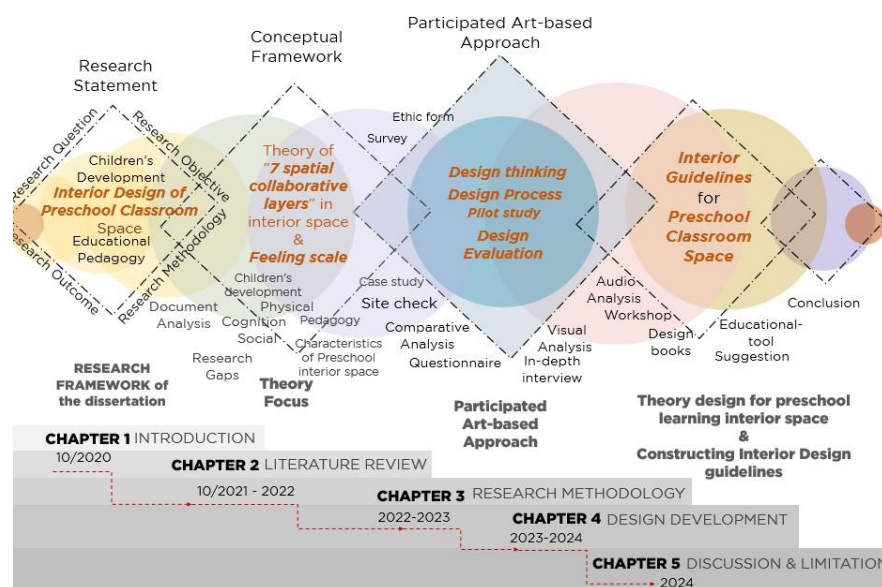


Figure 5: The research process with the methodology of primary research in five chapters of the dissertation

1.9 Research Outcome

The research outcome includes:

- Theory of the design of the physical learning space as a “micro-catalyst element” and “pedagogical tool” in the preschool space, acting as a “fourth teacher” in children’s lives
- Theoretical model design for learning spaces in preschool with key domains
- The concept of the “7 spatial layers” for the preschool learning space with the feeling scale, express through “interior design guidelines books” and “7 spatial layers wheel”.

Findings of research are theory of designed physical learning space as “educational-tool” and classroom as “micro-spatial factor” in preschool space. theoretical model design for preschool learning space and concept of “7 spatial collaborative layers” as well as the framework of “7 spatial collaborative layers” and feeling scale for interior space of preschool classroom. the interior design guidelines book for who want to design children learning space. The outcomes of this study offer valuable insights not only for interior designers, architects, educators, preschool teachers, but also for parents or whom care about children space, providing them with a deeper understanding of the design priorities for the physical classroom environment of young children. These findings serve as invaluable tools for analyzing project-specific requirements and prioritizing design elements within budgetary and contextual constraints.

1.10 Definition of Terms

1- Physical development includes the increasing abilities and functions of the body, while growth refers to the increasing height, weight and general size of a child (Yr Adran Plant, Addysg, Dysgu Gydol Oes a Sgiliau).

2 - Cognitive development is how children think, explore and figure things out. It is the development of knowledge, skills, problem-solving abilities and dispositions that

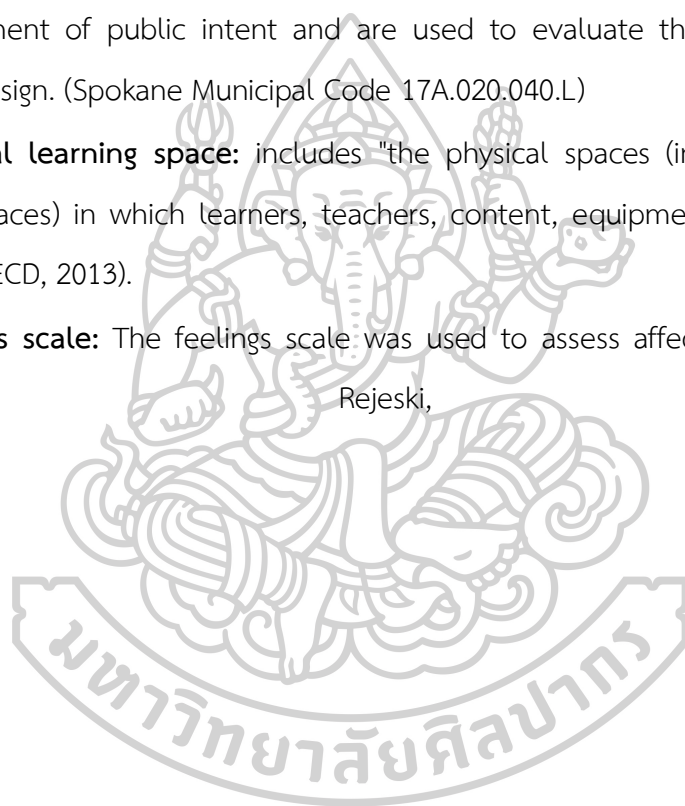
help children think about and understand the world around them (helpmegrowmn.org, n.d.)

3 - Socio-emotional development means that children begin to understand who they are, what they feel, and what they expect when they interact with others (helpmegrowmn.org, n.d.)

4 - Interior design guidelines: a set of design parameters for development that apply within a design district, subdistrict, or overlay zone. The guidelines are adopted as a statement of public intent and are used to evaluate the acceptability of a project's design. (Spokane Municipal Code 17A.020.040.L)

5 - Physical learning space: includes "the physical spaces (including formal and informal spaces) in which learners, teachers, content, equipment and technologies interact" (OECD, 2013).

6 - Feelings scale: The feelings scale was used to assess affective valence (Hardy and Rejeski, 1989).



1.11 The Relationship between Research Objectives (RO), Research Questions (RQ), Research Methodology (RM), and Research Outcomes (ROC)

Table 2: The Relationship between Research Objectives (RO), Research Questions (RQ), Research Methodology (RM), and Research Outcomes (ROC).				
Frameworks of title	The subject of the study /research	Interior design guidelines		
	Setting:	Preschool-aged children in Vietnamese preschool		
	Variable of the study/ research	Children’s development, learning interior space		
Title	Interior design guidelines: Developing learning space for children in Vietnamese preschool			
Problem Statements (PS)	Research Objectives (RO)	Research Questions (RQ)	Research Methodology (RM)	Research Outcomes (ROC)
1. Lack of attention to the influence of interior design elements on children’s development in the context of preschool design.	1- To find out which main domains play a role in the interior design of learning spaces for preschool children. The sub-objective is to investigate the interrelationships and influences between the design of the physical interior of the classroom, the spatial layers, the pedagogy and the developmental needs of the children.	1. What are the key interior elements and spatial levels in preschool classrooms that address the physical, socioemotional and cognitive developmental needs of children?	<ul style="list-style-type: none">- Literature review- Case study research- Document analysis	<ul style="list-style-type: none">- Identify the important elements in the physical learning space and their impact on children’s development- Explain the key areas in the design of the space.
2. Lacks the principle of interior design guidelines for Preschool	2- To develop a theoretical model for the interior design of the preschool learning space	2. How can interior design guidelines be developed and adapted to optimize classroom	<ul style="list-style-type: none">- Questionnaire- In-depth interview- Sketching and	- Develop a theoretical model of interior design for preschool. Theory of “7 spatial collaborative layers”.

design in Vietnam to focus on the relationship between child development and pedagogy.	3- To implement the concept of the 7 spatial layers in an interior preschool learning space.	environments for preschool education in Vietnam	Conceptual - Feeling Board Boards - Pilot study - Exhibition	- Clearly define characteristic design requirements of interior elements of space while designing
3. Developing the interior design of a Vietnamese preschool.	3- To propose guidelines design for 7 spatial layers. In the scope of the study, the thesis focuses on preschool children aged 3 to 6 years and on the interior design of the classroom to carry out a thorough analysis.		- In-depth interview - Design - Feedback - Design prototype	Construct a theoretical design model and develop a list of design requirements for spatial elements within an interior design guideline book

Table 2: The relationship between Research Objective (RO), Research Questions (RQ), Research Methodology (RM), and Research Outcomes (ROC).



CHAPTER 2

A. THEORY CHAPTER

Preschool classroom settings play a critical role in shaping the developmental needs and educational experiences of young children. This chapter reviews the existing literature on key concepts and theories related to the interior design of preschool learning spaces, focusing on three main areas: children's developmental needs, interior spatial layers, and pedagogy.

Section 2.1 focuses on how interior spaces can support children's physical, cognitive, and socio-emotional growth, particularly for 4-5-year-olds, identifying general design requirements to foster holistic development. Section 2.2 further examines classroom interior design's alignment with developmental needs and 21st-century requirements. Section 2.3 then contrasts international and Vietnamese early childhood pedagogies to highlight how design impacts classroom interactions among children, teachers, and peers.

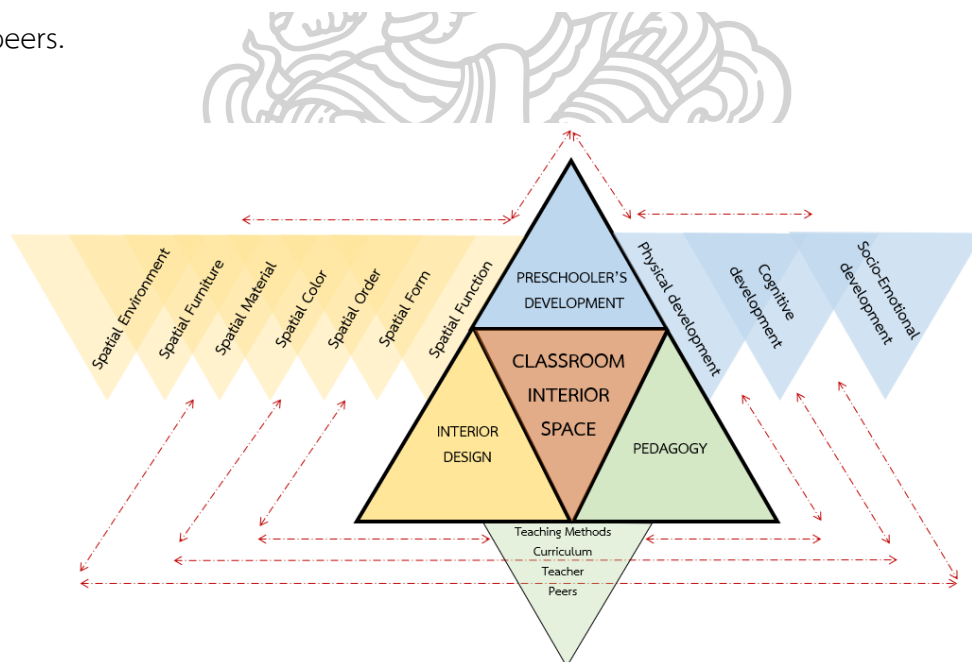


Figure 6: The Theoretical Framework

This section pertains to the theory chapter outlines the theoretical frameworks or models that guide the research. It explores specific theories that

directly inform how the research question is approached, often focusing on foundational or established theories relevant to the topic. This chapter justifies why certain theoretical approaches are chosen and shows how they will be applied to analyze or interpret the data.

2.1 Theoretical Framework

The theoretical framework of this study draws on Bronfenbrenner's theory of human development, Piaget's theory of children's cognitive development, theories of children's physical development, socio-emotional development, and concepts and principles of spatial design, with a focus on children's needs (physical needs, psychological needs, and socio-emotional needs).

By refining and narrowing these three theoretical models, the study identified research gaps in the study and development of interior space design for young children. The research focuses on promoting Vietnamese children's development through enriching the interior design of physical learning environments in the Vietnamese preschool context.

2.1.1 Bronfenbrenner's model of the ecology of human development

While ethological theory emphasizes biological factors, ecological theory emphasizes environmental factors. An ecological theory that has important implications for understanding human development was developed by Urie Bronfenbrenner (1917–2005) (Santrock, 2000). Urie Bronfenbrenner was an American psychologist, a physician, in Russia. He is revered as one of the world's leading authorities on developmental psychology. Bronfenbrenner's ecological theory (1986, 2000, 2004; Bronfenbrenner & Morris, 1998, 2006) states that development reflects the influence of different environmental systems (Figure 8), which emphasizes the child's biology as the primary microenvironment that provides the fuel for development, as well as the quality and context of the child's environment.

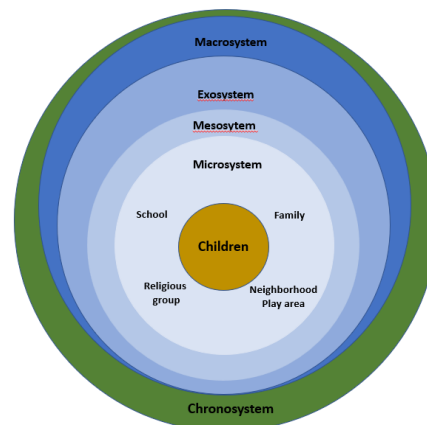


Figure 7: Bronfenbrenner's ecological theory of development. Adapted from Santrock, 2000

He asserts that interaction with the environment becomes more complex as the child develops. Complexity emerges as children's physical and cognitive abilities mature, enabling deeper engagement with their environment (D. Paquette, J. Ryan, 2001) (Härkönen, 2007).

According to bioecological model, microsystem is the closest environment for a child and comprises a structure with which the child is in direct contact. A microsystem consists of the developing person's closest environment, such as the home, daycare group, children in the schoolyard, classmates at school, members of a hobby club, or close relatives (Saarinen et al, 1994,88,89). Child development is shaped not only by biology and the home but also by complex interactions between biology, the social and physical environment, and broader systems like the "microsystem" (home, school, neighborhood), "exosystem" (e.g., parents' workplace), and "macrosystem" (culture, social class) (Maxwell & Evans, 2014). Microsystems like home, school, and neighborhood are where children spend most of their time, playing a vital role in their holistic development. In which, the key focus should be on micro-factors, where small changes can lead to significant results. These are the environments where children interact most closely with their physical surroundings and form essential social relationships with family, teachers, adults, and peers (Maxwell L, 2003).

During the time spending in school, he, or she has numerous daily interactions with other people (peers and adults) and with the physical environment. Bronfenbrenner describes these interactions as proximal processes and refers to them as the “engines of development” (KREBS, 2009). Children engage in activities like listening, writing, using technology, eating, physical activity, and personal hygiene. Bronfenbrenner’s concept of the school as a microsystem highlights the interconnectedness of all aspects of the school environment, including activities, social interactions, and physical spaces. Reggio Emilia approach similarly emphasizes that the physical environment serves as the “third teacher,” alongside the class teacher and parents. The school’s designed environment plays a crucial role in children’s development as part of this microsystem.

While Bronfenbrenner emphasized the role of schools in children’s development, his theory does not deeply examine the specific elements of a school’s designed environment, particularly interior spaces. Given that children spend a significant amount of time in these spaces, this study seeks to address this gap by analyzing the characteristics of preschool interior spaces. Recognizing the school as a microsystem in the larger biosystem also identifies it as a micro- factor in the built environment system that directly impacts a child’s growth and needs. Therefore, designing the school environment to foster development, starting from early childhood, is crucial.

2.1.2 Theory of child development

The three types are biological (physical), cognitive and socio emotional. Biological processes lead to changes in a person’s body. This is the process of physical development, including brain development, height, weight gain, motor skill development and hormonal changes. Secondly, cognitive processes refer to changes in a person’s thoughts, intelligence and language. The task of forming a sentence with two words, memorizing something, solving problems and imagining something. Socio-emotional processes include changes in a person’s relationships with other people, changes in emotions, in personality and behavior (Santrock, 2000). Three patterns are closely related to human development.

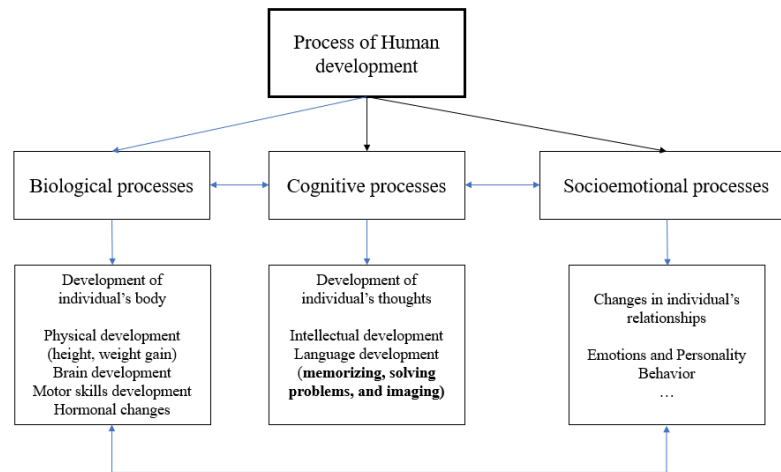


Figure 8: Process of Human Development.

It is important to realize that child development is holistic. This means that children's physical, cognitive, linguistic, emotional and social development are interconnected, inseparable and interdependent (Neaum, 2010). All aspects of young children's development occur simultaneously, and each area of their development is influenced by the others. Children grow and develop through a complex interplay of all aspects of their development. Therefore, the learning environment and premises must provide opportunities for playing and exploration. Children's development takes place in the context of the culture of their society. Children are part of the context in which they are conceived, born and develop, and since social processes are dynamic and two-way, children inevitably have an impact on the context in which they grow and learn. The context in which children grow up and learn has a significant impact on many aspects of their development (Neaum, 2010).

2.1.2.1 Physical development

It is pointed out that physical development focuses on increasing the abilities and performance of the body (Yr Adran Plant et al., 2008). According to Sally Neaum (2010), physical development describes the progress of a child's

control over their body. Progress is characterized by an increase in ability and complexity of performance.

Physical development encompasses the increasing abilities and functions of the body, while growth refers to the increasing height, weight and overall size of a child (Yr Adran Plant et al., 2008). The process of muscle movement is referred to as motor development. Motor development is divided into gross motor skills (requiring control over the large muscles of the body, arms and legs) and fine motor/manipulative skills (coordination of small muscles) (Neaum, 2010). During the Foundation Phase, children acquire and develop their skills in a variety of ways.

These include,

Gross motor skills are movements of the body. Rolling, sitting, crawling, standing, walking, running, hopping, jumping, etc. They all require strength, endurance and agility to improve coordination, balance, and judgment.

Fine motor skills involve using the hands in coordination with the eyes to perform precise finger and hand movements. (Neaum, 2010)

Children's physical development follows a specific sequence, including from head to toe and from the inside out (proximodistal).

Table 3: Indicators for the Physical Development of Children.		
Age	Gross Motor Skills	Fine Motor Skills
4 years	Can develop a sense of balance; climbs on playground equipment; going up and down stairs; one foot on each step; stand, walk and run on tiptoe;	build a high tower of bricks; can build other constructions; Mature pencil grasps; begins to fasten buttons and zippers;
5 years	can hop; can use various play equipment – swings, climbing frames, slides; play ball games well; can walk along on a balancing beam.	can draw a person with a general body and face; can sew large stitches; good control of pencils and paintbrushes.

Table 3: Indicators for the Physical Development of Children

According to (Yr Adran Plant et al., 2008), physical skills, body awareness and spatial awareness contribute to a child's personal and social development by enhancing self-confidence and self-esteem. Promoting good physical development, therefore also means promoting socio-emotional development. A suitable space is essential for physical movement, both indoors and outdoors, so that children can actively use their bodies to develop spatial awareness and experiment with movement without restriction. To promote physical development, children need opportunities to:

- Work alone or together;
- Work at their own pace to practice and consolidate their skills;
- Extend their skills and progress in their development;
- Make connections between skills acquired indoors and outdoors.

Yr A. Plant et.al. claimed that physical skills are also linked to the development of perception, visual skills, cognitive skills and the understanding of specific vocabulary related to spatial relationships. These experiences are enriched by a visually stimulating environment and opportunities to explore and discuss a variety of resources and materials (Yr Adran Plant et al., 2008). Sugden and Chambers (2006) describe child development as a complex interaction between the child, the environment, resources, and cultural context, emphasizing the environment as a key factor.

To stimulate children's senses, the designed space should enable exploration and sensory experiences. An enriching environment reflects values and helps children build connections. Through physical play, children discover their movement skills, can explore the movement environment and have time to practice to improve basic motor skills and strengthen the cardiovascular system and muscles (Maude, 2006). Physical and cognitive development are closely linked, especially in the first years of life, so when we talk about the holistic development of children, we should not neglect either area. Problems in a child's physical development can lead to difficulties in the learning process.

2.1.2.2 Cognitive development

The term "cognitive" comes from the Latin "cognoscere," meaning "to know." Cognitive activities involve psychological processes related to thinking and knowledge, including how information is acquired, processed, and organized. Cognitive development refers to how these processes evolve in children, becoming more efficient in understanding the world. According to Oakley (2004), cognitive development studies changes in a child's thinking and reasoning. Various theories explain the processes, changes, and factors influencing children's cognitive development, viewing it as a progressive improvement of biologically derived abilities.

Cognitive theories describe an interaction between the child and the environment in which development occurs through a "constant process of going back and forth between the person and the environment" (Piaget, 1929). The psychology of cognitive development has traditionally advocated cross-cultural ideas about knowledge development, most famously through Jean Piaget.

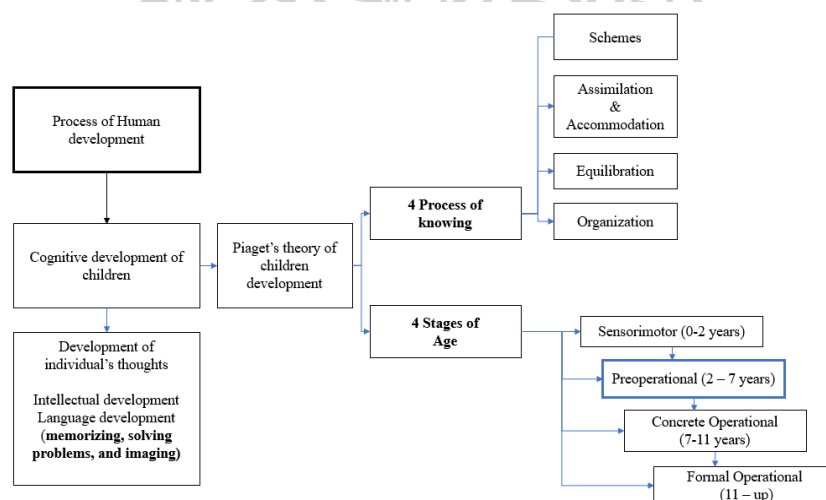


Figure 9: Structure of Piaget's theory about Children's cognitive development

Two main components of Piaget's theory of cognitive development were the process of cognition and the stages that children go through as they master this skill. His research has influenced today's ideas about child development and has

shaped many preschools and elementary school curricula. Piaget's cognitive theory identifies four processes that children use as they build their knowledge of the world. He emphasized that the following processes (Table 4) are particularly important (Santrock, 2000). **1-** Schemes, the process of organizing knowledge. Behavioral schemes (physical activities) characterize infancy, and mental schemes (cognitive activities) develop in childhood; **2-** Assimilation and accommodation, explain how children use and adapt their schemes; **3-** Organization; **4-** Equilibration. Piaget proposed this mechanism to explain how children progress from one stage of thinking to the next. It's important to note that the ages are approximate and influenced by the child's experiences and environment.

According to Piaget, the result of these processes (table 4) is that the individual goes through four stages of development depending on the age of the child, namely the **sensorimotor stage, the preoperational stage, the concrete operational stage and the formal operational stage** (table 5). Each stage is age-dependent and consists of different ways of thinking. It is important to know that these stages are fixed in their sequence. Cognition is qualitatively different in one stage than in another. The cognitive world of the preschool child is creative, free and imaginative. Preschoolers' imaginations are working overtime and their mental understanding of the world is improving (Santrock, 2000). **Piaget described preschoolers' cognition as preoperational, a stage not merely a waiting period for the next, concrete operational stage.** The term "preoperational" highlights that children are not yet performing operations—mental actions that replicate what they previously could only do physically. Operations are reversible mental actions. Pre-operational thinking is the beginning of the ability to reconstruct in thought what has been established in behavior. In which, from about 2 to 7 years, children begin to represent the world with words, pictures and drawings. Symbolic thinking goes beyond simple connections between sensory information and physical actions. Stable concepts are formed, mental thinking emerges, egocentricity is present and magical beliefs are constructed.

In this phase, children use symbols to represent words, images and ideas, which is why children in this phase also pretend to play (Group, 2020). In preoperational stage, children begin to use language but lack of understand adult logic or mentally process information. The term "operational" refers to the logical processing of information, so children at this stage are considered pre-operational. Children's logic is based on their own personal knowledge of the world and not on conventional knowledge. To promote children's cognitive development at this stage, the environment should therefore be designed in such a way that children's imagination is encouraged through the use of designed symbols.

Preoperational thinking can be divided into sub-stages, namely the sub-stage of symbolic function and the sub-stage of intuitive thinking (Santrock, 2000). The symbolic function sub-stage, occurring between ages 2 and 4, is marked by advances in symbolic thinking, in which the child is able to mentally represent a non-existent object, and by reliance on perception in problem solving. The lower stage of symbolic functioning (ages 2-4) is characterized by the rapid development of language skills and symbolic thinking, the ability to categorize objects based on similarities, and the limitations of egocentrism and animism.

Process of Children's Cognitive Development			
Schemes	Assimilation & Accommodation	Organization	Equilibration
<ul style="list-style-type: none"> - Actions or mental representations that organize knowledge - Behavioral schemes (physical activities) shape infancy. - Mental schemes (cognitive activities) develop in childhood. 	<ul style="list-style-type: none"> - Assimilation occurs when children incorporate new information into their existing schemes. - Accommodation occurs when children adapt their schemes to process new information and experiences. 	<ul style="list-style-type: none"> - Children cognitively organize their experiences and knowledge to make sense of their world. - The grouping of isolated behaviors and thoughts into a higher order system. 	<ul style="list-style-type: none"> - Equilibration is a mechanism proposed by Piaget to explain how children move from one stage of thinking to the next. The shift occurs when children experience a cognitive conflict or disequilibrium as they try to understand the world. Eventually, they resolve the conflict and achieve balance or equilibrium in their thinking.

Table 4: Process of Children's Cognitive Development

Egocentrism, a key feature of preoperational thinking, refers to a child's inability to differentiate between their own perspective and others. Animism, another aspect, is the belief that inanimate objects possess lifelike qualities. At this stage, children are not bound by reality—imagination dominates their drawings, with blue suns, yellow skies, and floating cars (Santrock, 2000).

Symbolic thought is developed through pretend play. Piaget believed that pretend play helps children to practice and consolidate new schemata that they develop cognitively. This play therefore reflected changes in their ideas or thoughts. However, children learn when they pretend and experiment. The development of symbolic representation not only ushered in an era of pretend play, but also revolutionized the way young children think and act. Representational skills underlie the emergence of language, which opens channels of communication with others and provides young children with words and concepts for their inner experiences (e.g., emotional labels) (2), (3). Symbolic skills also support memory development and enable young children to remember and talk about autobiographical events. In the preschool years, cognitive progress increasingly allows children to try out strategies in their heads before acting. Therefore, planning and problem solving (5) become central activities (Group, 2020). Problem solving can be used to facilitate physical play (e.g., planning to build a castle), resolve interpersonal conflicts (e.g., when two children want the same toy), or figure out how to comfort themselves when they are sad.

Intuitive thinking occurs between the ages of 4 and 7, when children begin to turn to logical thinking through some signs of logical thinking, but cannot explain how or why they think the way they do. This is an age full of questions, when children begin to make sense of their world. They go beyond perceptual thinking and turn to intuitive thinking. The sub-stage of intuitive thinking is characterized by a greater reliance on intuitive thinking and not just perceptual thinking (Thomas, 1979). This means that children think automatically without using evidence.

The Stage of Children's Cognitive Development				
Stages	Sensorimotor	Preoperational	Concrete Operational	Formal Operational
Ages	Infancy (0–2 years)	Toddler and early childhood (2–7 years)	Elementary and adolescence (7–11 years)	Adolescence and adulthood (11 years and up)
Substages	1. Simple reflexes 2. First habits and primary circular reactions 3. Secondary circular reactions 4. Coordination of secondary circular reactions 5. Tertiary circular reactions, novelty and curiosity 6. Internalization of schemes	1. Symbolic function (occurring between the ages of 2 and 4) 2. The intuitive thought (occurring between the ages of 4 and 6 years of age).	1. Conservation 2. Classification (Seriation + Transitivity)	1. Abstract, Idealistic, and Logical thinking 2. Adolescent Egocentrism
Abilities	Infants build up an understanding of the world by coordinating sensory experiences (seeing and hearing) with physical actions.	Children begin to represent the world with words (language development), images, and drawings (mental imagery) (2). Symbolic thought goes beyond simple connections of sensory information and physical action . => Physical activities help to promote language development	Children can perform concrete operations and logical thinking replaces intuitive thinking as long as the thinking can be applied to specific or concrete examples.	Children go beyond concrete experiences and think in a more abstract and logical way. As part of this more abstract thinking, adolescents develop images of ideal circumstances.

Table 5: The stage of children's cognitive development

At this stage, children ask many questions as they try to understand the world around them using immature thinking. Therefore, the environment should be designed to stimulate their curiosity and encourage them to ask more questions. Piaget called this sub-stage intuitive because young children seem so sure of their knowledge and understanding but are unaware of how they know what they know. That is, they know something, but they know it without using rational thought (Santrock, 2000). The intuitive period is the stage of development of mental ordering and classification (Oaklet, 2004).

Santrock outlines six key strategies for applying Piaget's theory in the classroom: adopting a constructivist approach, facilitating rather than directing learning, considering the child's knowledge level, using continuous assessment, promoting intellectual health, and creating a classroom that fosters exploration and discovery. The latter closely ties to the relationship between cognitive development and the learning environment. While Santrock emphasizes the teacher's role, it is equally important to design physical spaces that encourage exploration. Additionally, cognitive development parallels the development of intelligence and moral understanding (Oakley, 2004).

Indicators of Children's Cognitive Development	
4 years child	5 years child
<ul style="list-style-type: none"> - sort with several categories - solve simple problems, mostly by trial and error, but begin to understand "why" - expand their knowledge by constantly asking questions - develop memory skills, especially for significant events - include representative details in drawings, often based on observations - confuse fantasy and reality - understand that writing has meaning and use writing in play - social and cultural conventions increasingly influence their drawing and writing 	<ul style="list-style-type: none"> - have a good sense of time: past, present and future - become literate - good powers of observation through drawings - can count - concentration develops - thinking becomes increasingly coordinated and children can keep more than one point of view in mind.

Table 6: Indicators of Children's Cognitive Development

In summary, Piaget's cognitive theory offers a strong framework for understanding learning and education, emphasizing the interaction between children and their environment. Although not an educator, Piaget's ideas have significantly influenced educational theories and practices. His work plays a key role in shaping how children's learning develops. Below are some concepts from Piaget's theory that can be applied to teaching (Elkind, 1976; Heuwinkel, 1996; Santrock, 2000), all of which highlight the outcomes of children's learning. Piaget emphasized the importance of environmental interaction in cognitive development. He believed that cognitive growth occurs in stages, each stage becoming possible as the child's brain matures, following their biological development (Oakley, 2004).

However, it is not clearly stated here what role the indoor space plays or what we should do in the indoor space, as children spend more time in the indoor space compared to others. Therefore, the elements of the indoor space should be analyzed and designed so that they can be explored and discovered by the children. Consequently, the designed elements of the preschool environment can influence children's cognitive development in many ways, with both advantages and disadvantages. The spatial design and structure of the learning environment, especially the physical learning space, should not be underestimated.

These key components can be grouped into three themes of children's cognitive development. The first theme involves exploratory and organizational skills, such as exploration, classification, and mental ordering. The second focuses on executive functions and problem-solving skills, including planning, problem-solving, behavior, and imagination. The third theme covers language development and symbolic thinking, including language skills, symbolic play, and behavior.

When designing classroom spaces, it's essential to consider how the physical environment supports these cognitive development themes. Incorporating factors like gender and culture ensures inclusive and supportive learning environments.

2.1.2.3 Socio-emotional development

Socio-emotional development refers to how children learn about themselves, what they feel, what they expect when they interact with others.

Socio-emotional development is a concept that combines the social development and emotional development of an individual in their environment. This is the crucial developmental factors in the holistic development of children, and an important factor on the 21st century. Emotional development is the growth of a child's ability to feel and express an increasing range of emotions appropriately (Neaum, 2010). It is the progression of the ability to feel and express emotions in a way that contributes to our own well-being and that of others. Social development refers to a child's ability to interact appropriately with others, developing social skills and independence. Children grow emotionally and socially within specific contexts, such as family and school, which are embedded in broader social and cultural environments. They develop socio-emotional skills by interacting with peers and teachers at school. Social development focuses on these interactions and relationships with peers, educators, and other adults (Yr Adran Plant et al., 2008).

Indicators of Children's Socio-Emotional Development	
4 years child	5 years child
<p>can be very sociable and talkative with adults and children</p> <p>can be confident and self-assured</p> <p>can be afraid of the dark and have other fears</p> <p>play with groups of children – groups tend to revolve around an activity, then disband and</p> <p>are often dramatic in their play – engage in elaborate and extended imaginative play</p>	<p>enjoy brief separations from home and care. show good overall emotional control, but may argue with parents when they demand something</p> <p>enjoy cooperative group play, but often need an adult to</p> <p>have developed a stable image of themselves, are increasingly aware of differences between themselves and other people, including gender and status, and want adult approval. show sensitivity to the needs of others and a desire for acceptance by other children, and develop internal social rules and an inner conscience</p>

Table 7: Indicators of Children's Socio-Emotional Development

Previous studies suggest that these components reflect the capabilities for development. Weinstein (Carol Weinstein, Thomas G. David, 1987) presents four

components that express the skills of development, include self-esteem (Yr A. Plant, Addysg, Dysgu G.O Sgiliau, 2008), security and comfort, self-control, peer interaction, and prosocial behavior. (Neaum, 2010) presented concept of self-concept, self-image of children, patterns of behavioral development.

In terms of **self-esteem**, this is how children feel about themselves. Positive feelings indicate self-esteem, while negative feelings about oneself are an indication of low self-esteem (Yr Adran Plant et al., 2008). Weinstein has argued that children between the ages of 2-5 build a personal identity through their encounters with other people and the physical environment. There are two components of self-esteem: the presence of children and the feeling of competence. All these feelings come from creating the sense of identity, individuality and relevance of children using the space, which is related to the concepts of place identity with a sense of belonging, which are one of the components of cognitive development.

Secondly, safety and comfort, i.e. the feeling of security and confidence when children interact and have experiences in their environment. Children should feel confident to move and play without fear of physical harm or emotional distress.

Next, **peer interaction and prosocial behavior**, this component ties in with Bronfenbrenner's theory that key microsystem characteristics influence child development. *"This developmental change goes hand in hand with the increasing ability to show empathy, altruism and cooperation"*. Here, "prosocial behavior appears to be clearly related to the child's growing ability to adopt the point of view of others, that is, to engage in social role-taking" (Weinstein, 1987). Children develop social skills as they have day-to-day experiences in the classroom. Positive social interactions and learning good prosocial behavior lay the foundation for strong social skills in the future.

Self-concept and self-image, i.e. the view that children have of themselves and their beliefs about how other people see them, as well as children's behavioral development is by Sally Neaum (2010). According to Sally Neaum (2010), children's self-image and social play are closely linked to their emotional and social development. As part of this growth, children learn expected behaviors and how to

regulate themselves accordingly. Developing a positive self-image early on is crucial for long-term development. By ages 4 or 5, most children have a stable self-concept, seeing themselves as likable, though this can fluctuate. By ages 6 or 7, their personality and self-image are consolidated. Neaum identifies different stages of social play—solitary, parallel, associative, and cooperative—through which prosocial behavior (Weinstein, 1987) emerges. By around age 5, children typically achieve greater independence and self-control.

Simultaneously, the Institute of Medicine and National Research Council (IMNRC, 2015) identified **five key aspects of social and emotional development**—relationship contribution, emotional regulation, self-management, social and emotional understanding, self-awareness, and the impact of chronic stress and adversity—that should be prioritized in fostering children's growth, aligning with Neaum's (2010) concept of self-concept. The **relationship contribution and emotional well-being factor** is about children's positive contribution to their relationships, which has a positive impact on their social and emotional understanding of others, they show more advanced moral development and have a more positive self-concept or self-image. The **emotion regulation and self-management**, refers to a child's ability to regulate their emotions, thoughts and behaviors in different situations. Within the context of carefully designed daily practices in a well-organized environment, children are better able to exercise self-regulation, which is also associated with the development of independence and self-control, as proposed in Neaum's (2010); and self-control (Weinstein, 1987). The **social and emotional understanding**, i.e. children's ability to learn how people think and feel by directly observing, asking questions and talking to parents and other trusted people about people's mental states. **Self-awareness**, the last factor of children's socio-emotional development, can help to strengthen children's perseverance in accomplishing tasks and self-assessment. The last factor is **chronic stress, and adversity** can affect children's development. All these advances are fostered by children's experiences in the classroom.

In addition, children develop emotionally and socially in a specific context. According to (Weinstein, 1987), gender role identification, family background or culture also play a role in shaping the components of socio-emotional development. "Children grow and learn within family systems, school systems, and social systems. Families exist within a larger social and cultural context. Both family and cultural contexts have a profound impact on children's emotional and social development, including their behavior and sense of self." Differences in these characteristics can lead to differences in children's choices and social interactions.

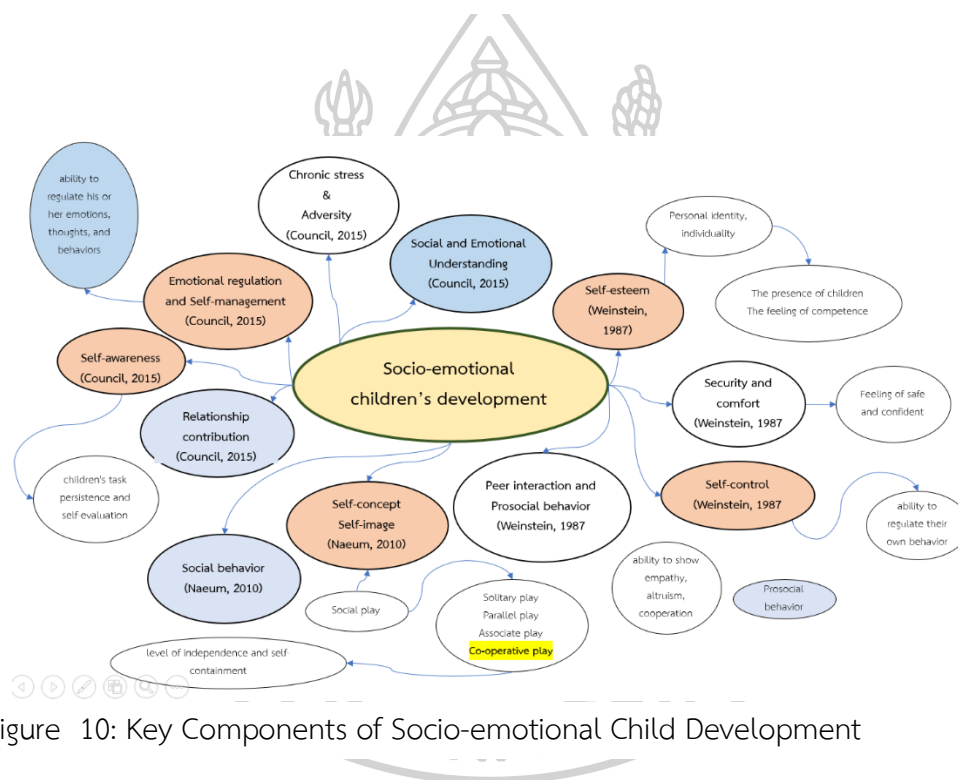


Figure 10: Key Components of Socio-emotional Child Development

All the characteristics of this process are influenced by the specific context of the social and physical environment. Therefore, the preschool environment, as part of the microsystem in children's development, plays an important role in promoting socio-emotional development. Council (2015) suggested that *"a well-structured and predictable environment that supports children's self-regulation skills and provides safe and warm relationships with educators and peers benefits children's social and emotional development..... a well-structured and predictable environment that supports children's self-regulation skills and provides safe and*

warm relationships with educator benefits children's social and emotional development". On the other hand, it is also important to consider the environment and interior design of the preschool classroom. The design of the classroom should aim to promote the above characteristics.

2.1.3 Interior design for preschool learning space

Next section presents theories on preschool and interior design and analyzes the interior design of the classroom for preschoolers - children aged 3-6 years. The first part of this section deals with the general role of interior design in learning environments for preschool children and its impact on children's development. The second part of this section deals with the exploration of the structure of the indoor learning environment, which consists of two domains: the objective physical environment and the subjective physical environment. The third part of this section deals with a general overview of the requirements and characteristics of optimal indoor design for learning spaces, emphasizing the factors to promote the developmental needs of young children, in order to develop a conceptual model of the characteristics of learning spaces that will serve as the basis for indoor design guidelines in the next steps.

2.1.3.1 Roles and Impact of Interior Design of Physical Learning Environment

Previous theories have consistently confirmed the crucial role of the physical learning environment in children's development (Table 8), such as the main theories of Werner, Piaget and Montessori, which claim that a child's environment is crucial for their holistic development. According to the study on Reggio Emilia schools (Carolyn Pope Edwards, Lella Gandini, 2018), the learning environment, referred to as "the third teacher", plays one of the most important roles in the education and development of children with special needs. The design of space for children is an important factor in children's experiences (Edwards, 2005) (Dudek, 2005); children's holistic development, children's socio-emotional development, children's behavior (Carol Weinstein, Thomas G.David, 1987), a group of authors have made some general statements about young children and the

physical environment. The built environment has both a direct and a symbolic influence on children, as the elements of the physical environment influence children's behavior. The symbolic meaning of the environment is particularly important for an emotionally disturbed child. Built environments for children should fulfill certain common functions in terms of children's development: fostering personal identity; promoting the development of skills; providing opportunities for growth; promoting a sense of security and trust; and enabling social interaction and privacy in children's learning (Maxwell, 2007); the holistic development of children: mental, physical and social instructions on the key to social development (B. Ece ŞAHİN, Neslihan TÜRKÜN DOSTOĞLU, 2012).

Claims about the role of the physical learning environment for children		
(Carol Weinstein, Thomas G.David, 1987)	Build environments have both direct and symbolic impact on children through influences of elements within the physical setting on children's behavior . The symbolic meaning of the environment is particularly crucial to an emotionally disturbed child. Built environments for children should serve certain common functions with respect to children's development: to foster personal identity ; to encourage the development of competence ; to provide opportunities for growth ; to promote a sense of security and trust ; and to allow both social interaction and privacy .	Children's holistic development, children socio-emotional development, children's behavior
(Dudek, 2005)	a successful designed physical environment for children's facilities is "a design that gives the child opportunities to discover, develop and learn " (B. Ece ŞAHİN, Neslihan TÜRKÜN DOSTOĞLU, 2012; Fabian, 1987).	Children's experience
(Maxwell L. , 2003)	Interaction with the physical environment is important for children's learning as well as people that surround them in their daily life	Children's learning
(B. Ece ŞAHİN, Neslihan TÜRKÜN DOSTOĞLU, 2012)	The physical educational environment has a great impact on children's mental development, physical health, and social development , which are long-term factors effects of such gains on society. The process of preschool education contributes with a short-long term influences on children and society since early childhood development is viewed as a key to social development	Children's holistic development: mental, physical, social. Key for social development

(OLDS, 1987)	The requirements of teacher. Adult needs such as these are legitimate and must not be overlooked in the design process	The voice of adult user.
--------------	--	--------------------------

Table 8: Claims about the role of the physical learning environment for children

Furthermore, the school is not only for children, but also for teachers, nurses and other adults who live with the children in this environment, and it is important that their needs are also considered. Olds (Olds, 1987) emphasizes that such adult needs are legitimate and must not be overlooked in the design. For example, the power of the teacher to control the classroom makes it imperative that designers of facilities for children ask themselves, "How does this affect the adult users?" to see how the classroom space as the fourth teacher becomes a "pedagogical tool" that supports teachers in the teaching process.

Based on the above literature review, it is evident that the role of interior design has a great impact on the development of the children and other people who spend time in this space. Understanding the structure of the interior design of preschool classrooms is critical to identifying the key spatial elements that should be influenced and understanding how they can be modified and designed to have a positive impact.

2.1.3.2 The structure of the physical learning environment

(A Tamblyn, Y. Sun, T. May, M. Evangelou, N. Godsman, 2023) mentions the concept of the physical and sensory early childhood educational environment. It considers "physical environmental factors" as "all aspects of the environment that have a physical component, such as instructional materials, outdoor areas, class size, activity areas, and quality". Sensory environmental factors are "any factors that do not have an obvious physical component, such as the weather, classroom chaos, and externalizing behavior of peers." It is important to fully understand the structure of the learning environment with its specific and internal components, consider the role of interior design. The concept of environment is defined as the physical environment, the surroundings and a specific setting (M. Vickerius, A. Sandberg, 2007). A learning environment is divided into many aspects, such as the socio-emotional environment, the behavioral environment and the physical

environment (Inan, 2009). According to (MENDEZ, 2017), the learning environment consists of **physical, social, cultural, educational, human and historical elements** that are interconnected and support or constrain children's interaction, communication, identity, sense of belonging and independence. In terms of the different types of learning spaces, learning environments can be built and natural, physical and virtual, indoor and outdoor, and formal and informal (Organization, 2019). The physical environment depends on the age and number of children in the classroom as well as the goals of the programs and specific activities in the classroom (Kim T. Ferguson, et al, 2013).

As a result, there are two types of physical environment: the objective physical environment and the subjective physical environment (Lawton, 1999, cited in Ancheita, 2005), which consists of many of the components mentioned above. The objective physical environment includes everything in the classroom that is observable and can potentially be measured accurately, such as chairs, toys, windows, carpets (Ancheita, 2005). The subjective physical environment is the teacher setting up in the preschool. It is important to understand the areas of the physical environment to apply the design effectively. At the same time, the physical learning environment also includes several learning spaces that are part of learning. Learning spaces can be designed with different combinations of resources (materials, technology, time, people, and places) that work together to support learning and teaching (Organization, 2019). Learning spaces should be aligned with pedagogy to support the development of approaches to learning and foster connections between different subjects within and beyond transdisciplinary studies (Organization, 2019). Learning spaces or learning environments also provide opportunities for symbolic exploration and expression, with teachers adapting the space and materials to support young students' evolving needs, interest, and theories (Organization, 2019). Famous earlier educators such as Montessori, Dewey, Freinet, the Agazzi sisters or Bronfenbrenner, for example, strive to create an orderly environment and respect the environment that surrounds the child so that they can discover the world and do whatever interest children. Based on these

principles, one of the most appropriate methodological strategies to transfer this to the classroom is the work corner.

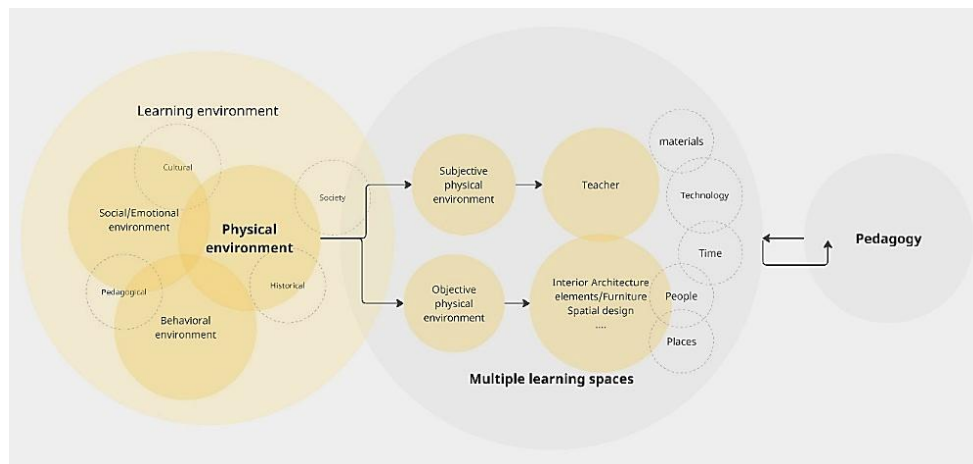


Figure 11: The model of the main components of the learning environment

The study of learning environments should not ignore the significant changes brought about by the particular needs of 21st century children, especially those aged 4-6, who represent the Alpha generation. The 21st century learning environment can be profoundly changed by modern technologies and can go beyond the traditional physical space to include virtual, online or remote spaces. It is important to consider learning environments as a versatile structure, tool and support system for effective learning. Such environments should be designed to meet the diverse needs of students, foster positive interpersonal relationships, and thus inspire teachers to teach the skills needed for the future. As (MENDEZ, 2017) suggests, a learning environment should function as a system that encourages the active participation not only of teachers but also of students and the community. It should actively contribute to the development of children's skills by providing the tools and resources needed to implement the educational methods used by educators.

To summarize, based on the above literature review, the author has developed a model of the primary structure of the learning environment in which its main components have been identified (Figure 12).

1. Characteristics of the domains of the objective physical environment in Interior Space

The physical environment includes all observable and measurable elements in the classroom, such as chairs, toys, windows, and carpets (Ancheita, 2005). However, interior space also consists of architectural components like columns, walls, floors, and roofs. These elements not only provide structure and enclosure but also shape the building's overall form by defining interior spaces (D.K. Ching, 2018). Previous studies highlight critical features that must be considered when designing classroom interiors.

(Evans, G. W., et al., 1996) suggested that the design of preschool interior spaces, including classroom size, layout, decoration, furniture, lighting, color scheme, and acoustics, can contribute to the improvement of preschoolers' educational processes and development (Evans, 2006, cited in (V. Papavasileiou, et al, 2018). More specifically, effective furniture can reduce the negative effects of noise in the classroom. Mendez (2017) concluded that certain elements in the learning environment, such as the space, distribution of furniture, esthetics, materials, tools and facilities, make up the classroom to support students during activities and encourage their interaction with environment and community. According to (Berris, R. & Miller, E., 2011), three specific dimensions of physical environment design have greatest impact on early childhood learning: space, which promotes exploration, independence, and development (a child's sense of self and readiness to play); spatial quality; and interaction between the outdoor and indoor environments. Spatial quality includes space (spatial order and spatial structure), color, light,

sounds and materials, which are considered elements of spatial design (Boettger, Threshold Spaces, 2014). (E. Matthews, Peter C. Lippman, 2019) have pointed out that the physical parameters of this space that interior designers need to consider are classroom noise levels, crowding, presence of stimulus shelters, spatial arrangement of the environment (classroom organization), lighting and air quality and ventilation, complexity of the environment (spatial arrangement), and legibility of classroom cues (E. Matthews, Peter C. Lippman, 2019). Classroom legibility can be improved by identifying activity areas that should be clearly delineated and by considering how physical cues can guide student behavior (E. Matthews, Peter C. Lippman, 2019).



Chronic noise can prevent children from interacting with materials, peers and adults. Noise contributes to a chaotic experience for young children, which can negatively impact cognitive and socioemotional development. Educators can use and strategically place sound-absorbing furniture in the classroom, such as sofas, bean chairs, or rugs near noisy areas (Barrett et al. 2015, cited in (E. Matthews, Peter C. Lippman, 2019). All these features shape children's exploratory behavior, attention, and interaction. In addition to the basic requirements of classroom interior design (Chu, 2014). This shows how important it is to carefully consider the design of the physical elements in the learning environment.

In summary, the objective physical learning environment includes **noise, crowding, presence of stimulus shelters, spatial arrangement, lighting, air quality, ventilation, complexity of the environment, and legibility of classroom cues** (E. Matthews, Peter C. Lippman, 2019), **classroom size, design, decoration, furniture, lighting, color scheme, and acoustics** (Evan, 2016), **spatial quality, integration of indoor and outdoor spaces, color, light, and sound materials** (Berris, R. & Miller, E., 2011) should be considered. All these features can be classified into hard features (architectural elements such as ceiling, walls, floor) and soft features (furniture, lighting, materials...) and visual representative aspects for the legibility of the environment (color, texture, materials...); they follow the principle of interior design and the characteristics of design vocabularies (shape, form, color,

texture, light, proportion, scale, balance, harmony, unity and variety, rhythm and emphasis) to create a functional and esthetic learning space.

As a result, in this study, the author develops the concept of the 7 layers of interior spatial design (Figure 13) by separating and rearranging these spatial elements layer by layer. These are spatial function, spatial form, spatial order, spatial color, spatial material, spatial furniture and environmental elements.

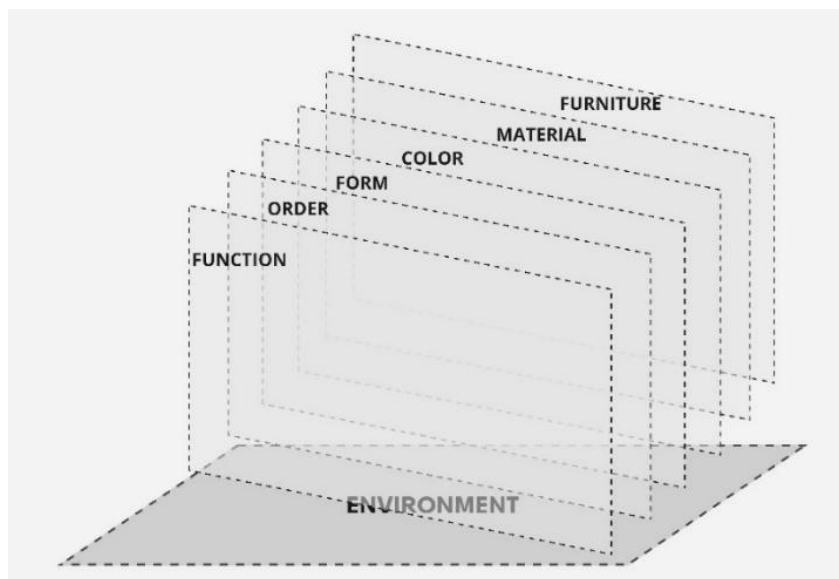


Figure 12: Design model of "7 spatial layers" of Design of Learning Space

2. Characteristics of the domains of the subjective physical environment in the interior space

The subjective physical environment is the responsibility of the teacher who sets up the preschool and applies the teaching methods for instruction (Ancheita, 2005). Previous studies have argued that the relationship between teachers, teaching methods and learning space influences children's learning process. The physical environment and the curriculum together promote and support the learning process of young children. It is important to know what activities are conducted in the physical environment, how these activities are organized and how they are designed. In contrast to other learning environments, teaching in early

childhood education revolves around learning centers that aim to promote physical development (play) and emotional, cognitive and social development (teacher-child and peer relationships), so that the environment in which the child learns becomes a key tool for the teacher at this stage (Perry et al, 2023; Van Liempd et al, 2020; cited in (Sara Conde-Vélez, Manuel Delgado-García & Francisco Javier García-Prieto, 2023). According to this study, the role of teachers as a fundamental factor in promoting an optimal environment for children's quality learning is of great importance.

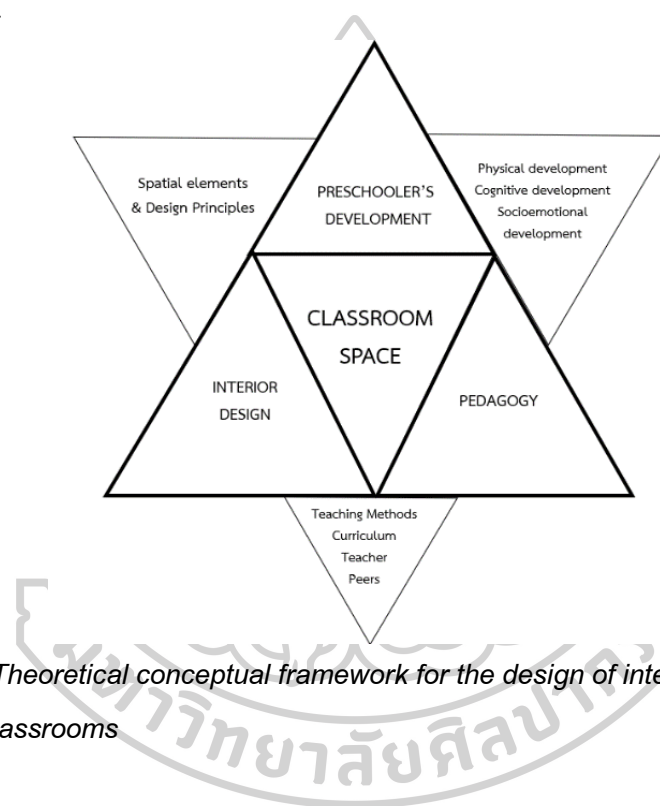


Figure 13: Theoretical conceptual framework for the design of interior spaces for preschool classrooms

On the other hand, a comprehensive learning environment is only achieved when teaching and learning activities take place effectively in the physical space and social interactions are enabled and encouraged. According to (Anna K. Kokko - L. Hirsto, 2020), the physical learning space is transformed, produced and developed through three cyclical interaction processes, including teacher-teacher interaction, teacher-student interaction and student-student interaction. Brykstute (2019) argued that the interaction between the pedagogy and physical environment in classroom is an undeniable and indispensable process in every school, which is reflected in

the spatial organization (Brukštutė, 2019). The school environment is shaped by pedagogy.

That's why, interior design of classrooms should be based on pedagogical strategies to support both the teachers in their teaching process and the children in their learning process. Therefore, the underlying pedagogical philosophies used in teaching should not be ignored when designing the interiors of classrooms for young children. The seven spatial layers of the classroom can be seen as tools to support interaction between teachers and students. Based on this awareness, it is important to establish a theoretical conceptual framework for the interior design of learning spaces that identifies the essential components including the key factors as well as the interactive relationship between these factors as fundamental knowledge for interior design guidelines in practice. In this context, preschool classroom interior designers also need to adapt the model to the 21st century conditions with the specific developmental needs of children and the evolution of technology. The theoretical conceptual framework (Figure) was created based on an analytical process that examined which elements are important in the physical learning space and how these relationships affect children's development and their activities in the preschool space.

2.1.3.3 General requirements for the interior design of preschool learning space

The aim of optimal interior design is to adapt to human needs, including psychological, emotional and physiological needs (Caan, 2011). Therefore, interior design should provide people with a sense of security, comfort, support, confidence, freedom and privacy, and sensory stimulation (Caan, 2011) through design vocabularies and design elements (line, shape, form, volume, color, texture, light, space) and design principles (balance, symmetry, variation, harmony) (D. K. Ching, 2018). This is also related to the interior design requirements for preschool classrooms mentioned in previous studies.

There are some studies that address the learning environment requirements that should be considered in the design of learning environments to create

environments that create relationships, invite people to act, and facilitate knowledge construction.

There is privacy and publicity (Altman, 1984); amiable, comfortable, pleasant, organized, clean, inviting and engaging (Cadwell, 1997; cited in (Izadpanah, 2011); rich in experiences and pleasant to suit children's needs, physical needs and emotional needs, where emotional needs include: security – a safe environment, attention, a sense of autonomy and control, emotional familiarity, a sense of being part of a larger community, privacy, a sense of status within social groups, a sense of competence and accomplishment, meaning and purpose (Neaum, 2010, p. 75); a well-planned, rich and stimulating learning environment with characteristics of healthy, safe, stimulating, empowering and respectful, welcoming and cozy, and encourages collaboration (Stonehouse, 2011); health, comfort, privacy, safety, legibility, complexity, scope, exploration, flexibility (Izadpanah, 2011); Flexibility, comfort, esthetics, learner-centeredness, community involvement, fostering independence, creativity, combination of digital and physical environments, contact with outdoor spaces (MENDEZ (2017); control, privacy, complexity, exploration, restoration, personalization, and legibility as features of the physical learning environment that address children's needs (Maxwell, 2018). Meanwhile, the International Baccalaureate Organization (2019) has identified three characteristics for the design of learning spaces: Engagement, flexibility and accessibility.

Requirements for the characteristics of interior spaces for young children	
Authors	Keywords
Altman, 1984	Privacy, Safety
Trancik & Evan, 1995	Competency
Neaum, 2010	Privacy, security, safe, attention, sense of autonomy and control; sense of competence and sense of status within social groups performance; emotional intimacy, feeling part of a larger community; meaning and purpose
Stonehouse, 2011	Healthy, Safe, Engaging, Empowering and Respectful, Welcoming and Comfortable, Encouraging Collaboration
Izadpanah, 2011	Health, Comfort, Privacy, Safety, Legibility, Complexity, Scale, Exploration,

	Flexibility
MENDEZ, 2017	Flexibility, Comfort, Esthetics, Learner-Centered, Community Involvement Encourage Independence, Creativity, Combine Digital and Physical Environment, Contact with Outdoor Spaces
Moghadam, 2017	Safety, Physical and Mental Comfort, Legibility, Flexibility
Maxwell L. E., 2018	Control, privacy, complexity, exploration, restoration, personalization, Legibility
Organization, 2019	Engagement, Flexibility, Accessibility, Safety, Digital/Technology Connectivity

Table 9: Requirements for the characteristics of interior spaces for young children

Learning spaces need to be both pedagogically and spatially flexible to accommodate the nuances of different knowledge domains, cognitive and social skills development, and personalization of learning. Learning spaces are designed to be accessible to all members of the learning community. Designers should design a flexible learning space through the spatial organization, inviting learning spaces through the ambience and esthetics of the space, engaging learning spaces through the spatial arrangement and spatial organization that invites engagement, meaning-making, exploration and reflection, and networked learning spaces Organization (2019. As John Edwards said, “the classroom is a microcosm of the world” (Dudek, 2005), i.e., “the architecturally defined areas in which each group of children is located. Classrooms may be separated by complete partitions or by partial barriers that also allow controlled visual or acoustic connections to other groups. The internal layout of a childcare classroom is quite different from that of a traditional primary school classroom.” Based on the above considerations, the classroom can be viewed as a micro element within the larger learning space. It serves as a key component that significantly influences children's perceptions of everyday life.

To summarize, preschool-aged and younger children (36v months and older) spend an average of eight hours per day in the facility. The children remain in the facility for most of their care. The center must promote optimal child development by providing a safe, interesting, healthy and appropriate environment that allows

children to engage in developmentally appropriate activities. The physical learning environment influences children's holistic development, including cognitive development, social development and physical development. The physical learning environment provides opportunities for children to explore, experiment and discover, which are important factors for basic cognitive development. In addition, a well-designed physical learning environment has a positive impact on the learning process by promoting children's independence, self-reflection, self-regulation skills and sense of competence through their experiences. It is important to note that the design of the physical environment also influences children's behavior and emotions in both directions. The classroom is an essential part of the learning environment. Its characteristic impact on children's cognitive development occurs directly through the subjective physical environment, which includes the teacher and pedagogy (teaching methods and curriculum), and the objective physical environment consists of elements of space (room structure and room design), furniture and materials. Analyzing the components of spatial structure and spatial design and their influence on the characteristics of children's cognitive development, including the indicators: children's behavior, children's emotions, children's language development, and symbolic expression through pretend and imaginative play is an effective method for proposing optimal classroom design, which was used in this study. To summarize, the classroom is a "micro-spatial factor" in the preschool environment and the design of the classroom should be considered as a "pedagogical tool" for young children. To further understand the definition of the term "pedagogical tool", the author introduces two concepts: "Children's development and the interior space of the classroom" and "Early childhood pedagogy and the interior space of the classroom".

In conclusion, theory chapter outlines the theoretical frameworks that guide this research, include Bronfenbrenner's ecological systems theory of human development, Piaget's cognitive development theory, theories of children's physical and socio-emotional development, theories on the layers of interior space, theories addressing the relationship between human and space, interior design principles for

learning environments, and pedagogical principles related to teaching methods & learning methods in early children education. By synthesizing these perspectives, the chapter identifies gaps in current research on the integration of children's developmental needs, physical learning spaces, and teaching methodologies, especially in Vietnamese context. This analysis informs the research questions and establishes the theoretical framework for the study.

B. LITERATURE REVIEW

This chapter provides a comprehensive survey of existing research, identifying key studies, findings and debates on the thesis topic, include children's developmental needs – physical, cognitive, socio-emotional developmental needs and the classroom space; philosophy of pedagogy in applying in interior space design; conceptual of seven interior spatial layers in classroom space with feeling scale. By synthesizing this body of knowledge, the chapter situates the current research within the broader academic context. It reveals unresolved issues, such as the limited integration of children's developmental needs with how many spatial layers in classroom spaces and a lack of focus on how spatial design interacts with pedagogy, particularly in the Vietnamese context. Additionally, there is a lack of clear identification of specific components within each spatial layer that are essential for supporting children's physical, cognitive, and socio-emotional development. Furthermore, while significant progress has been made in understanding individual components—such as developmental needs or spatial design—there remains a gap in cohesive frameworks that link these elements into a unified approach.

2.2 Children's Developmental Needs and the Classroom Space

As a micro element within the wider education system, the interior of the classroom plays a central role. It is often regarded as the 'father of design' (Caan, 2011) and has a significant influence on this process, as John Edwards also pointed out that the classroom is a microcosm of the world (Dudek, 2005). Consequently,

the interior space of the classroom is considered a "micro-spatial factor" within the preschool environment that exerts a significant influence on the developmental process of young children. The design of classroom interiors should be rich, well-planned and stimulating, serving as an "educational tool" to cultivate positive habits and behaviors in children to enhance learning outcomes and promote peer interaction and engagement with the environment. "Our interaction with the environment shapes our behavior" (Inan, 2009). Therefore, it is necessary to understand the relationship and interaction between the interior space of the classroom and children's developmental needs, including their physical development (motor and gross skills), cognitive development, and socio-emotional development. These areas of development are interlinked, so it is important to consider all aspects holistically rather than neglecting any one of them in the design process.



According to Prakash and Fielding (2007), designing an educational facility with the activities that take place there in mind helps to reduce solutions that inhibit learning. Architects must keep in mind that every design has an impact on users in one way or another. They must try to understand the complexity of human experience and learning processes (Prakash and Fielding, 2007). Trancik & Evans (1995) and Izadpanah (2011) assert that kindergarten/preschool interior design, especially the interior design of the classroom, has a strong influence on children's development. Children begin to experience their environment, they begin to form their self-esteem based on their unique identity to make children feel special, not just by making the furniture smaller or creating a colorful environment. Interior design can create a unique meaning in children's imagination, strengthen their attachment to the place and support their development in that environment. The design should fulfill basic design requirements that meet the basic needs of young children.

The size of a classroom should be based on the number of students and teachers, as space per child may be as important as the total number of children in the classroom. However, the number of children in preschool varies. The maximum

number of students in a public preschool is around 30-35 (TCVN/QCVN, 2022), while the number of children in private preschools is usually around 15-20 children. Although the number of students may vary, a minimum space requirement of 3 m² per child is considered sufficient to meet the specific developmental needs (B. Ece Şahin, Neslihan Türkün Dostoğlu, 2012). This contrasts with the requirements in Vietnamese preschools, where the minimum area is 1.5 m² per child and 36 m² per classroom (TCVN/QCVN, 2022). This considerable discrepancy leads to significant differences in the quality of learning and teaching processes across preschools, in children's behavior (William H. Brown, James J. Fox and Michael P. Brady, 1987), in psychological stress (Maxwell, 2003), in children's social interaction (Coralie Driscoll, Mark Carter, 2004) and in teachers' behavior in the classroom (MARTIN, 2002).

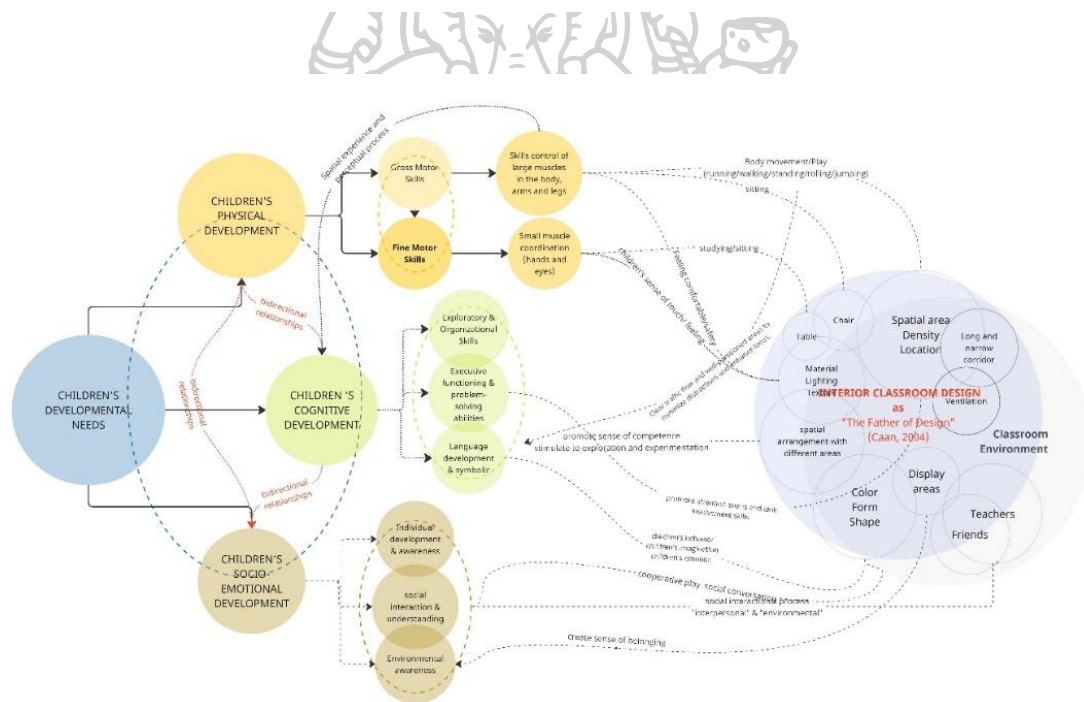


Figure 14: Characteristics of children's developmental needs and the influence of classroom interior design

To gain a better understanding, my thesis examines the reciprocal relationship between classroom design and child development (Figure 15). In particular, it examines how classroom design strategies influence children's

physical, cognitive and socio-emotional development. Based on the findings of this research, my work aims to identify the characteristics of seven spatial layers, discussed in the following sections, that correlate with children's developmental needs in the physical, cognitive and socio-emotional domains. The physical environment can significantly enhance children's experiences and development when it is thoughtfully and intentionally designed. The internal environment consists of an esthetically structured space where the design primarily aims to create a social atmosphere that supports learning. It collaborates with educators and allows students to explore and discover according to their interests. Through the practical application of theory, it shapes students by encouraging interaction between them within the space (MENDEZ, 2017, cited in Lippman, P.2010). It is clear that the space provides learners with opportunities that suit their abilities and different interests, and that learners feel safe to take control of what they are doing. And the influence of the interior design of the learning environment contributes to the application of teaching methods.

2.2.1 Children's physical developmental needs and the classroom interior design

In terms of children's physical development, the design of classroom interiors should facilitate the development and practice of gross motor skills (requiring control of the large muscles of the body, arms and legs) and fine motor/manipulative skills (involving small muscle coordination), which are discussed in the following section (Section 2.1). Not only is it important to support and encourage these physical skills in daily classroom activities, but also to ensure children's safety and comfort.

In the classroom, gross motor activities such as sitting, standing, walking or running can be influenced by the location of the classroom, spatial density, spatial zoning, spatial order, spatial shape, the arrangement of furniture and the dimensions of architectural elements such as stairs, doors and windows. Children need sufficient space (spatial density) to be able to walk and move freely under the teacher's supervision. This can sometimes be influenced by the design of

partitions or walls in the classroom to ensure that they do not encounter the dangers posed by barriers (spatial zoning and furniture arrangement).

According to Greenman (1988), room design influences children and their behavior. *“Long and narrow spaces encourage children to run. Some objects convey a warm and comfortable feeling, while others reflect fear and a certain texture prompts them to touch them”* (Izadpanah, 2011). Unlike adults, children first perceive the big picture of a place and then begin to look at the details, perceiving a big picture after looking at the details. *“A child begins perception of a new place”* by *“forming images and cognitive maps and representing the place in the imagination as a whole.”* According to (Caples, 1996), there are some requirements for preschool design, including **security, and safety**. The basic principles are a sense of well-being, the physical security of the facility and a guarantee that no child will ever leave the supervision of an adult. Ensure that all cupboards and rooms are fitted with locks. The **logical arrangement of spatial functional zones and furniture** can unconsciously shape and mold children's daily habits as they follow the flow of the space while learning and playing. Children can move from one zone to another without difficulty, they are encouraged to move, which helps them to reduce the risk of obesity, in a space where they feel safe and comfortable. Therefore, the shape of the facilities is soft, not harmful to children.



Figure 15: A large space can help children to walk more easily. An interior of a preschool classroom at HoaLan Preschool, HCMC, VN.

Children have a public zone for running and jumping as well as individual zones for sitting and sleeping. The ideal environment provides preschoolers with frequent opportunities to explore and discover through movement. It stimulates a range of body control, object control and spatial awareness activities, including sitting, rocking, crawling, hopping, running, jumping, reaching, bending and turning.

Fine motor skills, i.e. the use of the hands in coordination with the eyes, can also be influenced and encouraged by the design of furnishing details such as shape, color, material, texture and lighting. The shape and texture of furniture can stimulate children's sense of touch and allow them to experience the space not only through movement, but also through the use of their hands and eyes. The shape or texture of furnishings is soft and not harmful to children. When children are practicing their fine motor skills, they use their hands and eyes in tasks that require care and concentration. During this time, the classroom should have enough natural light to protect the eyes. In addition, heat and ventilation have a direct impact on children's health. They may feel uncomfortable in a room that is too hot, humid or cramped.

However, it is important to emphasize that due to the limited size of the classroom compared to other spaces, the development of fine motor and manipulative skills should be prioritized inside the classroom. The development of gross motor skills can be encouraged in the wider pre-school environment, including consideration of the positioning of stairs and how children move between different spaces.

2.2.2 The Children's Cognitive Developmental Needs and Classroom Interior Design

The close connection between children's physical and cognitive development highlights how classroom interiors influence both areas simultaneously. Children experience space through movement and observation, and the design of the space affects their perception of their surroundings. As Boettger (2014) notes, *"In order to perceive phenomena, humans must initiate*

motor processes." Consequently, children's cognitive development can be categorized into three key themes: exploratory and organizational skills (classification and mental ordering), executive functions and problem-solving skills (planning, problem solving, behavior, and imagination), and language development and symbolic thinking (language development, symbolic play, and behavior).

Previous studies that emphasize the impact of the physical environment on children's cognitive development. Carol Simon Weinstein and Thomas G. David (1987) suggest that early childhood educational settings that provide an appropriate level of social and physical challenge are critical for young children's development. They argue that the physical environment should foster the child's sense of competence by creating opportunities for learning and play as well as exploration and experimentation through a richly stimulating environment with many opportunities (Moore, 1987, cited in Rebecca Berris, Evonne Miller, 2011).

Proper physical movement in the classroom can significantly enhance children's physical spatial experiences, which in turn has critical implications for their cognitive and socioemotional development (Kim T. Ferguson, Rochelle C. Cassells, Jack W. MacAllister, Gary W. Evans, 2013). The impact of the learning environment on children's behavior is significant (Ancheita, 2005; Obaki, 2017). Both indoor and outdoor physical environments influence the behavior of all users, with children being the primary beneficiaries. Consequently, this environment can either promote or hinder the development of independence and learning in children (Mendez, 2017). Learning experiences in the classroom can be enriched when children are exposed to diverse experiences and supported in developing self-reflective and self-regulatory skills. Mendez (2017) emphasized that dividing the interior space of classrooms into different areas provides children with the opportunity to develop their skills and abilities in a positive way.

It is clear that the spatial division of the classroom has a major impact on how children engage in physical activities such as play and movement and interact socially, whether in large or small groups. To achieve this goal, the layout of the classroom should be strategically designed based on teaching strategies to create

optimal conditions for preschoolers to explore their environment. This includes a clear flow of traffic so that they can move around easily and have the opportunity to interact and play with their peers while facilitating teacher observation. As Goswami (2015) points out, this daily process plays a crucial role in the formation of children's self-identity. This underscores the need to design a classroom that not only promotes effective learning processes but also fosters cognitive growth.

This includes creating spaces that are easy for both children and teachers to navigate, strategically placing materials and storage units, and providing a clean and organized environment. Designers should provide a dedicated area to promote the activities of pretend play, which is one of the activities to promote cognitive development, such as a kitchen and bedroom (Evans, Shub and Weinstein (1971) or providing an appealing, well-organized library corner or reading area (Coody, 1973; Huck, 1976) (Weinstein, 1987) or career areas where the child can cosplay the people he or she wants to become in the future. The creation of an individual zone where children can find a quiet and peaceful place for themselves.

The clear flow of traffic, where children can move around safely, can help to boost their attention span and ability to engage with tasks. This means that children do not waste time reading and misunderstanding ambiguous spatial signals such as boundaries or different functional arrangements of furniture. Creating a clear and safe traffic flow for children can significantly improve their attention span and ability to solve tasks. Designing a clean and uncluttered space with plenty of storage options, separating incompatible activities (messy vs. neat, quiet vs. noisy), designating well-defined areas, and providing sufficient activities all contribute to this goal. In addition, color, one of the most important elements of the physical setup of the classroom, has a strong influence on children's cognitive development (An. T. T Nguyen; Eakachat J.; Veerawat S., 2023). Colors, forms, and shapes forms used in classroom décor have a direct impact on children's behavior (Read, 1999), children's emotions (Terwogt and Hoeksma, 1995), children's imagination (Usha Goswami, 2015) and language development (Pitch and Mullen, 2005). Color in this context encompasses more than just the paint on the walls, but also the colors of

the learning materials, the furniture and even the clothing of the teachers and students. When selecting colors for the entire space, designers must carefully consider each of these elements. Shapes and forms also have an impact on children's cognitive development through the different shapes or forms of interior design or furniture.

2.2.3 The socio-emotional developmental needs of children and the design of classrooms

B. Ece ŞAHİN, Neslihan TÜRKÜN DOSTOĞLU (2012) claimed that the process of preschool education contributes to short- and long-term influences on children and society, as early childhood development is seen as the key to social development. The components of socio-emotional development include individual development and awareness (self-esteem, self-concept, self-image, self-awareness, self-control, emotional regulation), social interaction and understanding (peer interaction, prosocial behavior, social behavior, contribution to relationships), and environmental awareness (safety and comfort, chronic stress and adversity). These components are shaped by children's interactions in their social and physical environments, including the “interpersonal” including educator-child and child-child interaction; environmental that is child – environment. The child's immediate environment provides space to support social interactions and the physical environment itself stimulates activity. The child's social and emotional development can be supported by the environment, play and the educator-child relationship that interact through participation in the ECEC setting (Kirk & Kay, 2018; cited in (Andrea Tamblyn, et al., 2023). Previous studies have argued that the characteristics of the environment can support recovery by promoting emotional engagement or acting as a catalyst for disengagement. Similarly, the physical environment of the school can influence attendance and motivation to learn.

Previous studies have demonstrated the effects of classroom environmental factors on children's behavior (Moore, 1994, 2008; Zimmons, 1997, as cited in Abbas, Othman, & Rahman, 2004), with a focus on spatial design. These authors emphasized that classrooms designed to facilitate prosocial interactions such as

cooperative play and social conversation are beneficial. Their research showed that children engaged in more cooperative play and social interaction when furniture was arranged to create specific spatial areas. (Obaki, 2017) pointed out that a friendly classroom creates an environment that elicits desired social behavior in children, impacts student learning and motivation (Asiyai, 2014), and affects children's language, cognitive, and social development in significant ways (E. Matthews & Peter C. Lippman, 2016); is positively associated with children's academic and literacy skills at the end of the preschool years (Mashburn, 2008); learning outcomes (S. Martin, 2006). (M. Broekhuizen, et al., 2016) have shown that children who experience higher levels of emotional and organizational quality in the classroom in preschool and kindergarten have better social skills and fewer behavior problems in both kindergarten and first grade than children who do not experience such high-quality classrooms. The design and spatial arrangement of a classroom can provide opportunities for children to interact positively with their peers and teachers while allowing them to find their own space for individual time. All the design elements of the space work together and influence children's social interactions and emotions in different ways. When these elements are combined harmoniously, they can affect all the children's senses, either positively or negatively.



By setting up areas to display the children's artwork, educators can visually reflect the children's lives throughout the space. Encouraging children to contribute their artwork as gifts for the classroom can foster a sense of ownership and belonging in children. This is important for the children. "Even with beautiful floor plans and room designs, classrooms can lack children's personalities" (Kaplan, 2015). Classroom interior design should include a small "gallery" of children's art in the classroom. Whether the art gallery is placed in a corner of the room or on a special bulletin board, children's artwork shows them that their work is valued and makes them feel more comfortable in the classroom. Designers may suggest using repurposed clipboards, pretty clips or clothespins to hang the children's artwork on

walls, cabinets, etc. This adds even more visual appeal to the room and puts the children's artwork front and center.

2.2.4 The 21st-century children and design requirements for space

The 21st century has brought about significant changes in various areas of human life, affecting children. It is a time of infinite possibilities, but also of potential risks. As a result, the lives of modern children have changed in many ways, and many of these changes have been underway for some time. The children of the 21st century is hugely different from those of previous generations. The OECD pointed out that *“the lives of modern children have clearly improved with better health care, public safety and support for their physical and mental well-being”* (OCED, 2019), but also bring new pressures, particularly at an emotional level: *“children report more stress and anxiety, including increased expectations and pressure to excel in an increasingly competitive educational environment”*. OCED has highlighted four main themes that characterize today's childhood, including physical health, emotional well-being, digital technologies, and peers and families (OCED, 2019).

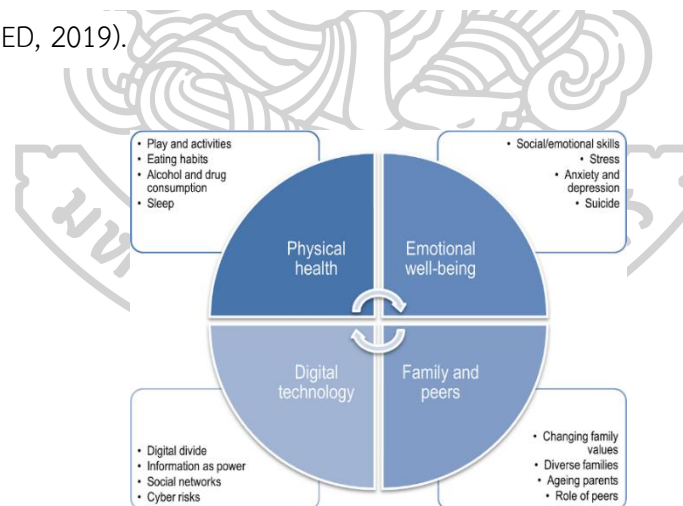


Figure 16: Four main themes of the 21st-century children

These four themes are interlinked and interact with broader social trends. In which:

Physical health: Good physical health can help children and young people to learn in the classroom and participate in their communities and wider society. Physical health is expressed through issues such as play and activities, eating habits,

alcohol and drug use, and sleep. The OCED explicitly points out in the paper that “improving and maintaining physical health can be achieved by supporting and modeling healthy lifestyles at school, at home and in the community (OCED, 2019)”. Therefore, children and adolescents' behavior is positively or negatively dependent on the environment in which they grow up, involving stakeholders such as educators, parents/caregivers, policy makers, and primary care providers in the design and implementation, using technology where appropriate.

Emotional wellbeing is the second important component that is critical to raising awareness of mental health issues and seeking help early, especially for children and adolescents, “as these issues tend to recur and have lasting negative effects on life satisfaction, education and labor market outcomes” (OCED, 2019). It is important to maintain stable and positive relationships with parents and teachers to improve children's well-being and social and emotional skills. Families and peers (friends) are critical to skill development and can influence later outcomes. The role of families and peers changes at different stages of a person's life. In early childhood, the strong bond between parent and child is associated with positive physical, social and emotional development. Therefore, the home and school environments play a crucial role in promoting socialization and fostering good relationships. In early childhood, young children spend much of their time at school where they interact with teachers and peers daily. The environment of these settings should be pleasant and positive, allowing children to have useful social interactions. Social life in the classroom is one of the key factors to pay careful attention to.

Digital technology is a defining feature of the 21st century, where children are becoming increasingly familiar with modern technology and the internet and spend a lot of time online. While digital technology brings both advantages and disadvantages for young children, the increase in online activity exposes them to digital risks such as cyberbullying, sexting and harmful user-generated content (OCED, 2019). These risks can potentially impact children's physical and mental health. The TV or laptop is one of the technological devices used in the preschool

classroom and consideration should be given to how children can interact with and use them.



Figure 18



Figure 19



Figure 17: Television and children in a preschool classroom in HCMC, Vietnam.

Figure 18: The preschool children at Stiegel Elementary School learn the alphabet with the Letters Alive program, in which the pictures on the letter cards come to life.

In conclusion, the four topics discussed play an important role in the development of children in the 21st century. In the context of the preschool environment, emotional well-being and digital technology are seen as particularly crucial factors that deserve special attention. The more digital technology develops, the more necessary it is to focus on the quality of children's emotional wellbeing. To ensure sustainable progression of these issues, children need to be equipped with and learn essential 21st century knowledge and skills to adapt to societal changes. These changes require new approaches to teaching and interacting with children. A substantial body of literature has emerged that addresses the particular characteristics of 21st century skills that children need to develop and the evolving demands on preschool education to adapt to these changes.

To cope with the rapid changes in technological society in the 21st century, the curriculum, teacher expertise and assessment must also improve (A. J. Rotherham, D. Willingham). C. Tutkun (Tutkun, 2023) pointed out that children consider 21st century skills to be important based on three themes: children's 21st century skills are **learning and innovation skills** such as creativity, critical thinking, problem solving and communication; **life and career skills**; **knowledge, media and technology skills**. Cansu pointed out that in this context, "*the preschool*

period is a very important period for promoting the skills of 21st century children. It is inevitable that the skills acquired and developed during this period will be relevant to the 21st century. As for the role of teachers, they become 'guides, mentors or counselors' rather than 'teachers'. (S. Suebsing, et al., 2023) presented on the competency development of early childhood teachers in the 21st century should focus on four areas: Curriculum, management of learning experiences, media use, innovation and technology in learning management, and measurement and assessment. Similarly, the classroom environment should be designed to accommodate teachers in creating curricula for young children. Families play an important and critical role in supporting children in 21st century skills in early childhood by engaging children from the preschool years and developing their skills.



In summary, young children in the 21st century need to learn relevant content and develop skills that will make them creative, collaborative and critical thinkers. Consequently, schools need to support the development of these skills. 21st century children need to *“use media and technology effectively and they need to be flexible, self-directed, productive and responsible”* (Henao, 2017). This leads to changes in the design of the learning environment to adapt to these changes. The design of indoor spaces, the arrangement of tables and chairs should be different, the composition of children is designed based on the interaction methods between preschool teachers and children. Previous studies have proposed an ideal 21st century learning space for children. Melissa (2017) emphasized that *“the 21st century learning environment is a place that puts students at the center, encourages collaboration and creativity, and allows students to develop problem-solving skills”*. Melissa (Henao, 2017) pointed out that the space should be adapted to different types of activities by creating different zones in the interior, such as areas for whole-class instruction, group and partner work, small-group instruction, and individual work, which are related to the concept of human proximities space, especially the individual areas where young children can work individually and reflectively. In her study, she pointed out that students want *“a warmer, more*

natural space, with more areas for individual work such as corners, lofts or 'dens'. Comfortable and safe are two key words Melissa highlighted in her study where children can experience the benefits of more privacy in their 21st century classroom (Henao, 2017). Interior designers should consider integrating the necessary digital technology into the front of the classroom space to support the needs of the technology age. Furniture should be designed to adapt to children's bodies, encouraging and enabling movement so that young children can adapt and manipulate the space to suit their needs. Not only that, multi-functionality in the seating area could be a positive, such as stability balls in different sizes and active stools. Important spatial factors such as appropriate temperature, light, noise and air quality must make students feel at home.

2.3 Pedagogy of early childhood, child development and classroom space design

Designing learning spaces for preschoolers goes beyond aesthetics and functionality. While addressing children's developmental needs is essential, it is equally important to consider pedagogy, teachers' needs, and teaching methods. A space becomes a true "pedagogical tool" when it effectively supports teachers in their roles as educators and caregivers. Without thoughtful design, managing a classroom of 30-35 active children can cause significant stress for teachers. Hence, classroom design must integrate pedagogical principles, curriculum, and teaching methods to meet children and teacher's needs. Research, such as Inan (2009), shows that a well-designed physical environment, aligned with the curriculum, enhances children's independence, social interactions, motor skills, specific for those with special needs.

2.3.1 Pedagogy: curriculum, teaching methods, teacher's needs and classroom design

Although various pedagogies, such as Montessori and Reggio Emilia, agree that the built environment significantly impacts children's development and learning, each pedagogy shapes a different learning space. These variations stem from the core

principles each pedagogy emphasizes, which influence teaching methods and children's activities. As a result, learning spaces must be designed to support the unique factors of each pedagogy. Previous studies have highlighted how classroom physical environments can be aligned with pedagogical approaches.

G. Brukštutė concluded that the interaction between pedagogy and the physical environment of the classroom is an undeniable and indispensable process in every school (Brukštutė, 2019). The physical environment of the classroom is defined as substance (matter), while pedagogical studies are perceived as an idea. The idea can only take root through matter, and the latter in turn needs the former to create the optimal physical learning and teaching environment. The relationship between the physical school environment and pedagogy is evident through the **spatial organization of the classroom, the size, shapes and furniture layout** (Brukštutė, 2019). S. Močinić and C. Feresin (2017) claimed that space is an essential element of an educational project, in which, the relationship between pedagogical-didactic intentions and architectural projects is becoming increasingly close, often leading to a demand for buildings characterized by maximum flexibility. The richness and diversity of spaces needed for new didactic requirements can be achieved (S. Močinić, C. Feresin, 2017). The Organization (2019) asserts that optimal learning spaces should reflect and support the values of learning by connecting pedagogy, people, and design. Figure 20 to depict the conversation in designing learning spaces or modifying existing learning spaces between stakeholders, including teachers, administrators, business leaders, architects, and students. In this model, pedagogy is aligned with the learning space to *“support the development of approaches to learning and foster connections between subjects and across subjects within and beyond the transdisciplinary program of inquiry”*.



In this model, the organization (2019) points out that pedagogy includes the teaching and learning approach (play, co-construction or facilitation), while resources include time, people, places, technology and learning materials. In addition, the design should be flexible, engaging and accessible.

Figure 19: The model of the relationship of design – pedagogy and resources in the learning space

It is clear that “the physical environment and the curriculum together enhance and support the child’s ability to do things for himself, to take care of himself, to initiate and complete activities, to take control of his actions and responsibilities, to communicate and interact easily with others, and to have better perceptual and motor skills” (Inan, 2009).

Summary of Literature on the Relationship between Environment and Pedagogy		
Authors	Findings of Study	Suggestion for space
(Brukštutė, 2019)	Physical environment (matter) and pedagogy (idea). Idea and matter work together to create forms of learning and teaching environments.	Prioritize classroom organization to express the relationship between the physical school environment and pedagogy. Lightweight sliding or folding partitions for easy moving and rearranging. Lightweight school furniture Storage rooms for students and teachers should be moved outside or separated from the learning space.
(S. Močinić, C. Feresin, 2017)	The environment has an impact on learning and is of great importance for the physical, intellectual, emotional and social development process of children,	To create environments of different sizes that can accommodate small groups of children for group research and individual activities as well as

	especially when learning is seen as an active and constructive process.	larger spaces for meetings, parent-teacher interviews, events, shows, parties and other activities.
(Organization, 2019)	Align pedagogy and learning space to support the development of approaches to learning and promote connections between subjects and across subjects within and beyond the transdisciplinary inquiry program.	Pedagogy includes: Play – co-construction – agency The learning environment should be a flexible and inviting space. “Learning spaces are designed with play in mind.”
(Inan, 2009)	The physical environment of a preschool should be considered along with the philosophy of the curriculum, the overall schedule of activities, and the factors that shape the curriculum.	Depend on the objectives of the curriculum and the changing needs of the preschool children.

Table 10: Summary of the literature on the relationship between environment and pedagogy

That’s why, designers should know the key principles for each curriculum to propose an appropriate interior design strategy for preschool children. The content of the curriculum, the teachers' teaching methods, the learning materials, the daily learning schedule and the way the children participate in activities all affect the design of the classroom. This includes the spatial organization between the different functional areas, the choice of materials and textures, and even the style and shape of the furniture. Various pedagogical theories illustrate how differences in curricula lead to differences in classroom interior design.

In Ho Chi Minh City, private preschools incorporate international early childhood education pedagogies into their curricula (see Appendix E for detailed information), such as Montessori, Reggio Emilia, and Rudolf Steiner approaches. These educational philosophies emphasize different aspects of child development. Montessori pedagogy encourages children to explore their world freely, driven by an innate impulse to learn. Rudolf Steiner’s theory focuses on nurturing children’s rich abilities and potentials through growth. Reggio Emilia’s approach places the child at the center of the school, recognizing them as individuals with rights, needs,

and the potential to independently construct knowledge and experiences. The space designs of these preschools aim to align with their pedagogical philosophies, creating environments that support teaching and learning activities effectively. In contrast, public preschools apply the national curriculum (see Appendix G for detailed information), which emphasizes a child-centered approach while also highlighting the significant role of teachers in classroom interior design. Teachers play a critical role in shaping the learning environment by preparing materials, developing questioning systems, and designing experiments and games. This approach ensures that the classroom setup supports the curriculum content while balancing the needs of children and the instructional responsibilities of teachers. In summary, literature reviews show that various pedagogical theories demonstrate how differences in curricula influence variations in classroom interior design.

2.3.2 The relationship between children, and teachers, Peers, and the interior classroom space

Teacher and peer are two important elements in the classroom and play an important role in interior design. These two elements are not only the end users besides children, but also the process of social interaction with teachers and peers affects children's holistic development, especially children's socio-emotional development. Thus, when studying how children are influenced by physical learning spaces, the influence of teachers and peers in the classroom should not be underestimated. In addition, the detailed interactions between teachers, peers and children should be considered.

The teacher is one of the crucial elements in the classroom and plays an important role in the spatial design of the classroom. While the structural design of preschool interiors, designed by interior designers and architects, remains constant over time, the interior design, spatial arrangement and classroom settings can be adjusted by preschool teacher month by month or year by year.



Figure 20: Study corners in a preschool classroom is set by teachers in HoaLan Public Preschool, Go Vap, HCMC, VN.

These changes consider the needs of new classes each year, adapt to different curricula and groups of different children, and are aligned with curriculum updates (Figure). In addition to designing classrooms that support children's development, it is therefore important that the interior design of classrooms — often referred to as the "fourth teacher" — supports the 'second teacher' through thoughtful physical factors. The classroom environment also affects the teacher's activities and teaching process in much the same way as it affects the children's daily activities or learning process. (MARTIN, 2002) pointed out that environmental competence is an important component of a qualified teacher. To create an optimal learning space for the future, preschool teachers should also be trained in spatial orientation skills so that they can better understand and utilize their environment together with their students. The classroom environment belongs to both the children and the teachers. As integral parts of the physical learning environment, both groups experience and interact with space (M. Blades, C. Spencer, 1994); spatial orientation skills of preschool teachers (Yusuf Koç, Kevser Koç, 2023).

Previous studies have identified three types of preschool teachers' attitudes towards the learning environment. The first type includes teachers who do not perceive their environment constructively and do not realize the significant impact the environment has on their teaching and classroom dynamics. Consequently, they do not act when problems arise. The second type consists of teachers who are aware of the impact of the environment on themselves and the children. The last type includes teachers who are victims of their classroom; they are aware that something is not working well but feel powerless to find a solution (MARTIN, 2002). Hence the need for preschool teachers to be aware of the connections that exist between their behavior in the classroom and its design, and to be involved in the process of designing their classroom with their ideas and specific input. Their involvement ensures that the design meets their needs for the teaching and management process and helps them understand the rationale for the design choices. "Preschool teachers should learn in their classrooms to understand their environment and redesign it to meet their needs. In this respect, every teacher becomes a designer, responsible for shaping the environment to achieve their educational goal" (MARTIN, 2002).

Not only the teacher, but also the peers are important end users of the classroom. In terms of the influences of peer interaction on the individual child in the classroom, previous studies have reported on the relationship between peers and children in terms of behavior and various components of children's development in the classroom.

Understanding the peer dynamics of children's victimization (Troop-Gordon, 2015); creating a stimulating environment and planning interesting activities to encourage peer interactions for shy and withdrawn children (T. S-Chapman, D. S. Hadden, 2011); peer interactions when children are guided to reach consensus, are effective in promoting learning (Tenenbaum, H., Winstone, N., Avery, R., & Leman, P. J., 2020); as a method of therapeutic intervention with children (Sancilio, 1987); effect on children's language development in relation to their classmates' abilities (L. Justice et al, 2011); tutor on young children's social interactions (Yaoying Xu et

al, 2008); social construction of mathematical knowledge (Forman, 1989); children's problem-solving ability (L. M. Fawcett, A. Garton, 2005); children's learning behavior (K. Coolahan et al, 2000).



Figure 21: Differences in furniture arrangements in classroom space based on teaching and learning plan.

Two different learning subjects, each with its own activity schedule set by teachers, can lead to different interactions between children and their peers. These interactions can vary between proximity and distance and involve working alone or in teams. Studies show that the physical environment in preschools plays a vital role in promoting children's social interactions, such as design interventions in park playgrounds (Jhu-Ting Yang et al.) and research on creating collaborative learning spaces (R. Støckert, G. Stoica, 2017). Additionally, teachers should actively shape peer relationships (Shannon R. Audley-Piotrowski et al., 2015). Therefore, when designing learning spaces, it's essential to consider the interactions, needs, and characteristics of both teachers and peers as part of the overall strategy.



Figure 22: Teacher-organized study activities demonstrate social interaction between children and their peers in public preschools in HCMC, Vietnam

In summary, while there are different educational methods, the role of the environment in enhancing children's learning and promoting their development is widely recognized. Educators should focus on creating a high-quality learning environment that provides ample space for children to experience, discover and explore, supporting both the learning process and daily life activities. Educators should develop a clear pedagogical methodology for their school or preschool. As the literature review shows, the pedagogical methodology leads to a specifically designed environment that is tailored to the requirements of this methodology, benefiting both children and teachers.

Hence, designers should understand the key principles for each different curriculum to propose an appropriate furnishing strategy for preschool children. The content of the curriculum, the teachers' teaching methods, the learning materials, the daily learning schedule and the way the children participate in activities all have an impact on the design of the classroom. This includes the spatial organization between different functional areas, the choice of materials and textures, and even the style and shape of the furniture. Integrating furnishing standards with pedagogy (including the philosophy of pedagogy, curriculum and teaching methods) is essential to creating an optimal learning environment. The specific pedagogical methodology should then be determined to ensure that the learning environment aligns with that pedagogy to support curriculum and teaching methods. The pedagogical philosophy chosen by an educator can serve as a filter for the design and differentiate the space from others. When designing the interior, designers should also listen to and consider the needs and teaching methods of preschool teachers.

Furthermore, individual children are not the only users of schools or teachers, nurses; peers also share these spaces of the preschool classroom with children. The teacher's voice in the learning space should not be underestimated; children's

social interaction with peers in the classroom should be considered alongside children's central position. The circle of relationships of end users in the classroom here includes children, teachers, and peers.

2.4 Conceptualization of 7 Interior Spatial Layers in the classroom space

The idea of layers in space or building is mentioned in some earlier studies. Pushkar and Sgavis (2013) mentioned a building in terms of six shear layers, a concept developed by Frank Duffy (1990) with four layers (Shell, Services, Scenery and Set) and further developed by Stewart Brand (1994) with six layers (Site, Structure, Skin, Service, Space Plan, Stuff) (Brand, 2007). This model (table) has been cited in recent years by researchers involved in the development of design theories in the field of ecological design and building ecology (Graham, 2005) in order to determine the lifespan of the individual layers. Based on this theory, buildings in construction and architecture are analyzed and further understood to develop or renovate them according to different design goals. In the context of the 6 layers, it is assumed that space planning and furnishing are two layers that belong to the interior space.

Layers of Longevity of Building Components	
Shearing Layers	Description
Site	The geographic setting, the Urban location
Structure	Foundation and Load-bearing elements
Skin	Exterior surfaces: cladding, walls, roofs, protection and control of climate and environmental conditions
Services	Working guts of a building: energy HVAC, lights, fires, lifts
Space plan	Internal partitions, ceilings, finishes, built-in furniture
Stuff	Furniture, consumer goods, food, waste

Table 10: Layers of Longevity of Building Components

However, there is a conspicuous lack of studies looking at coatings and their properties in interior spaces. There are very few studies that mention and analyze how many layers exist in interior spaces, how they function or what they are.

People define space through the process of perception and not as a frame. Therefore, designers and architects need to develop a better understanding of the layers and the individual components of interior spaces in order to create an optimal interaction between people and space.

2.4.1 The spatial collaborative layers in the interior space

The fundamental task of an interior designer is to create meaningful environments for those who inhabit them. In addition to pure use, interior designers must also consider how people, including children, interact with and experience spaces. They need to think about how to arrange and use the objects in these spaces so that we recognize our individuality and capture the intangible qualities that contribute to our success through the success of our surroundings. Interior spaces define people the most and reflect their behavior and feelings. It's obvious that it's not just about the story within the four walls. The design of spaces should also foster a greater appreciation and connection between the built environment and its occupants (Caan, 2011).

In “Rethinking Design and Interior” book, by Caan (2011), asserts that the new criteria for design today must include a comprehensive understanding of how humans interact with the physical and phenomenological world. It is necessary to take a deep look into the interior, to dissect each level of the interior and see how each of them works and how it affects the human being. People do not look at space from a distance, but define it through a process of perception, step by step, layer by layer.

First, interior space should not only be recognized as a zone of physical interaction, but also as one of psychological and emotional impact. Caan (2011) has developed the concept of interior space and second skin. Design is the intermediate zone between our skin and what lies beyond. As our second skin, it is an essential extension of our self.

The second is how the conscious design of the environment – that is, the design – can affect the person inhabiting the space. Certainly there are many fascinating elements within four walls, just as numerous layers can overlap within ourselves.

Similarly, Weinthal (2010) has pointed out that the interior space is like *“an ecological system that refers to cycles of time of its users, flowing organically from inside to outside, from one space to another and from one activity to the next. Temporal elements act as variables that appear and disappear throughout the day, while permanent elements are constants that help to ground the interior as a place”*.

Consequently, interior design does not consider individual elements or components in isolation, but as interconnected parts that work together and interact to create multi-layered layers within a space. These elements cooperate and work together to achieve a common goal within the interior space. This suggests a sense of teamwork and coordination between the different layers to enhance the overall interior environment and interact with the people who live within it. Looking at this aspect and the mechanism of their activities in the interior space, these layers could be called "collaborative layers" to illustrate how these elements form layers in the interior space and how they work together to illustrate the unified body of a space.

The next question is: How many layers work together in interior spaces where numerous details and different layers exist?

The main difference between architecture and interior design is the scale of the space. In the context of this study, the focus is on interior spaces. Consequently, there are notable differences in the way design elements are named or categorized into layered groups. The literature by Boettger (2014) (Boettger, 2014) has outlined a clearer concept with the identification of "five parameters" in architectural interiors. In his book titled "Threshold Spaces: Transitions in Architecture Analysis and Design Tools," Till Boettger categorizes and rearranges the above-mentioned elements into five parameters. These parameters are organized according to the characteristic scale of the architectural interior, which is often large and complex. This structure enables a targeted examination of the individual aspects and leads to a better understanding. Space remains the central focus for all

parameters (Boettger, 2014). Each parameter is further defined and subdivided into conceptual areas:

Spatial design: material, color, light;

Spatial function: space and use;

Spatial definition: objects and space;

Spatial structure: form and order.

These statements about the creation of space can provide a good overview, and space-defining elements can help to clarify the unified nature of a space. Literature by D.K. Ching (Ching, 2015) emphasizes the concept of primary elements (point, line, shape, form), shape, organization, circulation, proportion and scale, and principle (ordering principle, axis, symmetry, hierarchy, reference point, rhythm, repetition and transformation) in the design of an architectural space. Interior space contains its own systems that mimic ecology with various elements such as surface, color, furniture, objects, proximity, private interior spaces, public interior spaces, threshold between interior and exterior (Weinthal, 2010); design vocabulary and interior design elements, more specifically, the concept of interior building elements (ceilings, windows and doors, floors, stairs and walls); and the vocabulary of interior design includes form, shape, color, texture, light, proportion, scale, balance, harmony, unity and diversity, rhythm and emphasis; lighting and acoustics, surface materials and furnishing.

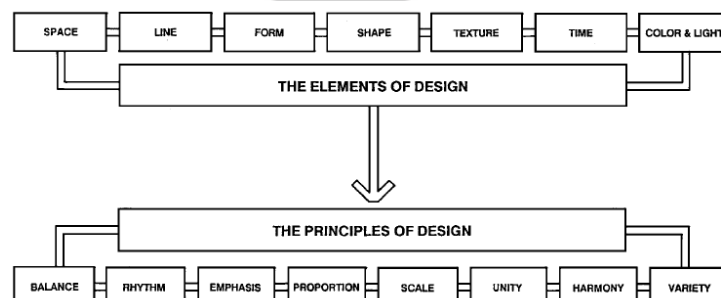


Figure 23: The basic compositional theory of design is traditionally divided into the elements and principles of design.

Chris Grimley and Mini Love (2018) outlined key design elements: space (proportion, room type), surface (color, material, texture), environments (light, systems), and elements (furniture, display). Rosemary Kilmer and W. Otie Kilmer (2014) emphasized interior components (stairs, doors, windows), design elements (space, line, shape, texture), and design principles (balance, rhythm, emphasis, proportion, unity, variety), as well as the roles of color, light, material, and furniture in Designing Interiors.

Concept of Elements of the Interior Space	
Authors	Definition of Elements of the Interior Architecture space
Brand (1994)	Space plan (interior partitions, ceilings, finishes, built-in furniture). Stuff (furniture, consumer goods, food, waste)
Weinthal (2010)	Temporal elements Permanent elements: Surface, color, furniture, objects, proximities, private interiors, public interiors, the threshold of interior and exterior.
Caan (2011)	Interior space should be recognized as a zone of physical interaction as well as psychological and emotional impact. Space is intimate and personal, with intimate space, personal space, social distance and public space.
Till Boettger (2014)	Spatial design: material, color, light Spatial function: space and use Spatial definition: objects and space Spatial structure: form and order Spatial sequence: places and paths
D.K Ching (2015) (2018)	Interior architecture: form, organization, circulation, proportion and scale Interior building elements: ceilings, windows and doorways, floors, stairways, and walls Interior design vocabulary: form, shape, color, texture, light, proportion, scale, balance, harmony, unity and variety, rhythm, and emphasis; lighting and acoustics, finish materials and furnishings
Chris Grimley and Mini Love (2018)	Space (proportion of space, type of room), Surface (color, material, finishing, texture, pattern) Environments (light, invisible systems)

	Elements (furniture, display)
(Rosemary Kilmer; W. Otie Kilmer, 2014)	The elements of design: Space, Line, Form, Shape, Texture, Time; The principle of design include balance, rhythm, emphasis, proportion, scale, unity and harmony, variety; Color, Furniture, Material

Table 12: Concept of the elements of the interior

Based on the above literature reviews (table 12), it is clear that the definition of spatial layers within the interior space can be complex and overlapping from both an architectural and interior design perspective. While the authors can divide and group the spatial elements based on their knowledge and experience, it is essential to organize these factors into primary layers. To address this need, this dissertation develops the concept of collaborative layers. The spatial layers in interior design need to be divided into different categories based on a synthesis, analysis and filtering of the reviewed literature. In addition, (K. Hristina, T. Annalisa, J. Goran, 2016) emphasize the value of layered space and its interplay and relationship between interior and exterior space, which can be considered as an intersection between interior and exterior. Thus, when thinking about the layers in interior space, it should not be underestimated that the layers between interior and exterior can be considered as environmental factors in the context of this study.

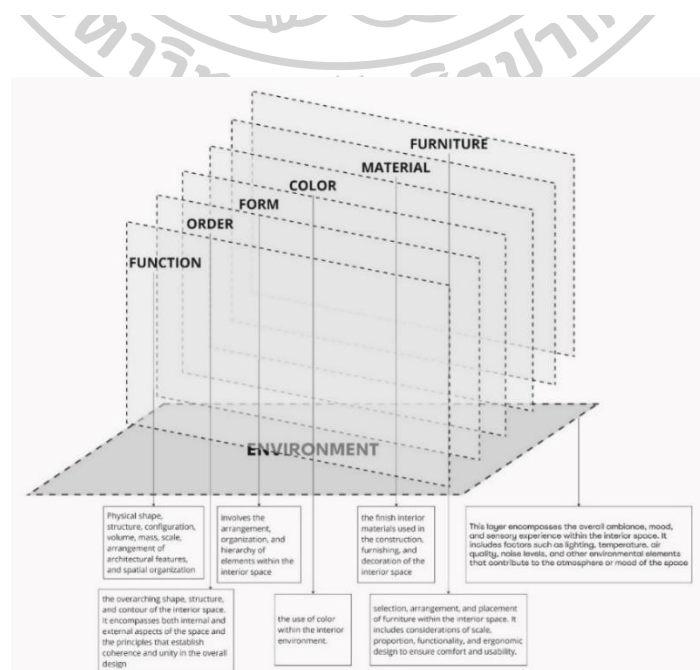


Figure 24: Model of the “7 interior spatial layers” in a preschool classroom space

More specific,

Spatial function: This level is about space and use, as it emphasizes the use of space. This includes considerations of physical form, structure, configuration, volume, mass, scale, arrangement of architectural features and spatial organization. It is about how the space is used and what interactions it enables.

Spatial form: This level refers to the overarching form, structure and contour of the interior space. It encompasses both the internal and external aspects of the space and the principles that ensure coherence and consistency in the overall design. Analyzing this level is about understanding the characteristics of interior design elements such as points, lines, shapes and volumes and how they combine to influence the human experience of the space.

Spatial order: This level covers the arrangement, organization and hierarchy of elements within the interior space. It looks at the way the components are structured and positioned to create a sense of balance, harmony and functionality. This level is therefore about the principles of interior design: proportion, scale, balance, rhythm, emphasis, unity and harmony, and variety.

Spatial color: This level is about the use of color in interior design. This includes considerations of color schemes, palettes and the psychological effect of color on perception and mood in a space.

Spatial Material: This level refers to the surface materials used in the construction, furnishing and decoration of interiors. This includes considerations of texture, pattern, durability, esthetics and suitability for the intended use.

Spatial furniture: Spatial furnishing is about the selection, arrangement and placement of furniture in the interior. This includes considerations of size, proportions, functionality and ergonomic design to ensure comfort and ease of use.

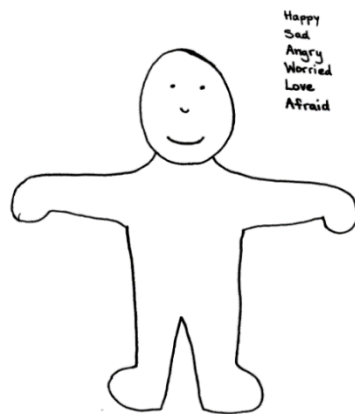
Spatial environment: This level includes the overall ambience, mood and sensory experience within the interior space. This includes factors such as lighting, temperature, air quality, noise levels and other environmental elements that contribute to the atmosphere or mood of the space.

In this context, selecting the key factors to prioritize in the interior or determining how many layers to combine becomes more flexible. These layers not only unify the space but also interact as individual components. Designers or educators creating spaces for preschools, schools, or home-work nooks can refer to the 7 interior spatial layers and choose two or three based on the specific site and design needs. This adaptability is the strength of the concept presented in this dissertation.

2.4.2 The 7 interior spatial layers, the feelings scale and the preschool children

The 7 interior spatial layers should be arranged and combined to create a positive atmosphere for the indoor space and also have an effective impact on emotion and behaviors of children and teachers. For better understanding, this dissertation uses a tool that has been used in some previous studies, namely the “feeling scale” based on the relationship between children's feelings and the design of the space, – to arrange and develop the collaborative layers in the indoor spaces. The feelings map, also referred to as the emotion map in some studies, is an instrument that has been used in previous research related to young children. Although the terms are sometimes used interchangeably, there are nuanced differences between them. “Feeling maps” and “emotional maps” serve different purposes and have different applications depending on the specific research objectives and areas of interest of the researchers.

The literature review examines both “feeling maps” and “emotional maps” in detail, highlighting their unique characteristics and applications. Feeling maps are a way to visualize different spatial and emotional realities (Andrew Steger, Elly Evans, Bryan Wee, 2021). Steger et.al. emphasized that human experiences are inherently emotional and spatial; joy, hope, fear, anger, love, stress and excitement transform attachment or antipathy to and towards places. Through the use of emotion maps, this study showed how emotion maps reveal the felt geographies of places that are critical to children’s well-being. Athena A. Drewes (2001) claims that this technique can also be used by children.



“The child then chooses a color for each emotion listed and uses the marker, crayon or colored pencil to make a small line next to the emotion word... Children have used blue for happy and yellow for angry” (Athena A. Drewes; quoted in (Heidi Kaduson, Charles Schaefer, 2001).

Figure 25: Gingerbread person with an emotional level

This tool is used in the initial stages of individual play therapy (research methodology) to determine how emotionally constricted children are, how aware they are of their inner emotional lives, and how connected or disconnected they are to their bodies (Heidi Kaduson, Charles Schaefer, 2001). Distribute lines that express the feeling (happy, sad, angry, worried, loving, scared) and have the children choose a color and visual aid for each feeling listed and draw a small line with the art tools (marker, crayon, or colored pencil) (Figure 33). A heart map is a combination of topographical and emotional aspects (Becchi, 1990; Lamedica, 2003’ cited in (Heidi Kaduson, Charles Schaefer, 2001).



Figure: Heart Map

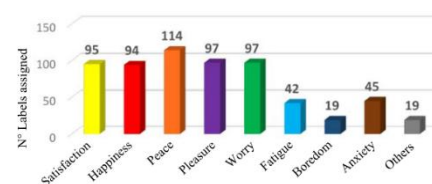


Figure: Histogram with Quantitative Data on the Emotion Labels

The research method of “emotional mapping” is used in the studies by Michela Schenetti & Elisa Guerra (Michela Schenetti, Elisa Guerra, 2018)

The topographical map and the reflection and interpretation in emotional terms (satisfaction, happiness, peace, pleasure, worry, tiredness, boredom, fear, others). Michela Schenetti & Elisa Guerra (2018), “in their study (Figure) on supporting preschool educators' and teachers' experiences, also suggest the creation of an emotional map, more precisely, they call this tool the heart map and the description of live experiences. Using a feelings map or emotional map can be an effective tool to understand the relationships between the people who live in a space and the space itself. the "feeling" represents the subjective perception of emotions and reflects how each individual interprets and labels emotions. It provides a broader and holistic context within interior spaces and reveals the complexity of the multi-layered human experience. Previous studies have successfully used this tool to explore the link between children's emotions and their environment, but the importance of indoor spaces has often been overlooked. Based on these findings, it is proposed that the feelings map can be a valuable tool for my research. I plan to integrate the concept of the seven layers of collaboration in classrooms and explore how these layers influence emotions and feelings of connectedness for both children and teachers. In my study, the emotion map is divided into six levels: extremely positive, positive, moderately positive, moderate, moderately negative, negative, and extremely negative (Figure C). These levels will be linked to the seven layers of collaboration, which reflect the key characteristics of preschool classrooms. The study will analyze each component of the seven spatial layers and align them with the "feeling scale" to determine which elements create a positive space and which contribute to a negative experience.

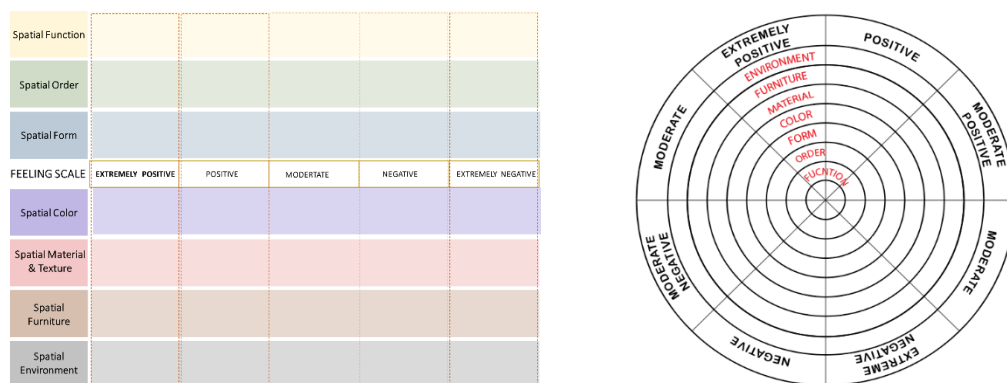


Figure 26: The feeling scale with 7 interior spatial layers in a board and in a wheel

This feeling tool is used in this dissertation in chapter 3 of the research method to find out how this tool can be used in analyzing and creating an appropriate interior learning space for children and supporting their developmental needs.

2.5 Preschool Children and the 7 Interior Collaborative Layers in Classroom Space

2.5.1 Seven interior spatial design layers in classroom space

2.5.1.1 Spatial Function

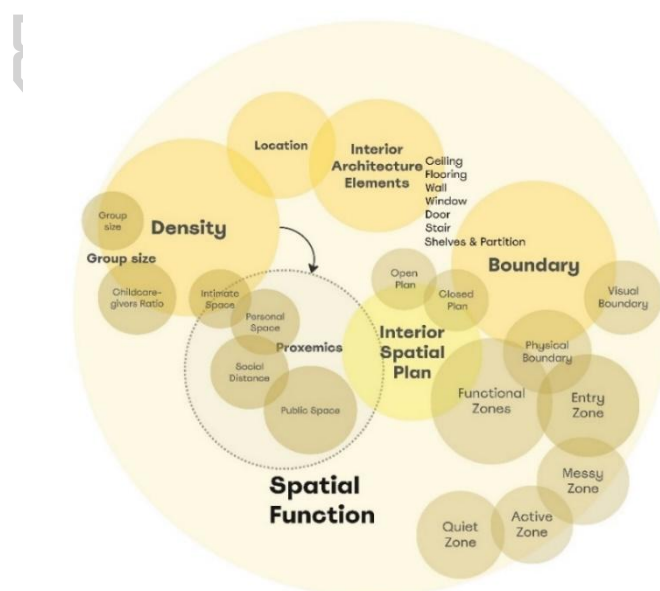


Figure 27: The key components in Spatial Function Layer.

1. Location

Classrooms should be located on the outside of the building to maximize access to natural light. Or the classroom needs to “borrow” maximum natural light from areas that are on an exterior wall with windows. This issue will have a strong influence when designers think about design solutions for the level of room function. The corridor in front of the classroom should serve as a welcoming space where teachers meet children and parents, parents say goodbye to their children and children meet their friends. The corridor should be open, run along the outer perimeter of the building and offer a view of the greenery so that the natural light falls indirectly into the entrance area of the classroom.

2. Group size, child-caregiver ratios, and density

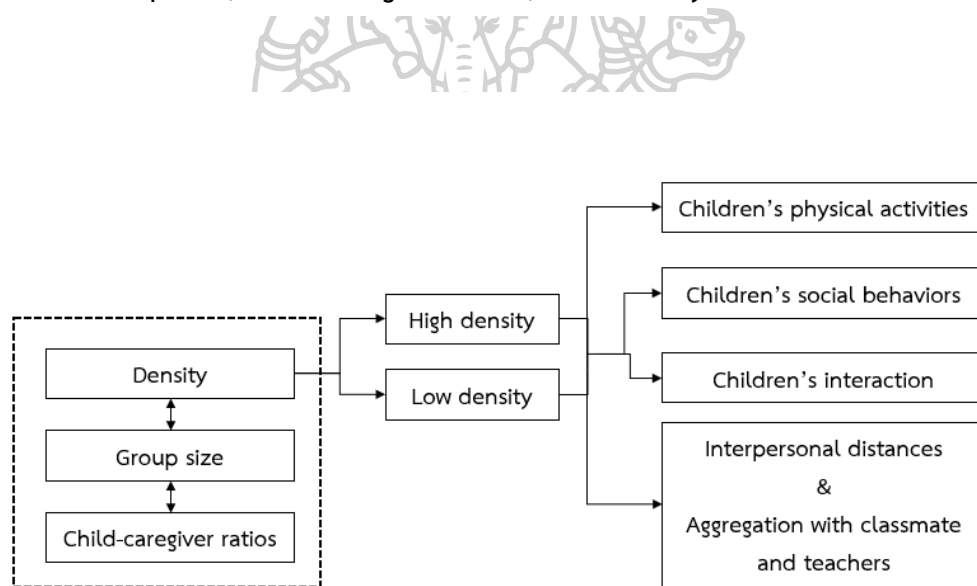


Figure 28: The main elements of density

When designing interiors, designers must think about the number of ends users who will inhabit the design space and connect to the history of a person's territorial space. This involves the perception of the appropriate use of space around the human body, which varies between different groups and cultures and between individuals within a group (D. K. Ching, 2018). He points out that “the presence of other people, objects, and the immediate environment can expand or restrict our

sense of personal space. Invading a person's personal space can affect the person's feelings and reactions to everything around them." A person's territorial space includes the intimate zone, the personal zone, the social zone and the public zone. These zones are important factors in the interior space as they change the characteristics of the space and the way people feel in it.

Much previous research has shown that the density of the preschool environment has a significant impact on the behavior and interactions of young children. Previous studies have found that young children's interpersonal spacing patterns are influenced by the density and design of the environment, with more space leading to greater interpersonal spacing and aggregation with classmates and teachers (J. Wesley Burgess, W. Kyle Fordyce, 1989); spatial density in the classroom has a significant effect on elementary school children's academic performance and behavior (Maxwell L. , 2003); as a framework for preschool children's social interaction (Coralie Driscoll *, M. Carter, 2004); the relationship between the number of children and the number of activity areas in the classroom correlates positively with off-task time (Kantrowits & Evan, 2004; cited in (M. Y. Abbas, et al, 2012). In (M. Abbas, M. Othman, P. Rahman, 2004), it was highlighted that well-demarcated classrooms showed more appropriate behaviors compared to poorly demarcated classrooms, indicating the importance of spatial design in influencing children's behaviors.

Density is one of the issues that interior designers should carefully consider when starting with spatial function and developing appropriate spatial design strategies based on this. It is clear to see that spatial density in classroom interiors has a significant impact on children's cognitive development and socio-emotional development as it affects children's behavior, social behavior and social interactions. More specifically,

Higher population density in these environments can hinder the development of important social interaction skills in young children. When necessary materials are not readily available, children may become hostile or disengaged from activities. In

classrooms with high student density, children's freedom to explore materials and activities may be limited. Physical interaction is critical to growth and makes high-density classrooms particularly challenging. In addition, large group sizes increase the likelihood of stressful situations. On the other hand, research shows that smaller group sizes are associated with more cooperative behavior, greater participation in activities, less aimless wandering, greater verbal initiative, and better scores on measures of cognitive ability (Ruopp, 1979, cited in Weinstein, 1987).

What is the optimal number of young children in a classroom with two teachers to facilitate both physical and social activities, enhance the teaching process and promote social interaction? The literature review indicates (J. Francis, W. S. Barnett, 2019) that reducing the number of children in a preschool class by five children, from a regular class size of 20 students to a reduced class size of 15 students, can enhance children's cognitive development after just one school year. Olds (2001) has argued that the number of children per group or classroom should be between 14 and 16 children with two adults, and no more than 16 children per classroom.

3. Boundaries

In relation to space and environment, boundaries serve as fundamental elements of spatial organization (Leimgruber, 2005). This study highlights the dual function of boundaries as barriers and points of contact within spatial organization and underlines their crucial role in structuring space and society. Boundaries are a line that marks the limits of an area in space. Indoors, boundaries protect children's activities from traffic, lunch and other distractions, promoting sustained play. They also support children's ability to memorize their location. Boundaries can be seen as environmental cues that help children represent the spatial environment and make it easier for them to plan and carry out purposeful activities (Weinstein, 1987). The requirements for boundaries are that they do not have to be permanent and must not interfere with supervision. *"Clear boundaries protect children's work and play"* (Products, 2009). Boundaries can be visual and physical boundaries and include some concepts such as pathways, movement, freedom to explore and privacy.

In interior design, spatial boundaries can be emphasized through two types of design: visual and physical boundaries. **Visual boundaries** such as the use of color – the strongest visual organizer. *“Different colored door and window frames are colorful but draw the eye to unimportant features of the room. Indeed, colors placed at child height on countertops, display boards, and partitions between areas signal that areas begin and end with specific hues (OLDS, 1987)”.* Alternatively, **altered lighting** can set spatial boundaries, achieved through spotlights or subdued lamps, creating a different appearance and atmosphere to the surrounding areas. **Physical boundaries** could include physical elements such as tables, chairs, partitions, shelves, solid or transparent walls. This connection to the collaboration of spatial function with spatial color or spatial environment, these elements influence each other and lead to a unified theme for the spatial design.

4. Interior spatial plan

There are usually three types of floor plans for learning spaces for young children, namely open-plan, closed-plan, and modified open-plan. In floor plans, (T. Moore, 1987) highlighted that open-plan centers lead to more caretaking, random non-developmentally relevant behaviors and higher levels of attempted control by the teacher, while closed centers contribute to more transitional and withdrawing behaviors, leading to lower levels of exploratory behavior. However, the modified open facility, which is midway between the two extremes, appears to contribute significantly to a number of behavioral indicators of cognitive development, such as task engagement, child initiation of behaviors, and exploratory behaviors.

Choosing the appropriate floor plan depends on factors such as the scale of the area, the number of students, the density and the desired arrangement of certain areas within the interior space. While closed-plan and open-plan layouts each offer different benefits, a modified open-plan design offers numerous advantages for children's cognitive development. Therefore, in situations where space is limited, designers can implement the option of a modified open-plan. They can use low partitions with a height suitable for childcare or create a more open space by

removing certain walls to slightly change the characteristics of the space and transition from large functional areas to smaller activity areas and vice versa. In addition, the division of space can also be achieved through the strategic placement of bookshelves, filing cabinets, chart and map easels, and portable partitions. Beacham (1996) emphasized the need to make spaces flexible so that they can be used for different purposes.

5. Interior spatial zones

In order to divide the spatial zoning into functional zones, interior designers should base themselves on fundamental questions about children (age, gender, culture, development and needs) and pedagogy (application of learning and teaching methods). Spatial organization includes interior design strategies for the floor plan of the classroom based on specific locations and end-user requirements. Classroom design includes functional areas defined by the arrangement of furniture and structural elements tailored to different age groups (Administration, 2003). Therefore, it is importance to design a well-designed plan that creates optimal conditions for children's movement and social interaction within the interior environment of the classroom. Ensuring direct circulation between entrances and exits is critical to maximizing the space dedicated to these essential functions. In terms of the characteristics of the zones in the classroom, separate the space for active and quiet activities: Use variation in ceiling height, floor height, wall configuration, light levels, finishes and open areas to modulate the perceived activity level in different areas of the classroom. The high activity areas have been separated from the areas designated for sleeping and quiet activities.

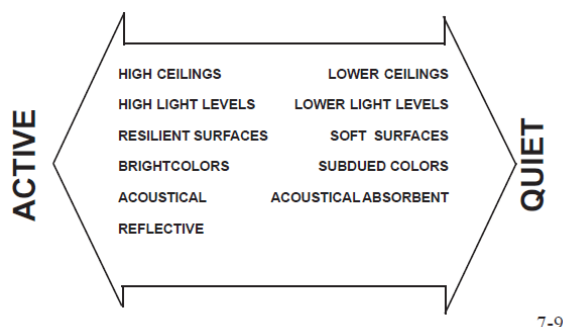


Figure 29: The design for active and quiet areas

The U.S. General Service Administration's "Childcare center design guide" (2003) identifies general concepts for classroom design, including:

First, classroom areas should be designed to accommodate small groups (4-5 children) or create "retreat areas" for individual or smaller group activities.

Second, the space should be flexible, allowing children and teachers to easily adjust it for various activities. For example, storage compartments for children's items should be adaptable, with prefabricated units anchored to partitions or low walls offering a cost-effective alternative to built-in models. Third, storage compartments should be designed to keep the space tidy, concealing items to maintain an uncluttered and functional classroom. The compartments should be arranged to create a "checkroom" or "entrance alcove," with openings facing away from the main classroom areas.

Apart from the mentioned considerations, (A. H. Jalalovich, T. K. Sidikovna, 2022) have also highlighted some important guidelines for designing a comfortable environment for preschool children that architects and interior designers should follow, including the design of open spaces to provide the possibility of active movement in each room and create good conditions for children's physical development needs. Using surfaces with different textures to allow children to explore more and have sensory experiences, as well as creating private spaces for relaxation, quiet play and tutoring.

Table: Functional zones in the interior space of classroom		
Wet region	Entry zone	The place where children's personal effects are stored.

	Messy zone	Contain tables, chairs, easels, woodworking benches, sand and water centers, nature study, sink and a kitchen area. Easy to access the outside play area.
Dry region	Active zone	Where support large motor play, wheeled vehicles, music and movement, climbing and dramatic play.
	Quiet zone	Where contain blocks, manipulatives, construction toys, puzzles, books, games or just places to be cozy.

Table 11: Functional zones in the interior space of the classroom

In each zone, there are functional areas whose characteristics interior designers should take into account when designing, entry zone include some areas such as entrance, cubby storage, classroom & teacher storage; messy zone include some areas such as toilet & sink, art sink, eating/table area, drinking fountain; active zone include areas with level change or open, unrestricted activity area, child-accessible display; the quiet zone with block area and sleeping area. (see **Appendix A** for detailed information).

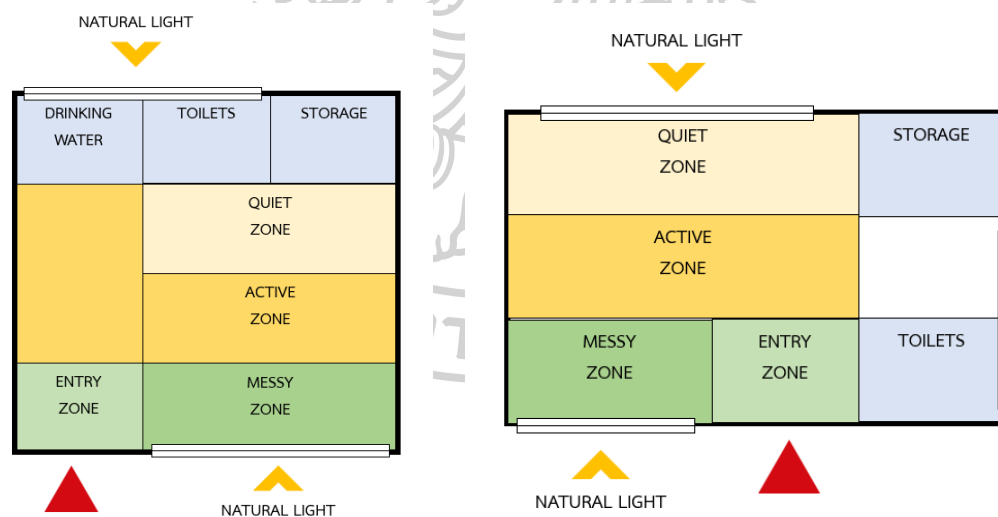


Figure 30: An example of organizing objects in the classroom can also help children's understanding of the space

6. Interior architecture elements

The interior architectural form of the classroom should be an appropriate setting for a child, providing a clear sense of place while offering optimal flexibility, as most of

the space is free of constructed elements. In this way, the arrangement of furniture can create the necessary functional areas. Interior architectural building elements include ceilings, walls, floors, stairways, windows and doorways (D. K. Ching, 2018).

Table: Characteristics of the Element of Interior Architectural Design in the Classroom Space	
Ceiling	Vary the ceiling height to delineate areas, diffuse light and create interest. A higher level of activity is often encouraged by higher ceiling heights, quieter areas are supported by lower ceiling heights (Read, Marilyn A., 2003). High ceilings increase usable space by allowing the development of lofts and platforms, creating intimacy. Low ceilings can create intimate spaces.
Floor	Different boundaries and materials to define areas on the floor
Walls	Vary wall configurations by considering modulating partitions to add interest, soften a space, give a more groomed impression or create special spaces. Consider beveled or obtuse-angled partitions instead. 25 mm rounded outside corners for drywall should be used. Visibility of all areas in the classroom is a key factor. Avoid 'blind' areas that would make it difficult for teachers to supervise. Movable walls with sliding doors could be used in interior spaces for easy to open, to extend, to separate spaces when needed.
Stair	The stairs are the area where children can develop their physical skills (Joanne E. Riley, M. Roys, S. M. Cayless, 1998). Stairs should meet the safety requirements specifically children's development. Interior designers must consider various factors to ensure stairs in preschool areas are child-friendly and consistent in design, including steps, treads, risers, banisters, balustrades, railings, hardware, baby gates, stair width, height, slope, and visual cues.
Windows	Windowsills and counters for children should be installed at child height, adjusted according to the age group using the space. Windowsills should be positioned 460 mm above the finished floor level to allow for furniture and equipment placement along the walls. Storefront windows starting at floor level are not recommended. Instead, windows should be at children's eye level with horizontal elements aligning with door height, avoiding windows placed too high for children to see outside.
Doors	Avoid designing solid interior doors that do not allow necessary monitoring.
Shelves & Partitions	Partition walls in preschool classrooms are designed to flexibly divide different areas, providing children with opportunities for various activities. These walls must be securely constructed to prevent tipping. Shelves and partitions should be child-sized but not so tall that they are out of reach for caregivers.

Table 15: Characteristics of the Elements of Interior Architectural Design in the Classroom Space

2.5.1.2 Spatial Form

This layer refers to the overall shape, structure, and contour of the interior space, covering both internal and external aspects while ensuring design coherence. Analyzing this layer involves understanding elements like point, line, shape, and volume, and how they collectively form the interior space and affect children's experiences within the classroom.

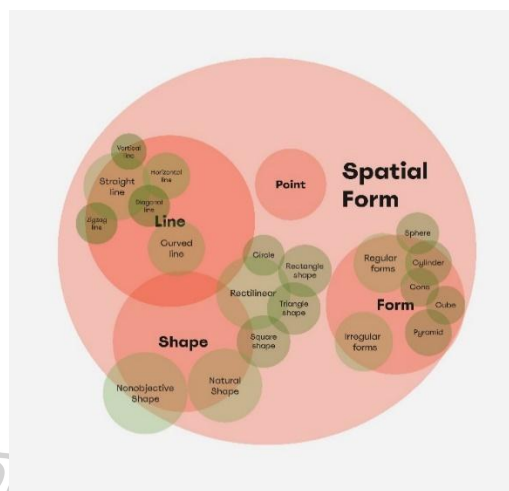


Figure 31: The main elements of the Spatial Form

In interior design, as described by D.K. Ching (2018), the design vocabulary consists of essential elements that impact both the function and aesthetics of a space. These include form, shape, color, texture, light, proportion, scale, balance, harmony, unity, variety, rhythm, and emphasis, all contributing to the character of an interior (Ching, Interior Design Illustrated, 2018). Additionally, concepts like atmosphere shape the mood and ambience of a space. Elements such as point, line, plane, volume, and form serve as foundational building blocks that designers skillfully arrange to define spatial form, solid and void. These elements influence both the furniture style and the overall design. By carefully manipulating them, designers create unique forms that reflect their concepts or the visions of educators. The specific characteristics of these elements shape the atmosphere and ambience of a space, profoundly affecting children's emotions through visual and physical

interaction. To achieve depth and detail in spatial design, it's essential to understand each component's characteristics.

For further understanding, it is necessary to understand the characteristics of each component to create a spatial form with depth and detail.

1. Point

The simplest component of the design elements is a point. It is claimed that a point is visually represented as a dot or mark. Points are in harmony or dissonance with the implied forces of a square, so that a point in the center is in harmony with the square (M. Puhalla, 2011). According to D.K. Ching (2018), the point is the creation of all forms. It has no length, width or depth. Therefore, the point is static, still and directionless. Other shapes can also be seen as point forms if they are sufficiently small, compact and directionless, such as a small sphere or a circle in a large space. At the center of a field or space, a point is stable and at rest and able to organize other elements around it. It retains its self-centering property, but becomes more dynamic and aggressive when it is removed from the center. Point-generated forms, such as the circle and the sphere, share this self-centering property of the point (Ching, 2018). A significant number of points strategically positioned along an implied path serve to guide the viewer's eye within the composition and create a sense of movement. Therefore, designers can use points in spatial design to shape the visual perception of people and direct their attention to specific focal points or positions in space (Figure). This technique draws the viewer's attention to specific locations, enhancing the overall spatial experience.

2. Line

An extended point becomes a line with the properties of length, direction, position. A line is a crucial element in the formation of any visual construction. In particular, a line can serve to connect, link, support or intersect other visual elements, describe and give shape to the edges of surfaces, and articulate the surfaces of planes (Ching, 2015). The character of the line, whether taut or slack, bold or timid, graceful or jagged, is determined by the human perception of its length-to-width ratio, its contour and its degree of continuity. The orientation of a

line influences its role in a visual construction. The line is classified as **straight, curved, vertical, horizontal or diagonal/slanted** — depending on how the viewer uses or perceives it (Rosemary Kilmer; W. Otie Kilmer, 2014). According to D.K.Ching, **vertical lines** are studied to express a state of equilibrium with gravity, symbolize the human condition, and can mark a position in space, while **horizontal lines** can represent stability, the ground plane, the horizon, or a body at rest. **Oblique lines** are dynamic and visually active in their unbalanced state. **Diagonal lines**, deviations from the horizontal and the vertical, can be interpreted as rising or falling. In any case, they imply movement and are visually active and dynamic. Each sign of the line can create the character of linear elements that express movement in space. The column, for example, is the vertical line element. A curved line, on the other hand, stands for a movement that is deflected by lateral forces. **Curved lines** tend to express a gentle movement (Ching, 2018) (M.Puhalla, 2011). Depending on their orientation, they can be uplifting or convey a sense of solidity and connection to the earth. Small curves can express playfulness, energy or patterns of biological growth (Ching, Interior Design Illustrated, 2018).

Marilyn A., (2003) also claimed that **vertical lines** show strength and resistance to gravity. They are created with tall windows, color, columns, and wall variations by using different materials to emphasize height (Read, 2010). **Horizontal lines**, on the other hand, are thought to evoke a sense of calm, rest and stability in a space. They help to lower the space and bring it closer to people. They are often seen in the division of a wall and lower walls with color and a chair rail if the ceiling in a room is high. It is important that a visually lowered ceiling is aligned with and reflects the height of the child. According to (R. Kilmer; W. Otie Kilmer, 2014), **horizontal lines can make a plane or space appear to elongate, while vertical lines can give an impression of height. Diagonal lines** suggest dynamic movement or tension within a space and convey a sense of movement, so they are typically used in play areas (Mittler, 2006). Curvilinear lines create visual movement, appearing soft, flowing or rhythmic. People feel more comfortable with curvilinear lines than

with rectilinear lines (S. S. Dazkir, 2009) or they suggest a flowing movement (Mittler, 2006).

Additionally, other lines such as zigzag lines, which are created by combining short lines in different directions, forming small, consistent corners along two parallel lines. Zigzag lines have a jagged, regular appearance and can evoke different emotions depending on the context—ranging from tension or discomfort to excitement or fun. Unlike smooth, flowing curved lines, zigzag lines are angular and geometric, conveying a sense of energy through their sharp movements. Additionally, the weight and size of a line significantly impact its character. Whether bold or delicate, taut or slack, the visual quality of a line is influenced by its length-to-width ratio, contour, and continuity. In interior design, line thickness applies to elements like columns, window frames, door frames, and furniture details, contributing to the overall aesthetic.

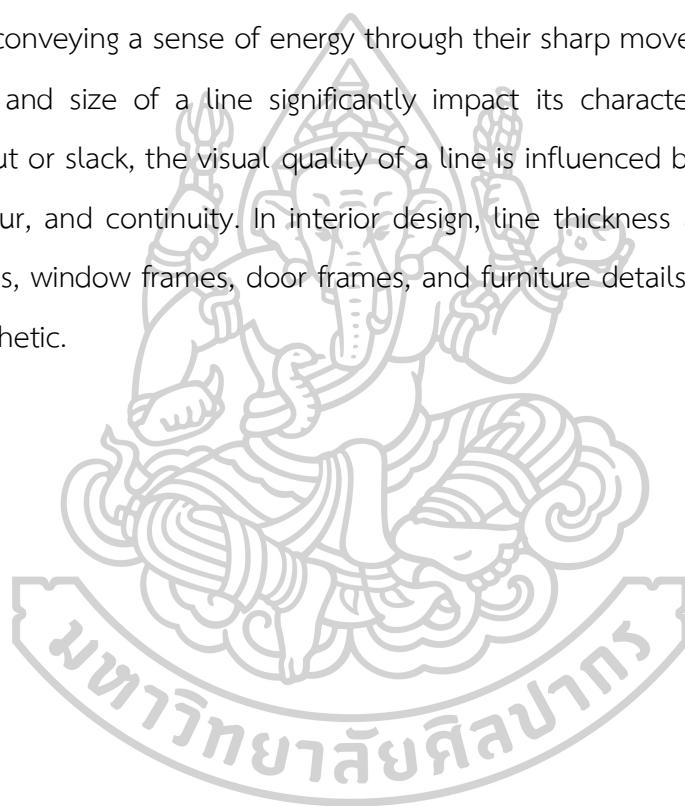


Table: Types of lines and their characters		
Types of line	Character	
Straight line	Vertical line	a state of equilibrium (Ching, 2018) strength (Read, 2010)
	Horizontal line	stability, the ground plane, rest (Ching, 2018) clam, rest and stability (Read, 2010) elongate a plane or space, restful feeling (Rosemary Kilmer; W. Otie Kilmer, 2014) calmness (Mittler, 2006)
	Diagonal line	rising or falling, movement, visually active and dynamic (Ching, 2018) dynamic motion or tension (Read, 2010)
	Zigzag line	a sense of tension or pain , while in other contexts, they can convey feelings of excitement or fun . a sense of energy
Curved line		gentle movement (Mittler, 2006), movement, a sense of solidity and attachment to the earth, playfulness, energy, patterns of biological growth (Ching, 2018) visual motion , have a sense of softness, has a flow or rhythm (Rosemary Kilmer; W. Otie Kilmer, 2014) feeling of pleasant (S. S. Dazkir, 2009) a flowing movement (Mittler, 2006)

Table 12: Types of Lines and their Character

3. Plane & Shape

An extended line becomes a plane with the properties of length and width, shape, surface, orientation and position. Conceptually, a plane has length and width, but no depth. According to D.K. Ching (2018), it is the contour of the lines that define the edges of the plane, or the boundary of a three-dimensional mass. In interior design, one has to deal with the shapes of floor, wall and ceiling planes that enclose the space, doors and windows, silhouettes and contours of the building. The shape is a fundamental unit to create a plane, and defined by the specific configuration of lines or planes that separate a form from its background or surrounding space. There are different categories of shapes, including natural shapes, non-objective shapes, and geometric shapes (Ching, *Interior Design Illustrated*, 2018). Natural shapes represent the images and forms of the natural world, such as animals, plants, land, soil, water and fire... so they are very close to the visual world of children. In children's rooms, the use of natural shapes can stimulate children's imagination about the natural environment and make them feel familiar and close to nature. These shapes can be abstracted in design through simplification, but still retain the essential characteristics of their natural sources.

Non-objective shapes have no obvious reference to object or subject. Some non-objective shapes may be the result of a process, such as calligraphy, and are meaningful as symbols. Others may be geometric and evoke responses based on their purely visual qualities. Geometric shapes are part of the built environment, both in architecture and interior design, and include different types of geometric shapes. The most important geometric shapes are the circle, the triangle and the square. Due to their different orientation, size, proportion, color and placement in space, geometric shapes can create different effects. There are two different types of geometric shapes: rectilinear and curvilinear (Ching, *Interior Design Illustrated*, 2018). Straight, tall, rectilinear shapes convey a sense of clarity, stability and formality. A longer side of a rectangular shape is horizontal and can convey a calm feeling. If we change the position of a rectangle, square or cube by placing it with the point of the edge, it becomes a very dynamic shape (Rosemary Kilmer; W. Otie Kilmer, 2014). The

triangular shape, a planar figure bounded by three sides and having three angles (Ching, 2015), is considered very stable because it cannot be altered without bending or breaking one of the sides. However, “this stability is evident with the broad base of a triangle at the bottom, but when the apex of the triangle is inverted and at the bottom, the triangle becomes very unstable” (Rosemary Kilmer; W. Otie Kilmer, 2014) (Figure).

The square shapes represent the quality of four sides and four right angles. They contribute to regularity and visual clarity, but also become dynamic when their axis is changed (An. T. T Nguyen; Eakachat J.; Veerawat S., 2023). A circular shape, which is a plane curve where each point is equidistant from a fixed point within the curve (Ching, 2015), is normally stable and self-centering in its environment. It also appears to be in motion when it connects to other elements. Meanwhile, curvilinear forms tend to imply movement by conveying a sense of continuity, motion and change. “Curvilinear shapes and forms can be very appealing because they reflect nature and natural objects. Because of their continuous nature, they tend to express uniformity” (Rosemary Kilmer; W. Otie Kilmer, 2014). Other curvilinear lines and shapes are often created from fragments or combinations of circular shapes. Regardless of whether they are regular or irregular, curvilinear shapes can convey the softness of form, the fluidity of movement, or the essence of biological growth (Ching, Interior Design Illustrated, 2018).

In the composition of a visual construction, a plane serves to define the boundaries of a volume. In interior architectural space, planes refer to walls, floors and ceilings. D.K. Ching pointed out that “the plane should be considered a key element in the vocabulary of architectural design (Ching, 2015)” because “it defines three-dimensional volumes of mass and space. The properties of each plane – size, shape, color, texture – as well as their spatial relationship to each other, ultimately determine the visual attributes of the form they define and the qualities of the space they enclose”. For further understanding, the additional properties of a plane – its surface color, pattern and texture - influence its visual weight and stability.

Table: Types of shape and their characters			
Types of shape		Character	
Geometric shape	Rectilinear	rectangular shape	a restful feeling (Rosemary Kilmer; W. Otie Kilmer, 2014) Variations of the square, Clarify and Stability (Ching, 2018)
			dynamic (Rosemary Kilmer; W. Otie Kilmer, 2014) (Ching, 2018)
		triangle shape	stable (Ching, 2018), Dynamic
		Square shape	regularity and visual clarity (Rosemary Kilmer; W. Otie Kilmer, 2014)
			Dynamic (Rosemary Kilmer; W. Otie Kilmer, 2014)
		Circle	stable and self-centering (Ching, 2018), motion
			Flowing Movement (Mittler, 2006)
	Curvilinear		continuity, motion, and change, pleasing, reflecting nature and natural objects. express unity (Rosemary Kilmer; W. Otie Kilmer, 2014). dynamic and visually active, leading eyes along their curvature, softness of form, fluidity of movement, or the essence of biological growth (Ching, 2018)
Natural shapes		animal, plants, land, soil, water, fire, trees...	feeling of familiar and close to the nature, stimulate the imagination
Nonobjective shapes		Calligraphy	meaning as symbols (Ching, 2018)

Table 13: Types of Shape and their Characters

4. Volume & Form

An extended plane becomes a volume with the property length, width and depth, form and shape, surface, orientation and position. The volume is the three-dimensional element of space. It can be either solid or void (Ching, 2018). Form is the most important identifying feature of a volume. It is suggested that form often involves a sense of three-dimensional mass or volume. Shape more specifically refers to the essential aspect of form that determines its appearance. It is determined by the shapes and relationships between planes that describe the boundaries of the volume. In Francis' theory, form refers to the shape and structure of something, as opposed to its substance or material. The design should be esthetically pleasing to the eye and other senses. There are two main forms: regular forms and irregular forms. Regular forms are those whose parts are in a consistent and orderly relationship to each other. They are generally stable and symmetrical about one or more axes: spheres, cylinders, cones, cubes and pyramids are the best examples of regular shapes. Irregular shapes are those whose parts relate to each other inconsistently and unevenly. They are generally asymmetrical and more dynamic than regular forms (An. T. T Nguyen; Eakachat J.; Veerawat S., 2023).

Among regular forms, circles produce spheres and cylinders, triangles produce cones and pyramids, and squares produce cubes. According to D. K. Ching (2018), a sphere is a centralized and highly concentrated form that is self-centered and normally stable in its environment. However, it creates a sense of movement when it is on an inclined plane. A cylinder is created by rotating a rectangle around one of its sides. The character of the cylinder is stable when it rests on one of its circular faces, and it becomes unstable when its central axis is inclined with respect to the vertical. The cone, which is created by rotating a right-angled triangle around one of its sides, is also stable when it rests on its circular base and unstable when its vertical axis is tilted or inverted. The pyramid is also stable, but it feels hard and angular. However, if its position is changed by placing it on one of its edges or corners, it immediately becomes unstable, suggesting movement, danger and the potential to fall apart. A cube is the most stable form that does not suggest

movement or direction due to its dimensions. Irregular forms are inherently different and do not have a consistent relationship to each other. They tend to be asymmetrical and more dynamic than regular forms. Therefore, irregular shapes can either be regular forms with some irregular elements removed or irregular compositions of regular forms. Natural shapes can be designed in different ways, e.g., by abstracting them into regular or irregular forms to make them more interesting. When mentioning volume and form, you need to think about size, i.e., the physical dimensions of length, width and depth of the form. “While these dimensions determine the proportions of a form, its scale is determined by its size in relation to other forms in its context” (Ching, 2015).

Table: Types of Form and their Characters		
Types of Form		Character
Regular forms	Sphere	self-centering and normally stable (Ching, Interior Design Illustrated, 2018)
		motion when placed on a sloping plane (Ching, Interior Design Illustrated, 2018)
	Cylinder	Stable
		Unstable
	Cone	Stable
		Unstable
	Cube	Stable
		unstable, suggesting movement
	Pyramid	Stable, feeling of hardness and angularity
		unstable, danger, and the potential for falling apart.
Irregular forms		asymmetrical and more dynamic, Dissimilar in nature, Abstracted, Asymmetrical, and More Dynamic (Ching, Interior Design Illustrated, 2018)

Table 14: Types of Form and their Characters

In order to achieve an optimal interior design for preschool classrooms for young children, it is important to understand the characteristics of the seven interior collaborative layers in the facility. These layers include various aspects such as layout, materials, colors, lighting, furnishing, decoration and technology integration. These layers are not rigid rules, but should be considered as guidelines for successful design. Knowing the characteristics of each spatial form gives designers a wide choice for their practical design (see Appendix B for detailed information). The character of the room form is shaped by human perception through experience in the room. Therefore, understanding this interaction between spatial form and children's feeling is the right method.

2.5.1.3 Spatial Order

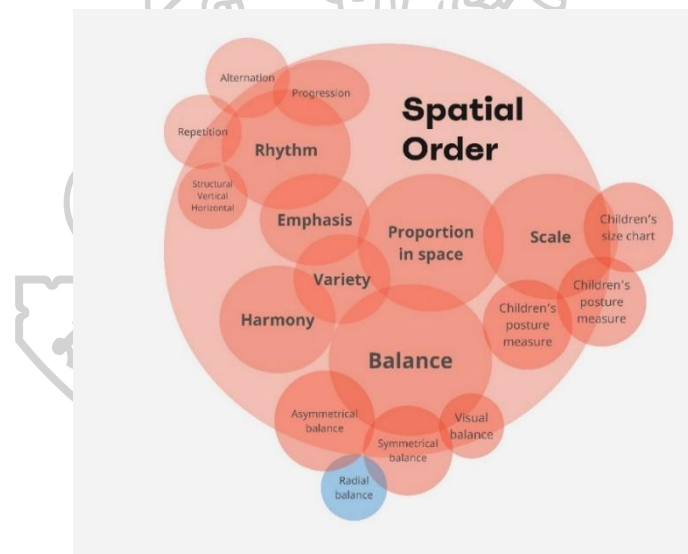


Figure 32: The main elements in spatial order

This layer covers the arrangement, organization and hierarchy of elements within the interior. It deals with the way the components are structured and positioned to create an esthetic for the space. According to D.K. Ching (2018), “Interior design involves the selection of furnishing elements and their arrangement within a spatial enclosure to fulfill functional and esthetic requirements. This arrangement of elements in a space involves the creation of patterns.” There are no

individual elements in a room that can stand alone. All parts, elements or pieces depend on other elements for their visual impact, function and meaning. Based on the literature on interior design by D. K. Chung (2018), proportion, scale, balance, harmony, unity and diversity, rhythm and emphasis are the elements of interior design that create the visual relationship in the space. Therefore, this layer includes proportion, scale, balance, rhythm, emphasis, unity and harmony, and variety. While these guidelines are not meant to be hard and fast rules, but rather serve as a guide for arranging design elements in recognizable patterns and structures, it is necessary to understand the characteristics of each element within this plane in order to combine them effectively in children's spaces. These principles can have a profound impact on children's visual perception and encourage them to explore, discover and observe. If designers cannot control the quality of patterns or combine elements inappropriately, it can lead to an overwhelming space and cause children to lose their attention. "We need to learn to judge the appropriateness of a pattern, its visual role in a space and its importance to the users of the space." They can help develop and maintain a sense of visual order among the other spatial layers, while considering their intended function and use" (D.K. Ching, 2018).

1. Proportion & Scale

First, one should consider merging proportion and scale into one category, which deals with the relative sizes of elements within a space. The only difference is that proportion refers to the relationships between the parts of a composition, while scale refers specifically to the size of something, including a standard or recognized constant (D.K.Ching, 2018). In terms of proportion, D.K. Ching (2018) asserts that it refers to the relationship of one part to another or to the whole or between one object and another, more specifically, proportional relationships between the parts of a design element, between multiple design elements, and between the elements and spatial form and enclosure. In line with this assertion, (Rosemary Kilmer; W. Otie Kilmer, 2014) pointed out that scale in architecture and interior design refers to the relationship of the object to the human body, while proportion refers to the

relationship of the parts within the object itself. Scale is about comparing the size of the object to an external scalar unit of measurement. (Rosemary Kilmer; W. Otie Kilmer, 2014). For the purposes of this study, we focus on classroom interiors, taking a child-centered design approach. Most classroom interior designs will be tailored to the scale of children, while others will be aimed at teachers. Therefore, it is crucial to have a clear understanding of children's postural dimensions (Figure 41) and children's height chart to establish an appropriate proportion between children and the space, as well as to ensure comfortable interaction between children and other objects in the classroom, while taking into account the scale of teachers and adults.

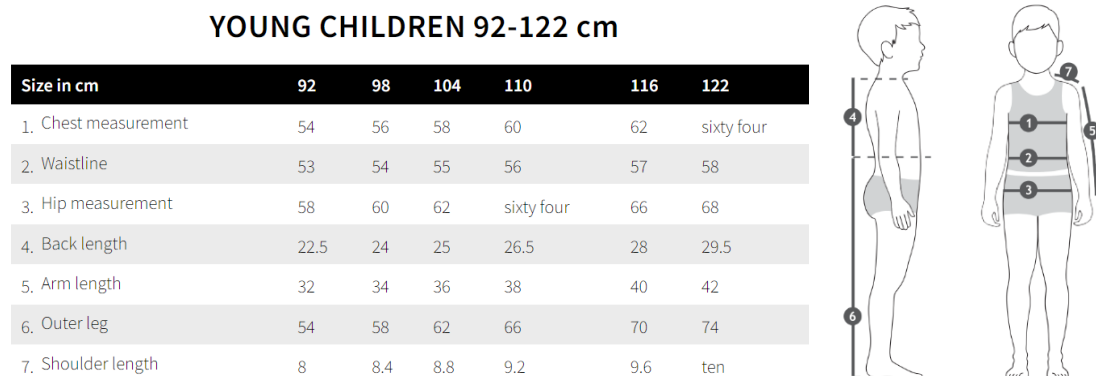


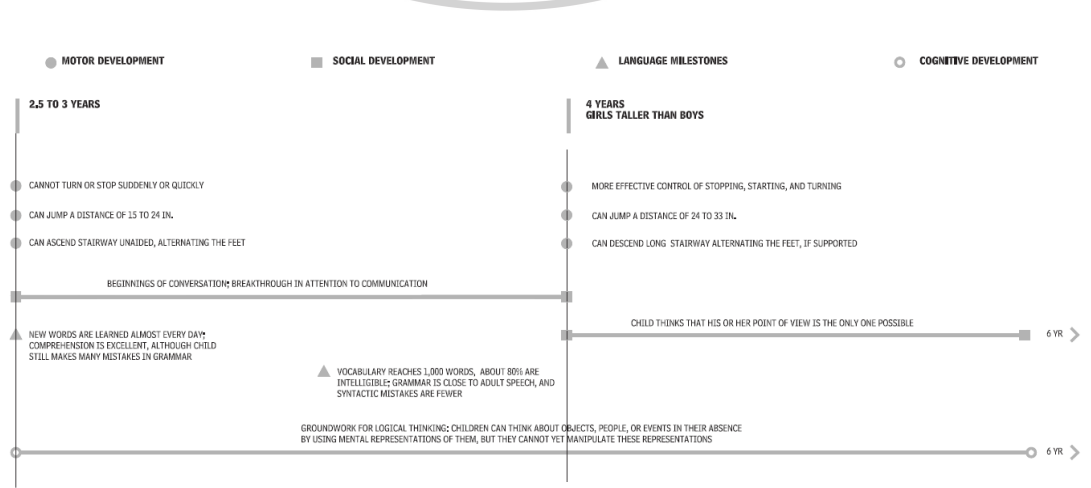
Figure 33: The size chart of young children

In this context, the child height chart and child posture measurements are valuable sources of information on the physical development, cognitive abilities and socio-emotional development of children at different ages (Figure 41). However, it is important to recognize that there may be specific cases that were not examined in this study.

Meanwhile, the term scale refers to the size of something in relation to a known standard or recognized constant. There are 3 types of scale that we need to understand comprehensively: the mechanical scale, the visual scale and the human scale. Mechanical scale is about calculating physical objects according to a standard system of measurement; visual scale refers to size in relation to other objects in the environment or the surrounding space; human scale refers to the sense of size that

something gives us. Interior space includes doorways, stairs, tables, counters, and various seating (D.K. Ching, 2018). In preschool space, it is necessary to consider the scale of the children. The size of the space must match the scale of the children, including the size of each space in the classroom and the size of the furniture. At the same time, when designing the interior, the designer should ensure sufficient display space in the preschool area, provide a large area on the walls of the classroom at child height for displaying artwork, and design projects that include fixtures for displaying artwork that do not require thumbtacks and tape (dangerous for children). Next, keep the inside corners because corners in the classroom provide an opportunity to create differentiated areas. Keep the inside corners and use elements such as low partitions at the back of compartments to create nurturing corners. Provide natural light and views for the children while providing visibility for staff.

In summary, proportion is the relationship of one part to another or to the whole, or between one object and another, and scale is a particular proportional magnitude, extent or degree, usually in relation to a known standard or recognized constant. Therefore, to create appropriate proportions in interior spaces, designers need to understand the significant scales of key physical components in interior design, particularly those tailored to the measurements of children and adults. Based on this understanding, designers can then contextualize these scales with other elements in the seven collaborative layers of interior design.



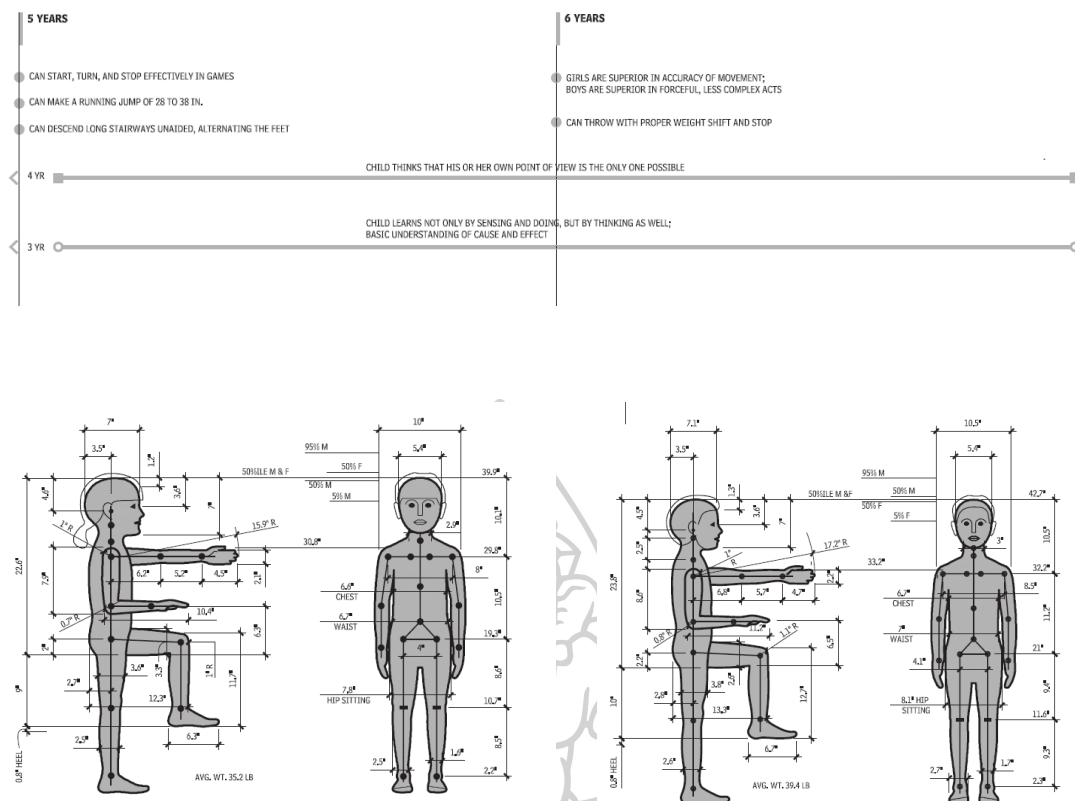


Figure: Children's posture measurement from 4 - 5 years old

Figure 34: Measurement of development of children from 2, 5 – 6 years old

The size chart for children is also an important factor when designing and selecting furniture for small children. On this basis, designers can reduce the scale of the architectural space at eye level to the size of children. This aspect is discussed in more detail in the layer of spatial furniture.

2. Balance

The concept of balance in interior space involves visual balance, which can be categorized into three types: symmetrical, radial, and asymmetrical (Ching, 2018; Kilmer & Kilmer, 2014). Balance is achieved by carefully arranging similar and contrasting elements to create equilibrium. According to Ching (2018), visual balance reflects the equilibrium between visual forces projected by various design elements. These elements, such as furnishings, lighting, and accessories, often vary in shape,

size, color, and texture. Kilmer & Kilmer (2014) describe visual balance as the perceived physical and visual weight of objects, shaped by their psychological impact on the observer. This concept is closely tied to spatial form layers, as it encompasses all seven layers, requiring evaluation in three dimensions.

First, symmetrical balance results from the arrangement of identical elements that match in shape, size and relative position around a common line or axis (D.K. Ching, 2018). Second, radical balance results from arranging elements around a focal point to create a centralized composition that emphasizes the middle ground as a focal point. The elements can be oriented inward toward the center, point outward from the center, or simply be arranged around a central element. (D.K. Ching, 2018) (Rosemary Kilmer; W. Otie Kilmer, 2014).

3. Harmony & Variety

According to (D.K. Ching, 2018), harmony can be defined as consonance or the pleasing agreement of parts or combinations of parts in a composition. The principle of harmony is a careful selection of elements that share a common characteristic or feature of components in space, such as shape, color, texture or material. "It is the repetition of a common feature that creates unity and visual harmony between the elements in the space." Harmony results from a composition that fits together, from a correct combination and balance of unity and variety, and it conveys a sense of belonging, consonance or unity (Rosemary Kilmer; W. Otie Kilmer, 2014). However, the two sides of a coin can, in principle, have too many similarities or similar features, resulting in an uninteresting composition. Conversely, excessive changes to create variety can lead to extremes just for the sake of interest, resulting in visual chaos. A classroom embodies chaos. It houses a variety of learning materials, the necessary furniture for about 15-30 children or more, and even accommodations for two teachers. It also accommodates accessories, decorative items, clothing, student bags, water areas and play zones... (more on this in the section on spatial functional layers). In such a complex classroom setting, it is therefore essential to carefully consider and maintain the artistic tension between order and disorder, unity and diversity.

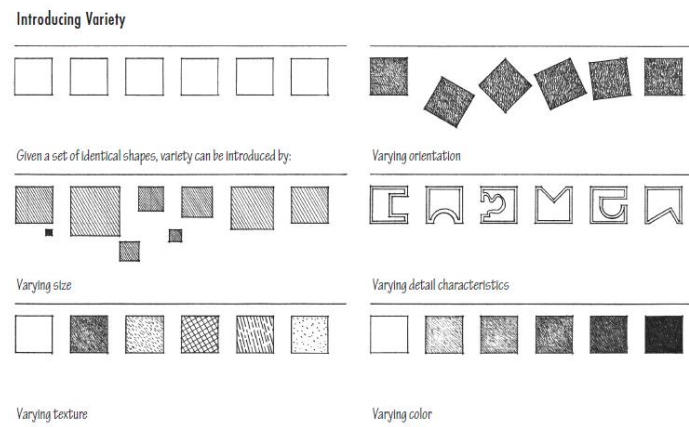


Figure 35: *Introducing variety*

There is no denying that a variety of orientation, size, detail features, texture and color (Figure 43) can make the space more interesting and encourage children to explore to "create "excitement and interest in an otherwise static, boring composition" (Rosemary Kilmer; W. Otie Kilmer, 2014). A design with different surface finishes allows the child to experience different tactile sensations. "A variety of finishes on the horizontal, vertical and inclined surfaces of the playground enriches the user's experience" (SHAW, 1987). Textural differences should reinforce key design decisions, which also applies to layers of spatial material and texture.

The principles of balance and harmony, which promote unity, also include variety and interest. Design should aim to achieve balance and harmony when different elements and features are present in the classroom space. To create unity and diversity in the space, you need to arrange a number of dissimilar elements in close proximity to each other. "People tend to view such a grouping as a unit, to the exclusion of other elements that are further away" (D.K. Ching, 2018). The use of colors, boundaries, and carpets to create a continuity of lines or contours can create visual unity within a composition and harmonize the characteristics of the different elements.

4. Rhythm

The principle of rhythm is based on the repetition of elements in space and time. Repetition not only promotes visual unity, but also creates a recurring

continuity of movement that guides the viewer's eyes and mind along a path within a composition or around a space (D.K. Ching, 2018). Visual rhythm is created through repetition and forms a linear pattern so that the rhythm expresses movement, unity and harmony (D.K. Ching, 2018). However, in space, there is a non-linear sequence of shapes, colors and textures that can create more subtle rhythms that create depth and perspective in interior spaces. Consequently, children can observe, interact and explore the spaces they spend time in on a daily basis, discovering many points of interest. According to (Rosemary Kilmer; W. Otie Kilmer, 2014), rhythm can be created through repetition, variety and progression. More specifically,

Repetition (Figure): the most basic pattern of rhythm – elements or concepts are repeated in a structured, organized way. In interiors, this repetition can also be used to direct the eye through the space by repeating simple forms, textures or colors.

Alternation (Figure): Alternation of rhythm can create a slightly more complex design system by alternating the elements of the design.

Progression (Figure): Suggests movement and directs the eye into directional sequences, such as the rhythmic progression of a series from light to dark colors or from small to large objects and the progression of patterns in different wallpaper designs. (Rosemary Kilmer; W. Otie Kilmer, 2014)

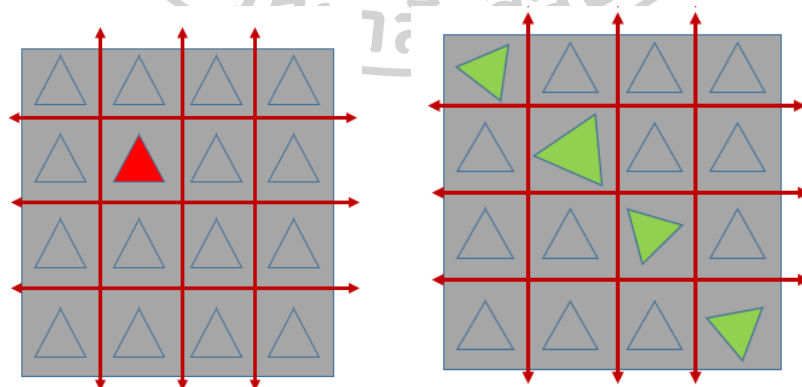


Figure 36: Arrangement in space combines rhythm and emphasis

Designers can create many rhythm layers in the space without making it boring by changing the form of the elements, such as structural rhythm, vertical and horizontal rhythm, which is based on three basic types of rhythm, namely repetition, alternation and progression in the three-perspective and two-perspective composition in the interior of the classroom. To minimize chaos in the classroom, we should opt for repetition – this character in design also conveys the sense of sameness and similarity between children (the reason why we have uniform in school). Variety, on the other hand, can make the space more interesting and fun, while progression is the best way to draw children's eyes to the sequence of the space, according to the interior designers' concept.

5. Emphasis

A design without dominant elements would be bland and monotonous. With too many assertive elements, the design becomes confusing and chaotic and distracts from what may be important (D.K. Ching, 2018). The coexistence of dominant and subordinate elements in the composition of an interior design is the principle of emphasis. More specifically, emphasis is “used as a design principle when certain elements are emphasized more than others, creating a relationship of dominance and subordination” (Rosemary Kilmer; W. Otie Kilmer, 2014). An important component or feature in space can be visually emphasized by endowing it with significant size, unique shape, contrasting colors, values, textures, lines, forms, or its strategic position and/or orientation in space.

Interior design elements vary, allowing for multiple focal points within a space. In designing a preschool classroom, it's important to identify the most significant element to serve as the focal point. Spatial form should also be considered in this process. According to D.K. Ching (2018), "focal points should be designed with subtlety and restraint, without overwhelming the overall design. Secondary focal points or visual accents can help unify dominant and subordinate elements." The choice of focal point depends on the design concept and solution, requiring creativity from the designer in this layer of spatial planning.

2.5.1.4 Spatial Color

Young children tend to prefer colors and older children tend to prefer form (Suchman, R. G., & Trabasso, T, 2019). Color surrounds humans in their living environment thanks to light. Color is one of the most important factors in the human environment (Huseynova, 2021), as it affects various aspects of human life. “The complexity of the phenomenon of color is reflected in the different meanings it has in disciplines such as psychology, physiology, linguistics, philosophy, social and art history, physics, psychophysics, anthropology, architecture or painting” (Durao, 2000).

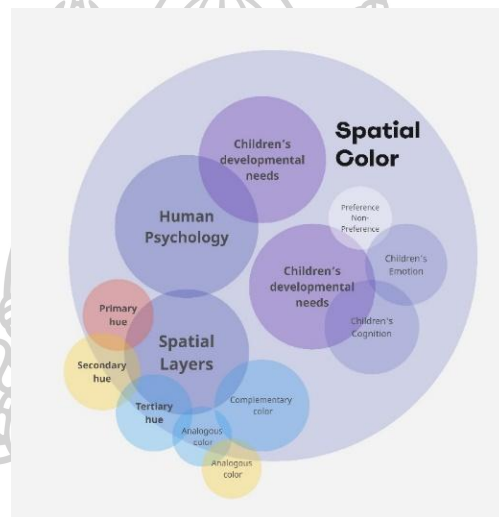


Figure 37: The main elements in the spatial color layer

Previous studies have shown that the effect of color psychology on human behavior through its symbolism and psychology are culturally constructed connections (Keskar, 2010); human affect, cognition and behavior (A. Elliot, Markus A. Maier, 2013); human emotions (Kaya, College Student Journal) (P. Valdez; A. Mehrabian, 1994) (Hill, 2011); such as human emotional responses to color (X.P Gao, John H. Xin, 2006). Color has a profound effect on the visual, emotional and mental conditions that contribute to quality of life and learning (C. Yu, H. Yoon, 2010). In this context, attention is given to the concept of the impact of color in space on the people who live in it. More specifically, M. Durao (2003) conducted an analysis of the relationships between the meaning of colors and the perception of

spaces (Durao, 2000) and colors in interior architecture, colors in interior design; (Pile, 1998) and (Kemal Yildirim; M. L. Hidayetoglu; Aysen Capanoglu, 2011) have both found that warm colors tend to evoke positive and stimulating responses, while cool colors are associated with calmness and spaciousness in living spaces.

1. Color and interior space

Color is a communicating element in interior design that carries the designer's words to the users (Izadpanah, 2011). In this study, the author will follow the concept of color code of Munsell color wheel which is mentioned in the famous book on interior design (D.K.Ching, 2018) and is the most important color theory for research with children's rooms. There are important color concepts, including hue, value and saturation (D.K.Ching, 2018), primary color, secondary color and tertiary color, complementary color and analogous color.

Hue: the attribute by which we recognize and describe a color; **Value:** the degree of lightness or darkness of a color in relation to white and black; **Saturation:** the brilliance or dullness of a color; this depends on the amount of hue in a color

The color wheel classifies color pigments into primary, secondary and tertiary hues. The primary hues are red, yellow and blue. The secondary hues are orange, green and violet. The tertiary hues are red-orange, yellow-orange, yellow-green, blue-green, blue-violet and red-violet (D.K. Ching, 2018).

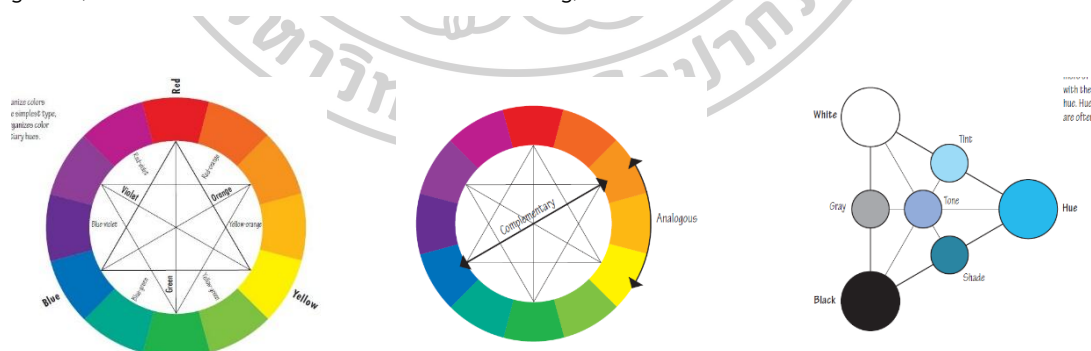


Figure 38: Matrix of color in design

Complementary hues are the colors that are directly opposite each other on the color wheel and produce neutral hues, with opposite pairs of colors on the wheel.

Analogous hues on the color wheel are colors that are next to each other on the color wheel and create a sense of harmony.

Complementary colors can attract attention through simultaneous contrast, while analogous colors convey a sense of harmony. Understanding these principles can help designers to emphasize focal points and areas of attention and stimulate children's attention.





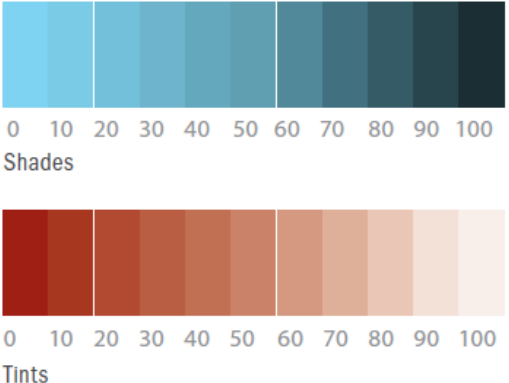
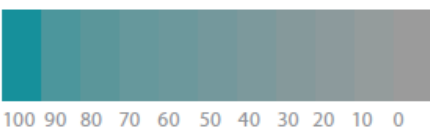



Hues			
	primary hues	secondary hues	tertiary hues
Value (Light/ Dark)			
Saturation			
Color Categories			
	Analogous color (Warm color)	Analogous color (Cool color)	Complementary color

Table 15: Identify of color.

Due to this different existence of color, the author focuses in this study on the analysis of the most important color concepts in the children's space, including

the primary hues of red, yellow and blue. The secondary hues are orange, green and violet. The tertiary hues are red-orange, yellow-orange, yellow-green, blue-green, blue-purple and red-violet (D.K. Ching, 2018), and also the pale and white are analyzed two. In reality, the colors can be changed and transformed with a wide range of shades, tints or hues depending on the choices of interior designers and suppliers. However, they still adhere to the basic concepts of intensity, saturation and hue.



The relative colors of yellow brown (Dulux.vn) The relative colors of blue (Dulux.vn)

Figure 39: The relative colors of yellow brown

Based on this very basic color wheel, many well-known color brands have developed thousands of different color codes for interior design. Each individual color has a group of relative colors. It is important to understand the basic theory of color and the properties of each basic color on the color wheel.

Characteristic of color and it influences on human				
Color Categories		Charcateristic		Influences
Warm color	Reds	Battle, blood, fire, passion, love, excitement (Rosemary Kilmer; W. Otie Kilmer, 2014)		Raise blood pressure
	Oranges	friendliness, pride, ambition, warmth,		speed up respiration and

		and relaxation, and is stimulating (Rosemary Kilmer; W. Otie Kilmer, 2014)	stimulating Light – tend to expand space and size of object. Similar to sunlight	heartbeat Increase Increase alertness
	Yellows	Sunlight springtime, cheerfulness, and optimism. the feeling of safety (Rosemary Kilmer; W. Otie Kilmer, 2014)		
Cool color	Blues	truth, honesty, loyalty, and integrity. It also is associated with coolness, repose, and formality (Reyhaneh Ghayouri, Sayedmohammad Ayat, 2020).	Subdued and relaxing Deep – appear to contract Sense of nature such as the ocean, sky, grass	creativity
	Greens	nature and the feeling of calmness, friendliness, and freshness.		Innovation
	Violets	royalty and has religious significance.		
Neutral	Grays and off-whites Warm (brownish) or cool (bluish)		Less forceful	

Table 16: *Characteristic of color and its influences on human*

When it comes to the influence of color on space, light values, cool hues, and gray tones tend to recede, creating an impression of increased space. In contrast, warm hues advance, and darker, more saturated colors evoke a sense of closeness. However, emotional responses to color vary based on individual experience, cultural associations, personality, and environmental factors, all of which impact color choices.

2. Color and Children's developmental needs

Color can arouse children's interest and promote their developmental needs. Children are sensitive and easily attracted to colors. They are a tool for children to express their feelings when their language development is still limited. As mentioned in chapter 2.1, children's developmental needs should be considered in preschool learning spaces.

Spatial color is one of the “7 interior spatial layers” in the general interior design of a classroom, which could have influences on children's physical activities in the areas of “gross motor skills” and “fine motor skills”; or the three main themes of cognitive development such as “exploration and organization skills”, “executive functions and problem-solving skills”, “language development and symbolic thinking”; or children’s socio-emotional development needs. It is suggested that color can be a powerful design principle, in both positive and negative ways, when it comes to its effect on children in classroom interiors. Positive colors can create a good mood, define the space and reflect the children’s home and community. Negative effects can be overwhelming, confusing and overstimulating.

According to Cameron (1993), there is a relationship between children’s creative thinking and color discrimination (Cameron, B. A., Brown, D. M., Carson, D. K., Meyer, S. S., & Bittner, M. T. , 1993). Color can serve as a powerful tool for symbolic representation and promote children's understanding of concepts and ideas. In space, color coding or color cues can help children identify and locate specific areas or resources. This promotes their cognitive skills of sorting, categorizing and visual discrimination, such as recognizing different areas, boundaries, distinguishing between public and personal areas, studying material objects in the classroom and personal objects, such as the school locker, toothbrush, sandals, books and notebooks. (Nicola J. Pitchford, Kathy T. Mullen, 2004) investigated the extent to which perception, language and color preference can influence color conceptualization.

Terwogt and Hoeksma (1995) found a correlation between colors and emotions, observing that young children often associate colors with their emotions when expressing preferences (Mazlum & Mazlum, 2019). Read (2003) highlighted the role of color in wayfinding and space definition in childcare settings, noting that it can help create a sense of place. Additionally, color in learning spaces can foster a welcoming, friendly atmosphere that stimulates children's imagination and creativity.

These literature reviews highlight that color plays a significant role in supporting children's developmental needs. Therefore, color selection in preschool environments should be guided by children's needs, perceptions, and preferences for color.

In research on children's color preferences in space, Barrett (2007), as cited in Hill (2011), noted that color preference is shaped by factors like genes, early childhood memories, upbringing, cultural influences, and other life experiences. Understanding children's color preferences is essential for selecting suitable colors for preschool classrooms. Suchman et al. (2019) found that children tend to prefer colors over shapes, and studies consistently show certain color preferences. Read and Upington (2009) discovered that children favor red and purple but show less interest in yellow and orange, preferring cool colors over warm ones. Purple, being a blend of blue and red, appeals more to children. Similarly, Ghayouri and Ayat (2020) found red to be the most popular, followed by blue and yellow. Pink is the most favored color for painting classrooms, with red and blue being common choices for furniture. Conversely, children dislike brown, white, black, and gray, consistent with Pitchford, Davism, and Scerif's (2009) findings. Mazlum and Mazlum (2019) also emphasized that black, white, gray, and brown are the least preferred colors, while blue, pink, and similar tones evoke positive feelings in children.

“Red is bitter, hot and funny. It is not dirty, strong or scary. Black is dirty, scary and boring. It is not funny, amusing, beautiful or clean. Pink is beautiful and amusing. It is not fast or boring. Purple is strong. It is not warm, cold or dangerous. Brown is dirty and boring. It is not clean, amusing or beautiful. Yellow is sweet. It is not cold or boring. Blue is cold. It is not scary. Gray is fast and dangerous”. (Mazlum, Ö., & Mazlum, F. S. , 2019)

Table: Summarise children's color preferences and non-preferences		
Author	Children's Color preference	Children's Color Less/non-preference
(Nicola J. Pitchford, Kathy T. Mullen, 2004)	Basic colors (red, yellow, blue)	Brown, grey

(Read, M. A., & Upington, D., 2009)	Red, purple Cool color	Yellow, orange Warm color
(Reyhaneh Ghayouri, Sayedmohammad Ayat, 2020)	Red; Blue; Yellow ; Pink (Color's painting classrooms); Pink; Red; Blue (Color's furniture); Red Colorfulness; Pink	(Color's furniture) Black Brown White
	Bright colors	
(Mazlum, Ö., & Mazlum, F. S. , 2019)	Blue, pink	Black, gray and brown
(Park, 2013)	Red, Green, Blue, Purple hue families; Lighness color	
(Read, M. A., & Upington, D., 2009)	Red; Purple (by girls); Cool colors	Yellow and orange

Table 17: Summary of children's color preferences and non-preferences

Previous studies have claimed that children's color preference is closely related to their emotions and personality, which reflects children's psychological feelings, such as happiness or sadness (Shan Xiaoxian, Wan Meicheng, 2020).

In terms of children's emotions, children's behavior, and colors in space, Olds (1987) points out that in addition to moderate variations in floor height, ceiling height, lighting, and other physical elements, color is an important factor in promoting feelings of comfort, interest, and safety in space. Previous studies have shown that children like bright colors (Qing, 2023) (Chris J. Boyatzis; Reenu Varghese, 2010). Bright colors are often associated with positive emotions and can evoke feelings of energy, happiness and vibrancy. In contrast, dark colors are often associated with negative feelings and can evoke a sense of seriousness, mystery or even sadness (Hill, 2011). Indeed, color elements in a space can influence children's attention. Colors can evoke certain emotions and stimulate sensory responses that can influence a child's engagement and concentration. Caples (1996) points out that bright reds create excitement, while deep purples and greens are very stabilizing and calming. Yellow not only has a calming effect, but is also "the first color that can be perceived by young children". (Caples, 1996)

According to Hill (2011), colors that children like can have a positive impact on their behavior, while colors they dislike can have a negative impact. Bright colors are often associated with positive emotions and can evoke feelings of energy, happiness and vibrancy. Dark colors, on the other hand, are often associated with negative feelings and can evoke a sense of seriousness, mystery or even sadness. (Mazlum, Ö., & Mazlum, F. S. , 2019). Preschool children generally label the bad and ugly as black and the good as white (Katz, 1984). Black is not a good choice for children's interiors. Another study on children and color looks at children's taste perception of color. This should also be considered when thinking about the design of rooms where children spend a large part of their daily activities. Too many "acid" colors can affect children's taste (Mehran Fateminia, Talayeh Dehghani Ghotbabadi, Kamran Mohammadi Azad3, 2020).



Table: The Categories of Colors and their Influence on Children's Emotions				
Authors	Color's Categories	Influence on Children's Emotion	Design Propose	
(Qing, 2023)	Bright colors	Warm, excited emotions	High purity color – small area.	
	Cool colors	Stable, Refreshing feeling	Light green, light blue, cool colors with low brightness for wall color.	
	Bright light beige, light pink, light warm colors	To stimulate children's brain activity	Light color for rest spaces Teaching space wall	
(Chris J. Boyatzis; Reenu Varghese, 2010)	Red color	Excitement and Happiness	Choosing color for children space should taken into attention o children's culture and race	
	Black	Totally negative feeling		
	Bright colors	Positive feeling		
	Dark colors	Negative feeling		
	Green	Creativity	Using in art room and creative writing classrooms	
	Blue	Claming, science	Math studying area, study science	
(Chin Xing Thung, Hakimi Ahmad, 2021)	Light colors; Yellow, Pink, Blue	Positive emotion, evoke the feeling of happiness & joy	None	
	Dark color; Dark blue; Dark green; Black	Negative emotion Gloomy		
	Warm color	Becom active		
	Cool color	Calm, relax		
	Blue, Green	Calm, Peaceful		
(Hall, 2019)	Bright color	Positive emotion Evoke a sens of energy, happiness, vibrancy	None	
	Dark color	Feeling of negativity, sense pf seriousness, mystery, sadness		

(Mehran Fateminia, Talayeh Dehghani Ghotbabadi, Kamran Mohammadi Azad3, 2020)	Red	Sourness and sweetness in the same time	None
	Blue	Tasteless, Sourness	
	Yellow	Sourness and sweetness in the same time	
	Orange	Sourness	
	Green	Sourness	
	Purple	Bitterness	
(Park, 2013)	Light color	Positive emotions	Application on wall surface
	Dark colors	Negative emotional associations	
(Caples, 1996)	Bright reds	Excitement	No need to limit children's environment to the three primary colors or to pastels. Should use "cultural color theme"
	Deep purples and greens	Stabilizing and soothing	
	Yellow	Restful	
	Hue of green and purple	a stabilizing effect	
(Read, Marilyn A., 2003)	Red	excitement	Don't use white, gray, or off-white environments: sterile, boring
	Yellow	encourage feelings of restfulness	
	warm hues and bright accents	enhance children's sensory stimulation	

Table 23: The Categories of Color and their Influence on Children's Emotions

3. Color and Preschool Classroom Design

Based on the theory of color psychology and children's responses in the literature review, the key question is how interior designers can effectively integrate these factors when designing preschool classrooms. Color is a flexible, accessible, and powerful design element, with the potential to influence six other spatial layers. The author summarizes and analyzes preferred colors for classroom interiors, considering not only the characteristics of spatial color but also how it interacts with the six other spatial layers, as outlined below.

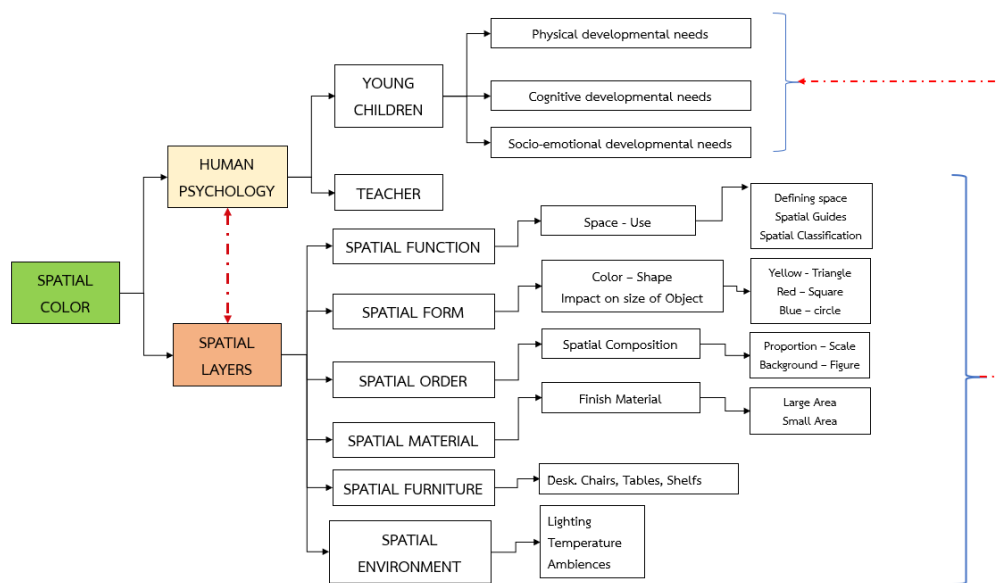


Figure 40: The interactive collaborative relationship of spatial color and the remaining six spatial layers and users in the classroom environment

To create a colorful interior with an appropriate level of complexity for children, it's essential to first consider color harmonies in the classroom. Too much visual clutter can make the space chaotic, while sufficient white space allows children to relax. The primary concern is the number of colors used in the preschool environment. An excess of colors can be as distracting as too many words spoken at once. Izadpanah (2011) pointed out that while colorful interior designs and objects are important, if walls and ceilings are overloaded with colors, it can confuse both children and adults. Conversely, Caples (1996) argued that

children's environments shouldn't be limited to just primary colors or pastels. The use of more diverse "ethnic" color palettes, where appropriate, can foster pride and a connection to the child's home community. Second, using color to support the layer of spatial function is about defining spaces and creating visual boundaries for children. Each area in the preschool classroom should be a different color so that children can identify the different functional areas in the classroom.

"Green and purple could be used for areas that encourage teamwork. Red, orange and yellow for active areas. Turquoise, light green and light blue allow pupils to relax. Light pink and pink help with active learning. Green is the trigger" for creativity" (Hill, 2011)

Olds (1989) recommended using warm tones in highly active areas to promote energy and cool tones in quiet areas for a calming effect. Similarly, Read (2003) highlighted various color strategies in childcare settings to aid wayfinding and spatial orientation, noting the common use of warm colors and bright accents. These recommendations also align with climate considerations—warm, saturated tones suit temperate and tropical areas, while cool, bright tones and neutral colors are more common in northern regions. Indoors, color serves as a powerful tool for defining boundaries, especially when placed at child height on surfaces, furniture, or partitions. Strategically, color schemes can influence the energy level in a space, with warm tones encouraging activity and cool tones fostering calm (Birren, 1961).

Read (2009) points out that it is important to clearly define the position of the color in the center, as the visual impact of the color is different when it is on a background wall than when it is placed on a toy. Tones with high saturation such as red, yellow and blue can be used to emphasize the main entrance and space layout and create a lively atmosphere. Light or wooden colors can be used to enhance the sense of space, complemented by furniture and decorations.

Colors and spatial order, the background of the classroom should be a neutral color to create visual harmony in the environment. Jessica. D, Sandra. D, Sara. H, Mary A.R, Lois. R (2010) mentioned that *"if you cannot see at least 75% of the walls and the majority that you do see (aside from the children's work) is*

brightly colored, it can create visual clutter". Kaplan (2014) suggested replacing bright colors with natural colors (white, khaki, tan, brown and other colors found in nature) to make the space visually less chaotic. Natural colors should be used on walls and larger items, as they go well together and can be paired with splashes of bright, trendy colors. To ensure that too much color is not used in the interior, no more than three coordinating colors should be used (Jessica. D, Sandra. D, Sara. H, Mary A.R, Lois. R, 2010).

Xiaoxian & Meicheng (2021) have argued that the basic elements of interior design should be in bright colors and that the overall hue should be bright and vibrant to convey a positive and cheerful mood. However, colors that are too bright will impair children's vision in the long run and distract their attention. Therefore, you should not use more than three colors and adapt the color scheme to local themes. The ideal colors to create a calm and peaceful environment are blue and green. They help to calm children who are active and focus their attention on learning in the classroom. Overuse of a bold color scheme should be avoided because it can lead to overstimulated, agitated behavior.

"The predominant color above the wall covering should be neutral and achieve a reflectance of more than 80%. Stronger, more vibrant colors with a reflectance of 65% can be used on a wall in hallways and along the back walls of classrooms (opposite the windows). ("Child Care Center Design Guide" (Administration, 2003),)

Children's clothing, toys, and artwork tend to be much more colorful than those of adults, adding plenty of color to their environment. Therefore, designers should apply color thoughtfully, making only subtle "color statements." Avoid using primary colors on the walls, as too much color can overwhelm a space where children spend a lot of time. Instead, opt for fewer colors, and avoid complex patterns on walls and flooring. Select colors that match the activity and use them to designate specific areas. High-saturation tones, such as red, yellow, and blue, can be used as accents to highlight entrances or define space, adding vibrancy. Research by Ghayouri and Ayat

(2020) found color-shape associations, linking yellow with triangles, red with squares, and blue with circles.

4. Color and Spatial Furniture

It is important to carefully select the colors of key classroom furniture, such as chairs, tables, shelves, carpets, and beds, as they significantly impact the overall color composition. Previous studies suggest using warm colors for children's desks and chairs, and cool colors for bookshelves. Additionally, natural, non-patterned forms and materials, like wood, are recommended for these pieces (P. Tamthintha et al., 2018). To ensure a cohesive spatial composition, the furniture colors should follow a unified theme, but slight variations in shading or hue can help children differentiate between furniture functions, which also aids in developing their cognitive skills.

5. Color and Spatial Material

When selecting finish materials for classrooms, it's important to consider color both as an applied surface and as an integral part of the material. Beyond the factors of texture, pattern, and color, maintaining the natural color of finish materials can significantly influence the overall composition of the classroom design and serve as a key design element. For large areas, light or bright colors are recommended, while smaller areas can feature more intense colors. Natural tones, inspired by the environment, are ideal for promoting a calm and relaxing atmosphere.

“The texture of an object or surface also influences the visual appearance of color. Materials with a rough texture tend to appear darker because they absorb light and color instead of reflecting it, as do shiny surfaces and materials. Also, textured materials such as nubby fabrics, pile carpets, and velvet cast small shadows within themselves and appear darker than a smooth material with the same hue, value and chroma.” (R. Ghayouri, S. M. Ayat, 2020)

In summary, color is an adaptable, accessible, and effective design element (Read, Marilyn A., 2003). Spatial color plays a key role in creating optimal classroom interiors. Children generally prefer bright, friendly colors, while dark colors tend to make them unhappy. Gray and brown evoke mixed reactions, sometimes creating a

contradiction between preferred and non-preferred colors. In classroom design, color impacts children's development by defining space for their physical needs, supporting cognitive abilities, and influencing behavior and emotions. Importantly, spatial color interacts with other layers, influenced by environmental and cultural factors. Understanding this complex interaction helps interior designers appreciate the role of color in classrooms and avoid overstimulating spaces without considering the overall design.

2.2.1.5 Spatial Material

Selecting finish materials for interior spaces is a complex task, made more challenging by the evolving nature of material technology. Today, interior designers have an immense range of materials to choose from, provided by numerous suppliers. To make informed decisions, designers must possess comprehensive knowledge of finish materials, stay updated on new industry developments, and collaborate closely with suppliers to access a wider selection and more detailed information. This research focuses on the use of finish materials in preschool children's spaces, specifically analyzing wall, floor, and ceiling finishes and their impact on children's spatial experiences and learning. Various types of finish materials are examined to determine their adaptability in preschool classroom design.

According to (D.K.Ching, 2018), surfacing materials “can be integral to architectural assemblies or applied as an additional layer to walls, ceilings, and floors”. Spatial materials play an important role in creating the desired atmosphere in an interior space, and this layer also has a major impact on children. While a room might be usable without color, it can feel incomplete and not ready for occupants without finished materials. Trow (2002) presents a range of specific surface materials, including tiles, plaster, concrete and resin adhesives, which can be used to create different textures and finishes in interior spaces; the potential of natural materials such as plants to enhance interior finishes and create an esthetically pleasing interior space (Setiawan, 2004). Several studies have explored how designers select materials

for interior finishing, including research by Salcı (2019), Kwak & Han (2005), Kim (2014), and Altay & Salcı (2022), about residential spaces, considering factors such as material properties, project requirements, and design considerations. Material selection and criteria differ across surfaces, with designers typically prioritizing sensory properties and placing less emphasis on ecological factors. Despite the undeniable impact of surface materials on children's developmental needs, few studies have focused on the materials used in classroom interiors.

The author presents a summarized literature review on finish materials in early childhood classrooms, examining how these materials impact children's physical, cognitive, and socio-emotional needs, as well as how they support teaching and learning. The review explores the relationship between finish materials and the six other spatial layers. The findings are further analyzed in Chapter 3 through questionnaires, in-depth interviews, and participatory art-based approaches to understand stakeholders' perceptions and decision-making regarding finish materials in classroom interiors.

1. Classification & Selection

There are several concepts for classifying materials for interior finishing. Depending on the source, as explained in many researches (D. M Bettaieb, R. B Malek and A. A Alawad, 2019) (R. Kilmer; W. Otie Kilmer, 2014), focusing on the existence of three categories to classify materials, including natural materials, transformed materials artificial materials (R. Kilmer; W. Otie Kilmer, 2014). Based on the physical and visual properties of materials, there are “hard materials” and “soft materials” (<https://www.portaire.com>, n.d.).

Table: Characteristics of Different Group of Material		
Source of Material		Physical / Visual Characteristics
Natural Materials	that are found in nature, either as organic or as inorganic substances. “Organic materials are those that come from plants and animal; inorganic (nonliving) materials are those, such as soil, clay, and stone,	Hard materials include flooring materials such as hardwood, laminate, and tile; wall materials such as paint, wall

	which exist in a natural state (Rosemary Kilmer; W. Otie Kilmer, 2014).	paper, wall panels, furniture materials such as wood, leather, fabric, and metal; and lighting materials encompass fixtures, bulbs, and innovative lighting technologies.
Converted Materials	are materials processed or manufactured into different forms, such as brick, tiles, ceramic (Rosemary Kilmer; W. Otie Kilmer, 2014)	
Artificial Materials	that materials do not exist in nature and created by synthetic processes that produce new substances, such as plastic, glass.	Soft materials which include upholstery fabrics, draperies, rugs, carpet.

Table 18: Characteristics of Different Group of Material

(D. M. Bettaieb, R. B. Malek and A. A. Alawad, 2019) mentioned that interior finish materials usually reflect the physical and psychological form of the space as well as the structure, finishes and contents used by people. Therefore, it is important to understand the characteristics of materials as a design element in its own right to have a wide choice of materials. Previous studies have highlighted criteria that should be considered when selecting the material. They are summarized and analyzed in the following table. The previous studies have shown that there are generally recognized criteria for interior finishing materials, such as function, esthetics, ecology, economy and technology.

Table: Selection Criteria for Finish Material in Interior Spaces		
Authors	Selection Criteria	
Kilmer & Kilmer	4 criteria	Functional characteristics
		Aesthetic characteristics
		Being visually for the mood and space areas by considering for the weight, size, and percentage of the space
		Qualities of exture, style, color, light, reflection
		All related costs
Florez and Castro-Lacouture	4	Visual,
		Technical
		Environmental
		Aesthetic
		Strength, hardness, density
Zhou	4	Mechanical characteristics
		Economic characteristics
		Cost of purchase, process, transport, recycling, possibility of disposal
(Donia M Bettaieb, Raif B Malek and Abeer A Alawad, 2019)		Power consumption, recycling, reuse, and division
		Environment characteristics
		Artistic
		Technical
		Functional
		Aesthetic
		Indoor finishing material as an independent design element

		Economic Environmental	
(Rosemary Kilmer; W. Otie Kilmer, 2014)		Functional characteristics	Appropriateness and suitability Durability Ease of maintenance Safety
		Aesthetic	Appropriateness to the design concept Surface qualities, such as texture and pattern Color and light reflection and absorption qualities Visual suitability Balance, size, and proportion
		Ecological	Environmental impact Nontoxicity to users Moisture resistant and inhibiting growth of biological contaminants.
		Economic	All related costs

Table 19: Selection Criteria for Finish Material in Interior Spaces

2. Material and Composition of Interior Spaces in Preschool Classrooms

The materials used in preschool classrooms should be durable and easy to maintain. Designers should consider the texture and sensory experience they create in the space. Ceramic tiles, for example, have a hard surface and are cold to the touch, glass is also cold, fabric is soft and warm and wood, although hard, gives a warm feeling. Varied materials express different textures, which leads to different tactile and visual experiences. Textures are particularly important in children's lives because of using their hands and eyes to learn and explore the physical environment. A variety of materials, views and spaces can stimulate children's sensations (Allison, 1999; cited in (Inan, 2009). Material and texture as “the skin of stimulation for the arousal system.” Assorted colors and textures of materials contribute to the vibrant culture of interiors. The choice of different surface materials not only affects the visual and physical design of the classroom, but also influences children's sensory experiences. Finishing material has physical and sensory properties.

“Physical properties are the core characteristics of materials, encompassing thermal, mechanical, electrical, and magnetic traits. Sensory properties, in contrast, are tied to human physiological sensations and reflect how the sensory system perceives these physical traits. Texture and performance evoke emotional responses such as warmth or coldness, calmness or excitement, hardness or softness, dryness or smoothness, and feelings of comfort or discomfort.” (Wang Xiaonan, Zhang Ruizhi, 2017)

Previous studies have shown that each material has its own sensory properties and they are positively associated with human psychological factors. Some previous studies interior design furnishing material (W. Xiaonan, Z. Ruizhi, 2017); the emotional connection between space and body through materiality in space (Lee, 2022); characterization of materials for product design (C. Bertheaux, et al, 2020). More specifically, smooth porcelain, the surface of metal and exquisite silk evokes the desire to touch and feel their delicate, soft and moist textures repeatedly. Durian shells, viscous caterpillars or shrubs convey a sense of resistance and discomfort (Wang Xiaonan, Zhang Ruizhi, 2017). Linen evokes a sense of nature and leisure,

while silk conveys a delicate and noble feeling. Leather is suitable for creating a rustic atmosphere. Most materials with a hard surface convey a feeling of strength and coldness, while materials with a soft surface tend to evoke a feeling of softness and warmth. Wood is a material that conveys a pleasant, hard texture, but also a warm feeling. The “mainly positive or neutral effects on IEQ include moderating indoor humidity fluctuations, inducing positive feelings in occupants and inhibiting certain bacteria.” (Tuomas Alapieti et al, 2020).

3. Finish Material Selection for Floor Surface

Previous studies suggest using a variety of textures in preschool spaces, including finished wood, ceramic and vinyl tiles, smooth and notched plaster, tear-resistant fabrics, rubber, leather, metal, safety glass, and durable surfaces. Carpets, though harder to clean, help create visual boundaries through their texture. The top layer of flooring, which is exposed to foot traffic, forms a large part of the room's surface (Ching, 2018). Flooring acts as the background in an interior composition, with furniture and objects serving as figures. It can either blend into the background or become a dominant feature, with its physical texture influencing the visual pattern it creates (Ching, 2018). There are two types of finish flooring material:

Hard flooring: Wood (hardwood, softwood, plywood (Rosemary Kilmer; W. Otie Kilmer, 2014)), stone, tile, resilient flooring such as linoleum (available in a variety of colors, motifs and textures) or cork.

Soft flooring: primarily carpets and rugs. Carpets and rugs add visual and textural softness, warmth, and resilience to floors, offering a variety of colors and patterns. These materials absorb sound, reduce impact noise, and provide a comfortable, safe walking surface. While carpets can cover the entire floor, rugs are smaller and often used to define areas, unify furniture groupings, or create pathways, making them essential in interior design.

The floor can play an active role in determining the character of a space through its color, pattern and texture. In particular, a light-colored floor enhances the light in a room, while a dark floor absorbs much of the light that falls on its surface. Previous

studies have shown that wooden floors can improve the overall atmosphere of a space, which in turn is linked to the concept of the “7 interior spatial layers” mentioned in this study. (Hoda Jafarian; et al., 2017) highlights the role of the materiality of wood in achieving light diversity and creating visually pleasing interiors, specifically:

“Light-colored wood, such as oak on interior surfaces, encourages a deeper penetration of daylight into the space, away from the window. The Cape Cod Gray coating provided a neutral color balance even in sunlight. High-gloss dark walnut on the ceiling creates the highest luminance levels and magnifies the pattern of window light” (Hoda Jafarian; Claude M.H. Demers; Pierre Blanchet; Veronic Laundry, 2017).

On the other hand, a light floor creates spaciousness and emphasizes the smoothness of polished floors, while a dark floor evokes the sense of depth and weight of the floor surface (D.K. Ching, 2018).

4. Finish material selection for wall surface

There is a list of finish materials that can be used for the interior wall: concrete, wood, metal, panels with plastic laminate or fabric, resin panels and vacuum formed 3D panel products. For wood wall panels, the pattern and texture of the walls will depend on the width, orientation and spacing of the boards, as well as the joint details. Plywood veneers with different patterns to create a different atmosphere indoors, such as book matching, herringbone matching, slip matching, diamond matching, random matching. The group of plasterboard, ceramic wall tiles, flexible wall coverings or paints and coatings are also a solution for wall design. Soft materials for walls are fabric and texture, which help to define a space (Duncan, 2011).

5. Finish material selection for ceiling surface

There are some for the ceiling finish such as plaster and plasterboard, wood, the mental frame, plaster modular, canopies and clouds. The spatial material layer is one of the most complex and challenging aspects of interiors that interior designers

must consider from the very first steps of the design process. This is particularly important in spaces designed for children, where requirements such as safety, flexibility and legibility must be met. Interior designers must not only know the properties of surface materials, but also have a keen visual sense to select the right materials for specific areas in the classroom. Although the average size of classrooms is not too large, the choice of materials must be carefully considered as they strongly influence children's sensory experiences.



Table: The Type of Finish Material in Preschool Classroom Space				
Type	Characteristic	Typical Use		
		Floor	Ceiling	Wall
Hard Material	Wood flooring	Active Zone; Quite Zone; Entry Zone; Messy Zone		Quite Zone Entry Zone Messy Zone
	Tile and Stone flooring	Corridor; Entry; Washing zone Toilet		Entry Washing zone Toilet
	Ceramic mosaic tiles	Toilet; Washing zone; Wet areas	Décor (maybe)	Toilet Washing zone Wet areas
	Stone tile flooring material	Entry zone; Messy Zone; Toilet		Entry zone; Messy Zone; Toilet
	Concrete	Outdoor area; Corridor		
	Terrazzo	Outdoor area Washing zone Toilet		Washing zone Toilet
	Resilient flooring materials	Active area Messy Zone		
	Glass	Transparent; Easy to observe		Flexible
	Metals	Cool, easy to change	Décor details	Frame

	Plastics	Easy to clean			Partition
	Plaster	durable, rigid, moisture resistant, and fire resistant.		x	
	Gypsum Board	less expensive and quicker to install. durable, rigid, available in different thicknesses, highly fire-resistant		x	
Soft material	Carpet	Soft characteristic Create comfort and safety for children	Active Zone; Zone/Passive zone; Quiet zone; Study Corner		
	Rug	Patterned, textured; Visual diversity, softness	Quiet Zone Personal corner Loft area (if have)		Decorative items on the wall
	Fabric	Patterned, textured; Visual diversity, softness		Décor	Partition
	Paint	Economical solution		x	x
Natural Material	Bamboo			Décor	Partition
	Plant				Partitio; Décor
	Clay				
	Rattan			Décor	Décor

Table 20: The Type of Finish Material in Preschool Classroom Space

2.5.1.6 Spatial furniture

Spatial furniture is a key element in the seven collaborative layers, influencing both the visual character of the interior and the health and behavior of its occupants. The form, line, color, texture, and scale of furniture, along with its arrangement, significantly define a room's expressive qualities. Furniture selection is a complex task in interior design due to its variety of forms, textures, and styles, including antique, modern, and contemporary (Ching, 2018). Spatial furniture plays a vital role in organizing and defining interior space, particularly in terms of proportion and child scale, reinforcing spatial order. The materials used further enhance its character, highlighting the interconnectedness of the seven spatial layers.

“Furniture is usually made of wood, metal, plastic and other synthetic materials. Each material has strengths and weaknesses that should be considered in the design and construction of furniture if the piece is to be strong, stable and durable.” (D.K.Ching, 2018)

One of the key elements in the design and selection of interior furniture is ergonomics. Especially when designing children's rooms, anthropometry for children should be considered. To choose the right furniture for a space, interior designers should consider the ergonomic guidelines and anthropometric data of children for the different functions of the specific space they are designing for. Children's ergonomics and anthropometrics depend on their height and weight at different ages (WHO, 2024).

A child spends 70% of his time in a kindergarten in constant interaction with other children, objects and furniture (J. A. Waldron, A. Garcia, Carolina M. Bedoya, L. Cuervo, Laura Marin, C. Morales, A. de Medellín, 2022). Furniture in the classroom should be child-friendly, not only for sitting or learning, but also so that children can easily move around the classroom and change the organization of the classroom according to their needs. Children see themselves in the role of how the space is organized for early learning (Manassakis, 2020). Function of furniture goes beyond simply providing a place to sit or a place to put tools. It has evolved into something

deeper — a catalyst for thought and imagination. Furniture today serves as an invitation to think and dream by evoking ideas and half-formed imaginings (Taylor & Preston, 2006; cited in (Izadpanah, 2011). Furniture, especially in preschool learning spaces, should prioritize both functionality and esthetics. They serve not only as functional items, but also as catalysts for children's thoughts and imagination during daily interactions. Therefore, furniture is one of the most important layers in the interior design of the classroom that affects children's development, as it influences children's movement in the space and is one of the key points in defining the space.

Previous studies have highlighted the importance of appropriate furniture design for preschool children. Wang (1989) and Kiran (2012) pointed out the need for furniture that is compatible with children's body dimensions to prevent health problems and support academic performance. Meanwhile, (B Setiawan, N Abdullah, A F Pratama, 2020) emphasized the factors of ergonomics of furniture, especially that functionality, safety and comfort are three main features of furniture in early childhood education. However, a specific analysis of preschool furniture in the context of classroom design and its interaction with other spatial layers is essential. This thesis focuses on examining the relationship between furniture and preschool classroom interiors and pedagogy. It also examines how the specific requirements of preschool furniture influence children's developmental needs. In addition, it identifies the essential pieces of furniture needed in a classroom.

1. Furniture and Design Requirements for Preschool Children

When designing or selecting furniture for preschool learning spaces, two key aspects are considered: functional requirements and aesthetic appeal. Seventeen design factors for children were identified through clustering, disassembling, and regrouping, including stability, age appropriateness, learning ability, environmental friendliness, emotional experience and regulation, parent-child interaction, adaptability, mobility, space-saving, easy cleaning, fault tolerance, independence, interestingness, intelligence promotion, aesthetics/artistry, child-specific design, and high quality (Dai & Xu, 2019). Furniture for preschool children must meet the needs

of both children and teachers in daily activities like learning, playing, and resting. Safety, comfort, and ergonomic design based on children's anthropometric data are essential considerations.

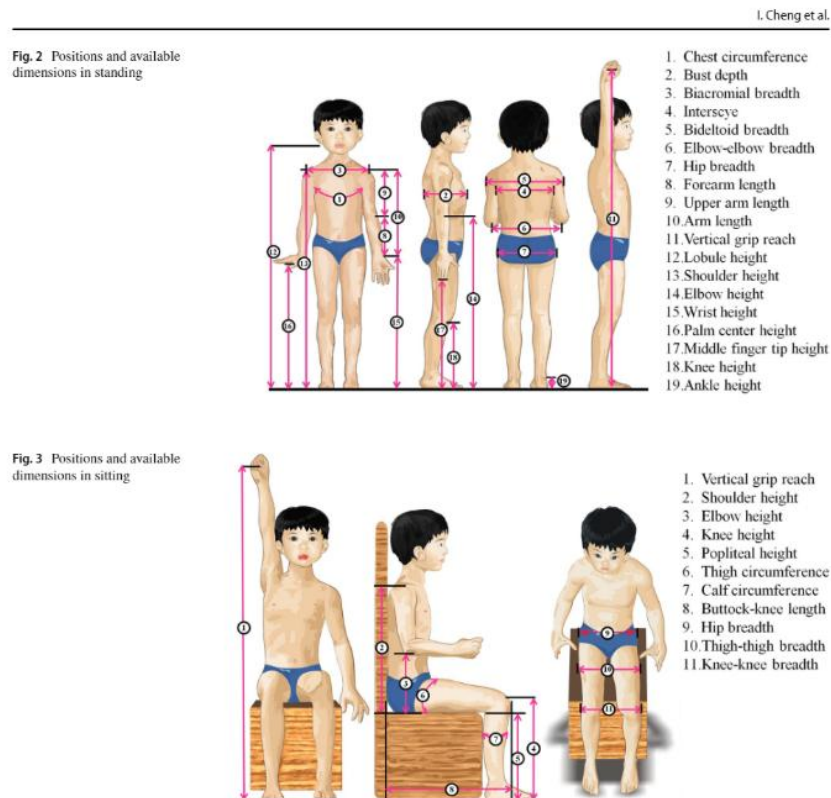
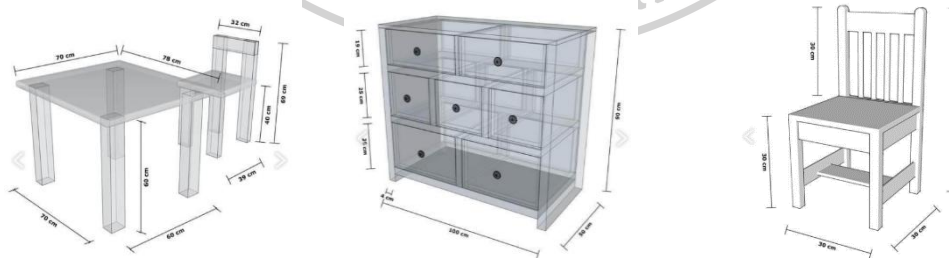


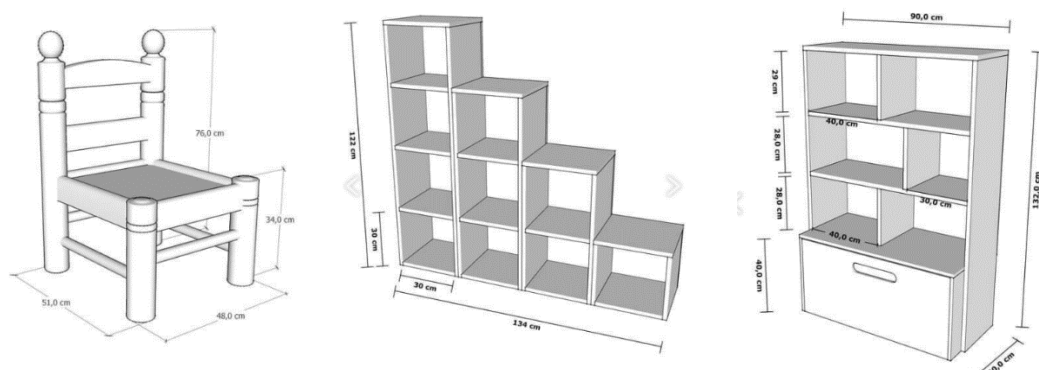
Figure 41: Anthropometric information of preschool children in sitting and standing posture

The first feature of furniture in children's rooms is scale. "Scale furniture for children is reassuring and provides a sense of security" (Hubbard & Olsen, 2004, cited in Izadpanah, 2011). Previous studies that emphasize that safety, comfort, and developmental appropriateness are crucial elements in the design of furniture for preschool children. Sumarno & Prasetyo (2022) emphasized that safe and comfortable furniture with educational animal themes can be created by using foam and fabric (Long et al, 2021). Meanwhile, incorporating children's drawings into smart furniture designs can promote creativity and personalization for children. Anthropometric considerations are crucial to ensure proper ergonomics and

functionality of classroom furniture (B. Setiawan, et al., 2021) (Shivarti, U.V. Kiran, 2012).

To transfer the furniture into children's scale furniture, not only the height, but the entire scale should be transferred. Interior designers need information about children's anthropometric data to select functional furniture for children in the right size. The dimensions of children's furniture should meet the requirements and be designed based on children's anthropometric information (I-Fang Cheng et al., 2018). The dimensions of shelves should be based on the dimensions of the standing position (Figure), and the dimensions of tables and chairs should be based on the dimensions of the sitting position (Figure 49), and other details should be based on the other dimensions, such as the structural dimensions of children's foot, children's hand and children's head. The second feature of the furniture is parallel to the character of the interior space. "The furniture must match the overall ambience of the interior. People feel differently in an environment with soft and comfortable furniture than in an environment with straight and sharp furniture" (Abercrombie, 1990). Feinberg & Keller (2010) claim that furniture in the kindergarten should be comfortable, safe and attractive. It is necessary to use weighted furniture, which is more useful than heavy furniture, to increase flexibility in the space.





<https://engineeringdiscoveries.com/standard-dimensions-of-furniture-for-kids/>

Table 21: Children's Furniture Measurements

According to (Izadpanah, 2011), there are three types of furniture: furniture that serves the human body, furniture that serves the human posture (e.g. chairs for seating, beds for lying, desks, shelves, tables), furniture that serves the human senses, which affects the quality of furnishings and visual presentation and does not serve the physical needs of humans. The furniture of the preschool classroom is assigned to the zone and the specific areas that belong to the spatial function in the space. Furnishings are used to designate areas of the classroom such as dramatic play, blocks, art, music, and science. If the furnishings are authentic and the right size for the children, the children's play will gain quality and depth (Kaplan, 2020).

2. Core furniture and sub-core furniture

Designing or selecting furniture for preschool classrooms is a complex challenge for interior designers. Preschool furniture must balance functionality with aesthetics, while also stimulating children's imagination and supporting their physical and cognitive development. This study examines the key requirements for spatial furniture in preschool classrooms, focusing on essential furniture and the material considerations for each. Below is a list of the most important furniture and equipment commonly found in preschool classrooms, though it may be adjusted based on specific needs and educational focus.

Table: Core-furniture and Sub-furniture in the Interior Space Classroom		
	Core-furniture	Sub-furniture
Entry/Entrance	Children's storage/cabinet Small Sofa to change shoes Lockable storage for teachers' belonging	Picture display Cot
Reading Area	Bookshelf Picture display Small sofa for children Library display unit	Floor pillow Solid color area rug Bean bag chair Flannel board
Eating Area	Chair (1 per child), height 355-406 mm Table (rectangle or square), height 508-558 mm	
Block Area	Wall-mounted storage; Cardboard blocks	
Dramatic Play	Shelf, studying material in cabinet	
Active Play	Preschool loft (if has)	
Construction Area	Workbench Safety goggles	
Teacher's area	Teacher's chair and table Teacher's cabinet with lock	

Table 22: Core-furniture and Sub-furniture in the Interior Space Classroom

2.5.1.7 Spatial environment

This layer encompasses the overall ambience, mood and sensory experience in the interior. This includes factors such as lighting, temperature, air quality, noise levels, technology and natural elements that connect the interior to the exterior and contribute to the atmosphere or mood of the preschool space. The components of this layer can be easily modified depending on the specific site conditions and the typical building.

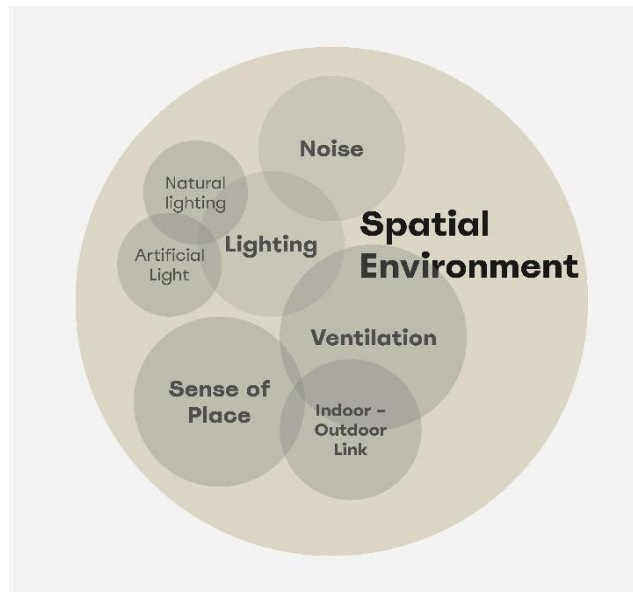


Figure 42: The main element of spatial environment layer

1. Noise & Acoustics

Previous studies have shown the effects of noise in the preschool environment on children's development or behavior (K. Persson Waye, et al., 2019). Building on initial studies such as Weinstein (1987), some views were presented, such as "a high level of noise from which a child cannot escape is negatively related to cognitive development" (Wachs, 1976), associated with "less efficient information processing in children" (Wohlwill & Heft, 1977); lower teacher ratings of creativity and lower language performance (Parke, 1978); low efficiency in children's use and understanding of language in noisy classrooms (Maxwell & Evans (200)); to more recent studies such as the study on noise pollution in the learning environment, which emphasize the importance of implementing noise control measures and awareness programs in preschool (M. Bulunuz, et al., 2017); negative effects such as deafness, distraction, negative internal emotions, displacement, avoidance, withdrawal, exhaustion and learning (K. Persson Waye, et al., 2019); meanwhile (S. Bates, et al., 2021), excessive noise levels in early childhood settings have been found to have a direct negative impact on both children's learning and teachers' well-being. More specifically, noise contributes to increased stress levels in adults, resulting in less sensitivity to children's needs and fewer interactions with them. School noise can be divided into two categories: external noise and internal noise.

(Seda Ata, et al., 2012) presented that external noise is generated by airplanes and surface traffic, and studies on internal noise generated by the daily activities of teachers and students (Rivlin & Weinstein, 1984; cited in (S. Ata, et al., 2012)). This highlights the importance of designing preschool classroom interiors with other spatial layers to minimize noise, both indoors and outdoors, and create a peaceful environment. Beacham (1996) emphasized the need for sound-absorbing materials in the construction of preschool spaces.

2. Lighting

The second critical environmental factor to consider in preschool interior spaces is lighting. As a primary source of sensory stimulation, light plays a pivotal role, yet it is frequently undervalued in interior design practices. Classroom lighting consists of both natural and artificial sources, each with its distinct advantages and challenges.

Natural light offers substantial benefits for young children but requires careful management. Insufficient or excessive exposure can negatively affect children's health. Adequate natural lighting is essential, as it promotes vitamin D synthesis, inhibits mold and bacteria growth, fosters a positive mood, and strengthens the connection with the natural environment (Caple, 1996; cited in Inan, 2009). However, the dynamic nature of natural light presents difficulties in controlling its intensity and direction within interior spaces. Thus, interior designers must strategically address the 1st spatial layer — space function — through effective spatial organization and precise window and door placement. As Weinstein (1987) emphasized, "Ideally, no space without windows should be used for childcare."

Artificial lighting must complement natural light, providing balance through a variety of forms such as ambient, task-specific, and accent lighting. Utilizing multiple lighting types—ceiling, wall-mounted, floor, and desk lighting—ensures flexibility and enhances spatial depth. Wall-mounted fixtures that reflect light upwards and downwards simulate the effect of being enveloped by natural light, offering a superior alternative to fluorescent lighting (Weinstein, 1987). Beacham (1996) also

highlighted the importance of employing various lighting solutions to maintain spatial adaptability.

“Light affects activities and moods: stronger lighting uplifts, while softer lighting calms. Use soft lamps or directional lighting as needed, but avoid fluorescent light, which can worsen hyperactivity” (Inan, 2009).

To allow natural light into the classroom, Greenman (1988) points out that windows should be 18 to 24 inches (approximately 457.2 to 609.6 millimeters) above the floor so that children can see outside (Inan, 2009). The position of windows and doors affects how much natural light enters the classroom, and careful consideration should be given to the positioning of windows and doors for different functional areas in the classroom. In addition, the height of the ceiling affects both light and air circulation.

3. Sense of Place (Feel & Smell)

Next factor in a classroom that is often underestimated is the mood of the class. More specifically, the mood in the classroom can correspond to the different energy levels of the children and teachers who are in it. Mood, which has to do with beauty, is the result of decorating techniques that make a space sensory rich and varied – this is also a link to design solution when designers think about the spatial layer of color, material & texture and furniture. *“Anything that moves, grows, changes shape or reflects movement adds visual interest and excitement to the environment”* (Olds, 1987). The mood of the space is also created through signage that shows the relationship between images, words and spaces.



Figure 43: A decorative corner in the classroom bring a unified sense of each class

4. Indoor-outdoor link

When designing preschool classroom interiors, it's crucial to consider the connection between indoor and outdoor spaces. Designers should maximize windows and doors to bring in natural light, provide views of greenery, and create a seamless connection with nature. Effective interaction with nature is key to fostering environmental awareness (Shaari, Ahmad, Ismail, 2016), incorporating landscape elements like vegetation, topography, and small gardens. In addition to natural lighting, natural colors and forms should be integrated into the design to further bridge indoor and outdoor spaces, particularly in preschools with limited space. In larger preschools, creating a strong connection between natural outdoor elements and the indoor environment is easier, while smaller spaces can achieve this through visual solutions and carefully planned layouts.

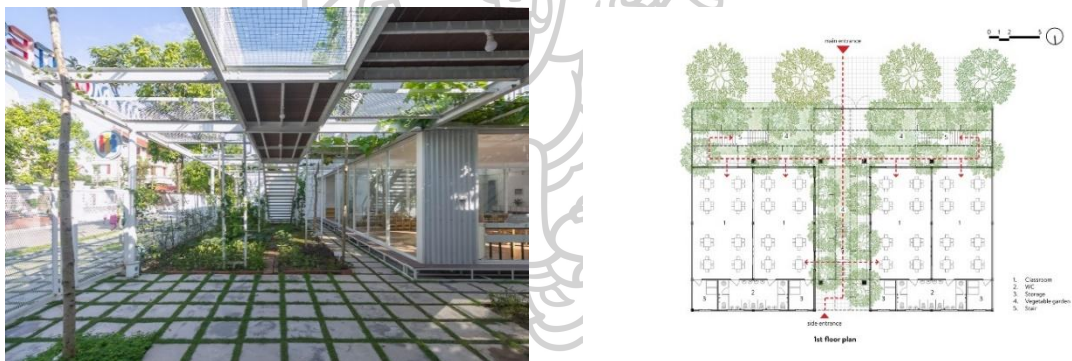


Figure 44: My Montessori Garden Preschool” in Ha Long, Quang Ninh, Vietnam

“My Montessori Garden Preschool” in Ha Long, Quang Ninh, Vietnam, for example, was designed by HGAA. Architects and interior designers created a garden – a natural space for children, a classroom among trees and flowers (Abdel, 2021). A continuous cycle in the garden creates more space for the children to move from the ground up and back down, which becomes an interesting discovery space. The most interesting design solution of this preschool is that the investor dedicates more than 50% of the land to the garden to create a nature-based learning space where children can learn, connect and interact with nature more than in regular classes. The classroom

interiors feature large windows that provide views of the grounds, promoting a sense of openness and connection with nature. In addition, the use of shared toilets encourages social interaction between students from different classes, promoting a sense of community within the school.



Figure 45: My Montessori Garden Preschool” in Ha Long, Quang Ninh, Vietnam

Even in preschools with a lot of space, designers strive to seamlessly connect indoor and outdoor areas. They separate the indoor and outdoor areas for safety reasons, while creating an inviting environment where children can move freely between the two spaces without any noticeable separation.

5. Technology

In the 21st century, it is undeniable that technology is having a huge impact on young children, especially Generation Alpha (those born between 2010 and 2024), for whom it is becoming an integral part of their lives. Therefore, it is imperative to recognize technology as an important topic in the classroom and consider its impact on various spatial factors. In this study, technology is conceptualized within the

confined space of the classroom as a component of the spatial environment layers that aims to create a technologically enriched classroom environment. Like the other six remaining spatial layers, these elements also influence other aspects of the spatial environment and interact with elements in the remaining spatial layers.

Teachers will use technology to support their lessons and provide entertainment for preschoolers. In interior design, designers should carefully consider how much technology will be used in the classroom and the impact this will have on the natural environment.

“The more CT devices there are in the classrooms, the more heat dissipation is needed. The more whiteboards are used, the less natural light, especially sunlight, is welcome in the room. The use of natural materials, which are often quite hard, and bright, airy spaces can make it more difficult to maintain the required noise levels” (Chiles, 2005).

Digital and non-digital technological literacies are crucial in the design of learning spaces, as they influence when, where and how learning and teaching take place. In the 21st century, the role and impact of technology cannot be underestimated or hidden from children. Effective design provides opportunities for children to use technology effectively, learn it safely and integrate it seamlessly into their learning (Organization, 2019).

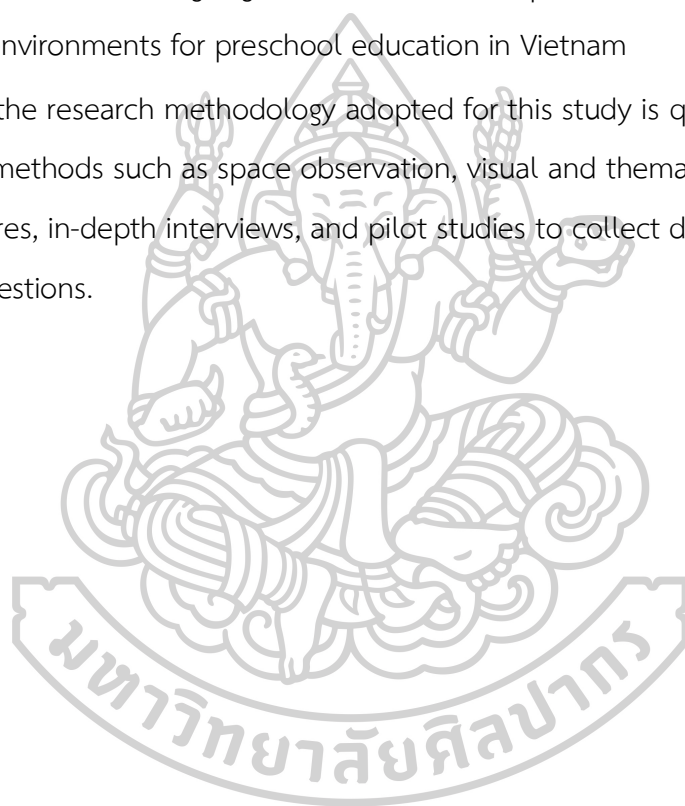
2.6 Summary

This chapter highlights the progression of thought in field of interior design for learning children space, tracing how the research focus has evolved over time and identifying areas where existing studies fall short. By addressing the gaps in research about the relationship between children’s development – interior spatial layers in learning space – pedagogy, as well as interior design guidelines for interior design, specific in Vietnamese context. The thesis seeks to contribute new insights, particularly in designing classroom spaces with specific spatial layers that align with

children's developmental needs and educational philosophies. The chapter concludes by defining the research gap and articulating the key research questions that guide the study, that is:

1. What are the key interior elements and spatial levels in preschool classrooms that address the physical, socioemotional and cognitive developmental needs of children?
2. How can interior design guidelines be developed and adapted to optimize classroom environments for preschool education in Vietnam

This is why the research methodology adopted for this study is qualitative, employing methods such as space observation, visual and thematic analysis, survey questionnaires, in-depth interviews, and pilot studies to collect data and address the research questions.



CHAPTER 3

RESEARCH METHODOLOGY

Building on the foundational findings from Chapter 2, Chapter 3 describes the research methods used to discover, validate and evaluate the key concepts from the literature review, including the concept of the theoretical model for the design of preschool learning spaces with three main themes: preschoolers, spatial layers, and pedagogy; the concept of the 7 spatial layers and the feeling scale instrument; and the guidelines for designing each layer.

To achieve this, three phases are presented in this chapter:

- Phase I is Design Thinking, which includes site visits to 5 private and public preschools in HCMC, Vietnam. In this process, photos, observations, notes and visual analysis are taken to understand the physical environment, context and the relationship between children, space and pedagogy. What are the differences in the interior design of spatial layers that are intended for children of the same age but differ in terms of location and pedagogy? What factors determine the differences in the design of spatial layers in the interior space of a classroom?
- Phase II is the design process that narrows the scope of the research analysis to gain deeper insight, including a focus on site visits and analysis of 3 preschools using Montessori education. At the same time, a questionnaire with about 15 questions was sent to stakeholders to obtain results on the concept of the 7 spatial layers, children's development and pedagogy. The summarized results of Phase I and Phase II, the 7 layers and the feeling scale tool were developed and both theoretical and visual guidelines were proposed for the institution to proceed to Phase III, the design evaluation.
- Phase III is the design evaluation, including a pilot study and an in-depth interview with 5 participants, including a preschool teacher, a parent, an interior designer, an architect and an educator. The pilot study will be conducted as a workshop with 5 participants to apply the concept of the 7 spatial layers and the feeling scale tool.

The in-depth interview will be conducted to gather thoughts, ideas and feedback in the responses and gain insight into the effectiveness of the design.

This research was reviewed and approved by the Institutional Review Board (IRB) of Mahamakut Buddhist University (MBU) according to ethical guidelines. The Ethical Human Research Certificate issued by the university ensures that all procedures involving human subjects conform to established ethical standards.

3.1 Phase I - Design thinking



Phase 1 of this study involves the implementation of the design thinking process in two main steps. First, the researcher visits five different preschools in different districts of Ho Chi Minh City (HCMC). These preschools include both private and public facilities with varied sizes of land. The aim is to observe the interior architecture of the school space and the interior layout of the classrooms. Through this observation process, the author aims to gain insights into the spatial design characteristics and analyze the current design conditions of preschools in Ho Chi Minh City. In this analysis, the theory of "seven spatial collaborative layers" developed by the author is applied to evaluate each space of each preschool. Through a comparative analysis of classroom interiors in the five selected preschools, each layer will be thoroughly examined. In addition, this stage will allow the author to examine potential differences in design based on location, educators, pedagogy, and between private and public preschools that all serve children of the same age group.

The results of this phase will provide valuable insights into the current design conditions of both private and public preschools in HCMC. By analyzing the seven spatial layers of cooperation in these spaces, researchers will gain an understanding of how these layers interact and influence children's learning experiences and skill development in these specific environments. In addition, the results will contribute to the development of a practical theory to guide the finalization of a spatial design model for preschool classrooms.

3.1.1 Site 5 preschools in Ho Chi Minh City

The author has visited, observed and analyzed five different preschools in Ho Chi Minh City (HCMC), Vietnam, with different total areas (from 3,392m² to 100m²) and different pedagogical approaches (public preschools with national curriculum to private preschools with Montessori combined with Steam, Thinking Mathematic...) on site to find out what are the main differences in preschool interior design in general and classrooms in particular between public preschools and private preschools. Based on these observations, it is analyzed what leads to the shaping of the 7 spatial layers and how they should be included in the interior design strategies. The aim is to find out which spatial layers are crucial in the design of preschool spaces and have a strong influence on the developmental needs of children. In addition, the comparative analysis table attempts to identify the primary layers and the sub-layers within the overall interior space.

3.1.1.1. The City's May 19th Preschool, HCMC, Vietnam



Figure 46: The façade of The City 19thMay, District 1, HCMC

Address: 94 Nguyen Dinh Chieu Street, Da Kao Ward, District 1, Ho Chi Minh City, Vietnam. Date to site: September 2023.

Website: <https://mn19thang5tp.hcm.edu.vn/homegd3>; Young children from 18 months to 6 years old.

The May 19th Municipal Preschool is one of Ho Chi Minh City's largest and most important educational institutions. Located in the city center, its expansive campus

features architecturally significant buildings and classrooms designed to suit various age groups. This layout supports tailored education for children at different developmental stages. The preschool follows the national curriculum set by the Ministry of Education, with teachers playing a key role in planning daily, monthly, and yearly learning activities.

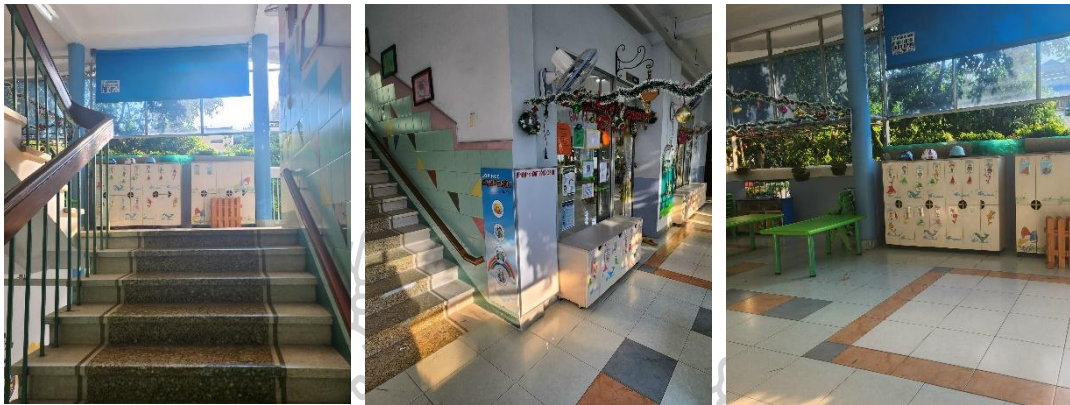


Figure 47: The design of stair, lobby, and corridor of classrooms

As shown in the site analysis, City 19th May Preschool enjoys a prime location in the central district of HCMC, close to national offices, government buildings, businesses, other preschools, high schools, and a university. The total land area is 3,392m², with a construction area of 6,470m². The campus includes three rows of buildings, each with a ground floor and two upper floors, surrounded by many trees and a large playground. Each classroom covers about 50m², with a low building density that allows for ample natural light. The classroom interiors follow simple designs with geometric shapes, offering no distinct design vocabulary specific to the preschool. On the upper floor, rhythmic spatial composition divides classrooms and creates a long corridor that connects all rooms throughout the school. (Figure 55).



Figure 48: Interior space of corridor where has the information board, children's cabinet, and The interior design of the preschool classroom

It's not hard to see that color is a prominent element in the design of 19th May Preschool, which uses many bold and primary colors not only for the classroom interiors, but also for the building's façade (Figure 56). The interior design focuses on the use of color to create stimulation and impressions and set visual boundaries within the space. Strong blue is used for the façade and columns, while strong green and yellow are used for tables and chairs. Bright colors such as light blue or beige are used for the entire wall and are decorated with many drawings and bold colors in detail (Figure 56). There are still some preschool classrooms with many drawings on the walls that overstimulate the children. Different colors and different types of animal or plant pictures are used on the children's cabinets to help them distinguish their own cabinets, especially before they learn to read. Different materials are used in the different areas to create visual boundaries: Wood for the bookshelves, tiles and ceramics for the floor and curtains for the windows. The lighting consists of fluorescent tubes mounted on the ceiling.

3.1.1.2. The Le Thi Rieng Preschool, HCMC, Vietnam



Figure 49: The façade of The Le Thi Rieng Preschool, District 1, HCMC

Address: 39 Nguyen Dinh Chieu Street, Da Kao Ward, District 1, Ho Chi Minh City, Vietnam. Date of site visit: October 2023. Website: <https://mnlethirieng.hcm.edu.vn/homegd3>.

Student: Young children from 18 months to 6 years old.

Le Thi Rieng Preschool, a public preschool located in the heart of Ho Chi Minh City – District 1, near numerous office buildings, has been officially recognized by the Ho Chi Minh City People's Committee as meeting national level 1 standards under Decision No. 909/QĐ-UBND. The school has a construction area of 1,624.54 square meters and a three-story building with 10 classrooms and 8 functional rooms that can accommodate 300 children aged 19 months to 5 years (www.giaoduc.edu.vn, 2016). The pedagogy of this preschool was also developed based on the educational methodology of the Ministry of Education and follows the national curriculum.



Figure 50: Outdoor and Indoor area in the center area of preschool

The classroom for 4-5 year old children is about 60 m², two teachers with about 25 children. Le Thi Rieng Preschool has some functional classrooms, such as music class, physical education, STEAM or smart classroom. The design of the indoor and outdoor areas is changed daily according to the content of the learning and leisure plans. The outdoor areas for dynamic play and free play help the children to promote their physical and socio-emotional development. (Figure). The Figure is about the outdoor area of Le Thi Rieng Preschool, which is not too big but big enough for the children to participate in outdoor activities. The boundaries between the indoor and outdoor areas are fluid. In addition, the layout of these areas can be changed depending on the changes in the learning plans.



Figure 59



Figure 60

Figure 51: In the 1st option of the U-shaped space layout, the children sit on a chair and follow the plan of the U-shape so that the teacher can easily teach and guide them.

Figure 52: The 2nd option of space design for a specific group with a table and chair group

There are several areas in the classroom for 4-5 year olds, including a common activity area, a quiet area, a learning area, toilets for children and adults and a storage room. The interior of the preschool classroom is carefully organized to accommodate these distinct functions. The furniture is arranged and adapted according to the daily learning schedules and other activities such as meal and bedtimes. This flexibility in furniture arrangement allows for seamless transitions between the different activities and ensures that the classroom environment is conducive to learning and development throughout the day (Figure 60). In Figure 61,

the first option for the space layout is the U-shape, where the children sit on chairs arranged in a U-shape. This layout makes teaching and guidance easier for the teacher as they can interact with all the students from a central position. In Figure 65, the children are divided into different groups and can choose from a variety of classroom activities, such as drawing, displaying symbols and exploring the kitchen area. The space is divided up using movable shelves, tables and chairs, allowing for a flexible arrangement that meets the diverse needs and interests of the children. This approach encourages independence, creativity and exploration and provides a dynamic learning environment in the classroom.



Figure 53: The interior design of the corridor as a connecting element with the classrooms for personal discussions - Interior design of a characteristic preschool classroom in the LTR preschool

Similar to City 19th May, Le Thi Rieng benefits from a prime location and well-designed architecture, offering excellent views and ventilation in each classroom. The classrooms are clean and have unobstructed views, enabling teachers to easily monitor children's activities. The restroom atmosphere is also well-maintained,

featuring light, bright colors and partitions that separate different functions within small areas. the classroom includes a small storage room for storing items used during nap time, helping to keep the space clean and organized, even as learning, sleeping, and eating activities occur in the same area at different times In day.

3.1.1.3. The Hoa Lan Preschool, HCMC, Vietnam



Figure 54: The façade of The Hoa Lan Preschool, District 1, HCMC

Address: 3 Le Loi Street, Ward 4, Gò Vấp District, Ho Chi Minh City, Vietnam

Website: <https://mnhoalangovap.hcm.edu.vn/homegd3>; Date of site visit: November 2023; Student: Young children from 18 months to 6 years old.

Hoa Lan Preschool, a public preschool in Go Vap District, is privately owned and located a considerable distance from the city center. It has been officially recognized by the Ho Chi Minh City People's Committee as meeting national level 2 standards under Decision No. 2816/QĐ-UBND. Like other public preschools in the city, Hoa Lan follows the Ministry of Education's methodology but has adapted its pedagogy to better meet the needs of preschool-aged children and align with the school's vision. The preschool features a large campus with 13 classrooms, each equipped with its own toilet, serving children aged 2 and above. Additionally, it has two special function rooms— a physics classroom and an art classroom— along with three offices and a kitchen facility.

Compared to Le Thi Rieng Preschool, Hoa Lan has a larger outdoor play area with various play areas but is still smaller than The City 19thMay. The schoolyard is located in the center of the preschool site, and the classrooms are arranged in an L-shape at the edges of the schoolyard. This layout creates a spacious and cohesive

environment, with a long corridor facilitating access to the classrooms and outdoor play areas.



Figure 55: The design of outdoor play-yard in Hoalan preschool.

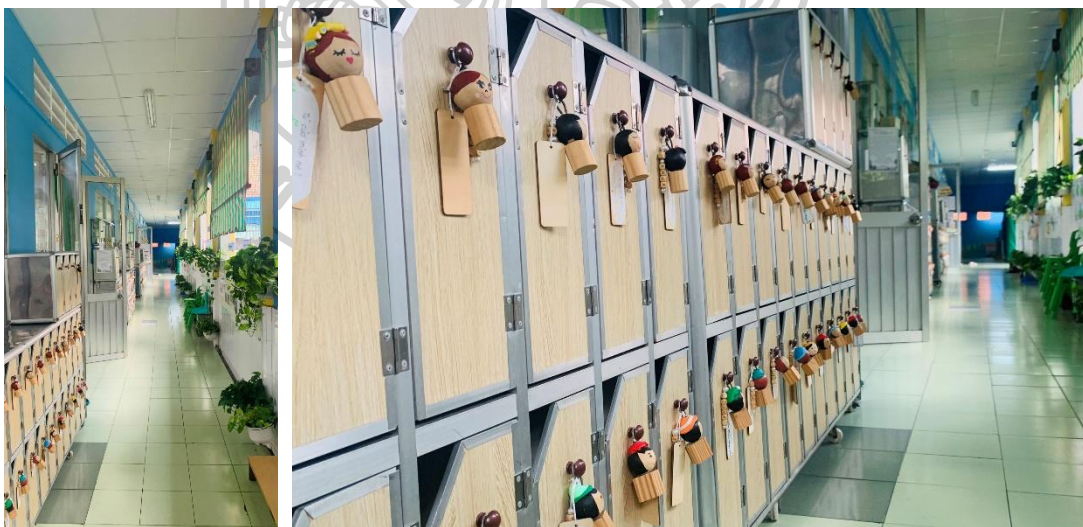


Figure 56: The corridor follows the classrooms and the L-shaped floor plan of the preschool

The corridor follows the classrooms and the L-shaped floor plan of the preschool

A cupboard outside the door of each classroom for the children's clothes and handbags in the corridor – as a social area where teachers, children and parents meet and exchange ideas before and after classes.

The average size of a preschool class at Hoa Lan Preschool is about 50 m², including the restroom area. Each class accommodates about 30 - 35 children who are looked after by 2 main teachers and 1 nanny. The classrooms at Hoa Lan Preschool are not uniformly designed, but vary depending on the budget or the parents' investment in the class.



Figure 57: Interior design of a signature preschool classroom in Hoalan Preschool, GV, HCMC

Similar to the classrooms at The City 19th May and LeThi Rieng Preschool, this preschool classroom features large windows on two opposite walls, allowing ample natural light to enter from both the hallway and outside. The windows are also opened in the restroom to ensure sufficient natural light throughout the space. This design not only brightens the classroom but also creates a welcoming atmosphere for the children. Additionally, a 900 mm wide children's shelf between the classroom and corridor serves as a "social connection area," where parents can drop off their children, interact with teachers, and where children can greet their peers in the morning.



Figure 58: Corridor area – as a social area where teachers – children – parents meet and discuss before and after classes

The strategic arrangement of furniture, such as tables and chairs, helps divide the interior space for different daily activities. For example, during nap time, furniture is arranged to create sleeping areas, while during meal time, tables and chairs are set up for group meals, promoting social interaction around round tables.



Figure 59: Cluttered corners in preschool classrooms make the space appear smaller and hinder children's movement around the space

However, since learning activities, eating and sleeping all take place in the same space, there is a lot of furniture for these activities. Unfortunately, there is no storage space or well-designed shelving to store all this, so the space still looks cluttered in some corners (Figure). Despite the large windows, the classroom looks dark in some areas due to the clutter. In addition, the high density of furniture makes the classroom look smaller and the children do not have much space to move around freely. For this reason, the teachers have decided to tidy up all the decorative items to make the space look bigger. In general, the furniture in the Hoa Lan preschool is outdated.

3.1.1.4. The Creative Kiddo Preschool (CKP), HCMC, Vietnam

Date of site visit: November, 2023 Students: infants 18 months to 6 years. Creative Preschool is a private preschool with about 5 campuses in Ho Chi Minh City. The campus is located in Phu Nhuan District. Since its establishment until today, . The Creative Kiddo Preschool - has always followed the mission to work with 5 main principles. They are: Building positive relationships and interactions between children and teachers is the foundation for successful learning; social-emotional competence is a key factor for academic success; play activities must be purposefully designed to complement learning; the physical environment affects the nature and quality of learning; coordination between school and family improves the quality of children's development and learning (<http://creativekiddo.edu.vn/>, n.d.).



Figure 68

Figure 69

Figure 60: The outdoor and indoor play yard on the ground floor

Figure 61: The stairs and lobby before classroom are too small.

The Phu Nhuan campus, originally a villa, has been renovated, so space is limited. As a result, the individual functional areas in the pre-school area are small. For example, the outdoor area consists of a compact front garden on the first floor, which is really small, resulting in noise and crowding during mealtimes for the toddlers (Figure), although this preschool also has a separate dining room, but it is not enough for all the children. Also, the playground has been taken over from the roof and needs to be decorated to simulate an outdoor environment.



Figure 70

Figure 71

Figure 62: The setting of ground floor for eating time of young children

Figure 63: The rooftop is renovated to outdoor school yard for children in CKP preschool.

The preschool was renovated from a villa, with each classroom functioning as an individual, separate room, without connections or disruptions between them. Additionally, the hallways are limited in space and not designed to store children's handbags or clothing, leaving no space for parents. Due to the restricted space, children cannot move or run freely and must follow the teacher's supervision for safety. Each classroom accommodates 18-20 children and is supervised by two teachers, with a layout based on CPK's Montessori-inspired pedagogy. The main vision is to encourage interaction, solidarity, and support between students and teachers. There is no individual closet space for children's belongings, so all items

are stored in a shared closet on the first floor. Additionally, parents do not have social spaces in each classroom. The preschool classroom, designed for 20-22 children, is divided into an active zone and a quiet zone, with a central column covered in rope for safety. Furniture includes wooden shelves, tables, and chairs. The shelves, standing 1000 mm high, have no wheels and are organized into learning corners following Montessori and STEAM principles. These areas cover five key learning domains: Practical Life, Sensory, Mathematics, Language, and Cultural Studies, based on the Montessori curriculum.

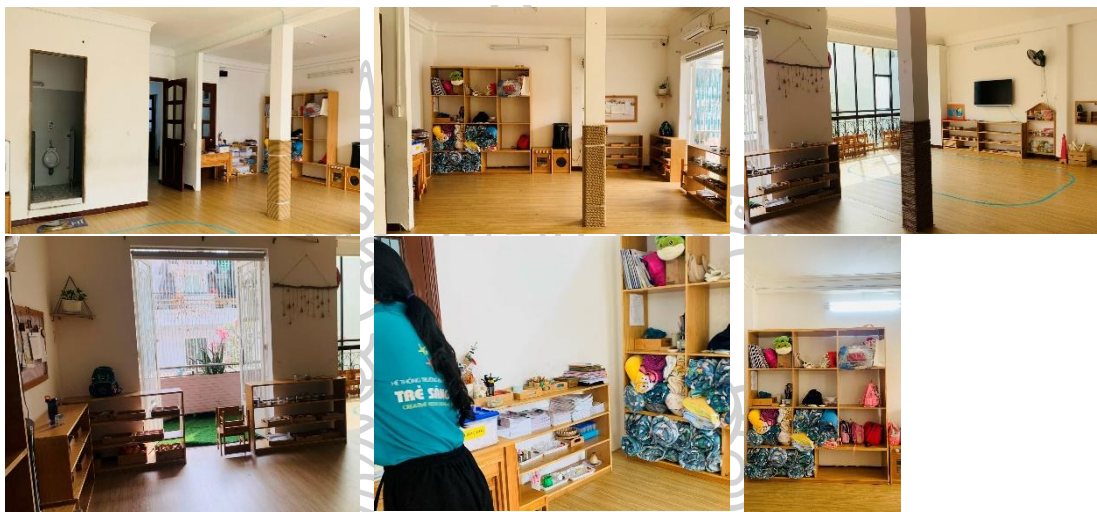


Figure 64: Interior design of signature preschool classroom in CSC

This preschool classroom lacks key functional areas, such as designated workspaces and toilets for teachers, due to space constraints. There is no indoor drinking fountain; it is located in the corridor. Additionally, storage facilities for both teachers and children are absent. The toilet facilities meet only basic requirements, with solid walls that hinder teachers' ability to monitor children's activities.

3.1.1.5. The Maitri Montessori Kindergarten, HCMC, Vietnam

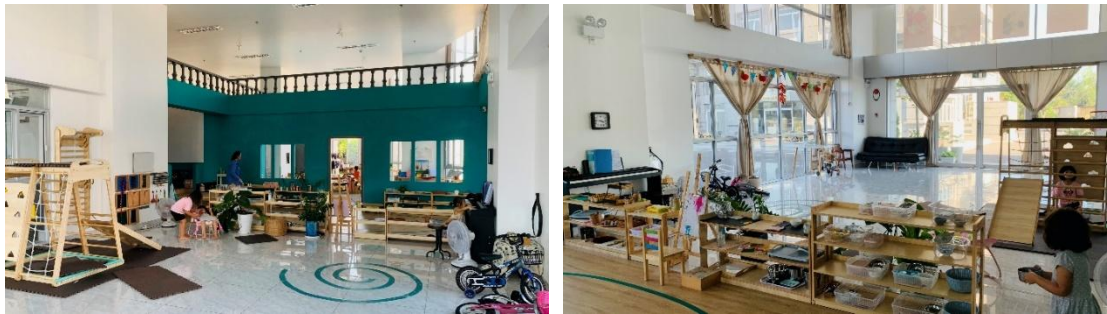


Figure 65: The indoor play yard in Maitri kindergarten

Address: 31 Luong Dinh Cua Street No1, Binh Khanh, District 2, Ho Chi Minh City, Vietnam; Website: <http://maitri.edu.vn/>; Date of site visit: December 2023

Student: Young children from 12 months to 6 years old.



Figure 66: The Maitri kindergarten floor layout

The Maitri Montessori Kindergarten, a private school following the Montessori pedagogy, is located in District 2, far from the city center. Unlike the previously mentioned preschools with their own campuses, Maitri is situated on the first floor of a residential building, surrounded by apartments and families. The school operates with a low occupancy density, covering around 100 m² for 30-35 children of all ages. This space includes a covered playground, kitchen, napping areas, and two learning areas for children aged 1-3 and 3-6. Due to its limited location, Maitri lacks a large outdoor playground compared to other preschools. (Figure).



Figure 67: Interior design of the area for 1-3 years old children

The main advantage of the Maitri preschool is its well-ventilated space. It has many large doors and windows that allow natural light to enter the classroom. All functional areas are interconnected, creating a well-organized flow of traffic and allowing children to move easily between the different rooms under the teacher's supervision. The limitation of Maitri, however, is its overall space. Since it is a private preschool with a small total area, it lacks an outdoor playground and green spaces. The children can go outside through glass windows, but they cannot really interact with the natural environment.



Figure 68: The area for 4-6 years old children



Figure 69: Interior design in Maitri preschool, HCMC

The advantage of the Maitri Preschool, however, is its high ceiling, which ensures good ventilation and allows natural light and wind into the space. Maitri has a small scale, so it is better to manage the design of the entire space. Changing the material can create visual boundaries to make the space look larger. The entire space of this preschool has the same design theme with the same material and a key color (dark bluegreen) to create a focal point. The use of different materials in furniture and working materials according to Montessori pedagogy to create a stimulating and complex learning environment for children, such as hammock chairs, oak wood tables, curtains, fabrics, tile floors, wooden floors, plants and acrylic working materials.

3.1.2 Comparative analysis of classroom interiors in public and private preschools

(see Appendix H for detailed information)

3.2 Phase II – Design Process

3.2.1 Analysis 3 specific campuses of a private Montessori preschool

After completing Phase I, which included an on-site analysis of five different preschools, both public and private, the author discovered the core layers and sub-layers within the system of 7 spatial layers of cooperation in the interior of preschool classrooms. The study revealed how the type of preschool, curriculum,

and pedagogy influence the design of not only the interior spaces, but also the entire preschool. The author will continue to analyze the interior design of a particular preschool with different locations in HCMC to examine how the differences in design manifest even when they use the same pedagogy and similar teacher training programs led by an educator. What is the most important factor in the systems of this preschool that affects the design of the indoor spaces and the children's activities?

In Phase II, the author analyzes three locations of the Creative Children Preschool (CCP), a private institution in Ho Chi Minh City known for its specific Montessori pedagogy, which is very popular in Vietnam and other Asian countries. The three sites are in different districts of HCMC. The aim was to observe and analyze the interior design of the preschool classrooms and other spaces to assess their alignment with the principles of Montessori education in combination with the national curriculum and STEAM. Classroom observations, short interviews and exchanges between preschool teachers and educators were conducted to discover and understand how the interior design of the spaces can support the children's daily activities and contribute to their development.

The selected preschool is "Creative Kiddo Preschool", it has five campuses around HCMC, the author goes on site analysis of three main campuses, including the two campuses located in District 12, and one campus located in Phu Nhuan District, which is mentioned in Phase I. The reason for this is the difference in scale in this area. The campus on Ha Huy Giap Street is large, Thanh Loc Street is medium, and Pho Quang Street is small.

3.2.1.1 The campus is in 461- 463 Ha Huy Giap Street, Thanh Xuan Ward, District 12, HCMC

The HHG campus has a total area of approx. 2500 m², including the playground, parking lots and many functional areas. Due to the large land and construction area, this campus is one of the main campuses and will be equipped with a large budget. The preschool has a swimming pool, a parking lot, an outdoor playground, an indoor playground, a main lobby with a reception area, a parent's

corner, three separate functional rooms with art classes, a dance/gym class, a play class, a kitchen and a fairly large dining room for all students.



Figure 70: Outdoor space of CCP preschool

The offices, reception area and main lobby on the first floor are more spacious and convenient for children's movement and for dropping off children in the morning and picking them up in the afternoon. This main lobby could be a good place for the children's social activities as they meet and talk to new friends in the other classes.



Figure 71: Main lobby and office rooms on the ground floor, CCP Preschool

Many preschools offer well-organized classrooms, typically arranged opposite each other with a central connecting corridor. Each classroom, accommodating 20-22 children, has large windows and ample space for functional areas. Shared restrooms are positioned between classrooms to save space, while teachers have their own cupboards and restrooms. Unlike public preschools, teachers do not need a workspace within the classroom, as administrative support is provided at the reception. The space is designed for functionality, with the reception centrally located on the first floor to manage traffic flow. Functional rooms, such as the kitchen, dining room, dance studio, art room, and pretend play area, are separate, offering dedicated spaces for various activities. This layout encourages physical

movement and social interaction as children transition between classrooms and activity areas.



Main pre-
Classroom 1



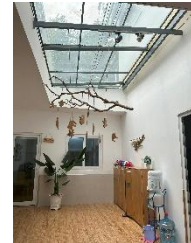
Pre-classroom 2



Dance classroom



Pretend play
classroom



Lobby at art and
block areas



Figure 72: Interior space of CKP preschool classroom.

On the second and third floors, the rhythmic composition was developed with a series of classrooms on different levels facing a central long corridor (see Figure). The corridor contains wooden cupboards for the children's belongings, such as handbags, outerwear, helmets, blankets and pillows for naps. Large foyers and corridors as well as a clear flow of traffic between the functional areas throughout the space help to ensure that children can move freely and safely around the interior under the supervision of the teachers. Socio-emotional development is also supported by open and connecting spaces. The cupboards are designed as drawers without doors, making it easier to store items and for students to access them.

However, the lack of doors can lead to a cluttered appearance in the corridor, where an airy feel for physical and visual activities should be the priority. The overall color theme on the campus and in the classrooms is light, featuring shades like beige and natural wood tones from wood materials. This keeps the space bright and highlights the colors of furniture and elements intended to

capture children's attention. Wood is the primary material used for chairs, tables, cupboards, shelves, and floors in the classrooms. Walls in classrooms and restrooms are tiled up to 900 mm for easy cleaning, while restroom floors feature matte tiles for safety. Classroom ceilings are flat and undecorated, equipped with clean, dust-free LED downlights. The space has minimal decoration, with a few children's pictures displayed on the walls and beige curtains in the classrooms, maintaining a clean and clear atmosphere. Colorful partitions in the restroom add a cheerful touch. However, the furniture lacks uniformity, creating a visually inconsistent space.

Each classroom is equipped with air conditioning and wall fans. Due to the advantageous location and the total area, the classrooms are located away from the main road, resulting in a low noise level. The noise comes from the children and the interior.



Figure 73: Interior design of pre-classroom, toilet space

This campus is characterized by a uniform interior design, from the physical elements to the visual elements, with a bright color theme. Wood is used as the primary material, and the main color is green-blue, which appears in various spaces to create visual boundaries or highlight key points. One teacher said: “Children can thrive in a well-organized and thoughtfully designed environment like this preschool.

3.2.1.2 The campus locates in 230 Street TL13, Ward Thạnh Lộc, District 12, HCMC

The HHG campus has a total area of about 600 m² and a built-up area of about 1500 m², which is smaller than the Ha Huy Giap Street campus. However, this campus also has enough functional areas, such as a swimming pool, a parking lot, an outdoor playground, a half-half covered playground, classrooms and two functional classrooms.



Figure 74: Outdoor playground of the campus

The biggest difference and also the advantage of this campus compared to other campuses of CKP is the big garden with big trees (Figure) in the middle, where young children can learn how to be a farmer and what the natural environment looks like. Sometimes the children take their lunch outside, without air conditioning, to enjoy the fresh air and the beauty of the garden. The garden is changed from month to month and year to year so that the children learn about the weather. This campus was modeled after the Ha Huy Giap campus and is characterized by a large area with large trees that were incorporated into the interior design. In this campus, the architects have designed two different buildings with a central garden as a connecting point. One building is intended for children aged 3-6 years, the other for children aged 1-3 years. This division offers significant advantages in controlling noise from other classes and children.



Figure 75: Interior space of the preschool classroom and art classroom

3.2.1.3 The campus is in 22/4 Pho Quang Street, Ward 9, Phu Nhuan District, HCMC



Figure 76: Outdoor playground on the ground floor

Figure 77: Indoor playground, ground floor

The HHG campus covers a total area of about 150 m², with a built-up area of approximately 500 m². In analyzing Phase I of this campus, it is clear that the Pho Quang campus has a smaller total area compared to the other two campuses, leading to limited building space. As a result, the spatial layout restricts children's ability to move, run, or jump, and social spaces like lobbies and corridors are also constrained. To ensure safety, space is further limited. Additionally, the small outdoor play area allows minimal natural light into the classrooms. While the color,

materials, and furniture themes are similar to other campuses, the PQ campus uses more graduated color tones and decoration. Overall, the spatial environment, shaped by the spatial layers, shows little variation between campuses.



Stair



Corridor and lobby between classrooms



Interior space of a preschool classroom



Outdoor playground on the rooftop of the school

Figure 78: Design of interior space of CKP Preschool, Pho Quang Campus, HCMC.

In summary, although the three sites use the same pedagogy, similar teacher training programs, and a uniform administrative system with a similar number of children and teachers in a classroom. But the difference in location, i.e. total area and building area, leads to significant differences in spatial function, i.e. core layers, and then affects the design of spatial order and spatial form. This leads to

differences in terms of the influence of space on the holistic development of children.

Although the three campuses belong to the same preschool system, the 'Children Creative School' (CCS), and share a unified vision and pedagogy that combines the national curriculum, Montessori and STEAM education, differences in location, average building size and number of teachers lead to variations in some spatial design layers. The results of the analysis show that the different location and size of the building can lead to differences in spatial function, spatial organization and spatial environment. The commonalities in the design of the three campuses are spatial color, spatial furniture, spatial material and spatial form. Each campus, whether newly designed or renovated, retains the characteristics of the location, such as the interior design elements: stairs, doors or windows

The results clearly show that sites with a smaller average location have disadvantages when it comes to creating a good flow of traffic for the children and integrating outdoor and indoor spaces into the classrooms. Maintaining the location of the hard-core feature of the previous building leads to difficulties in setting or layout in the preschool classroom. Compared to Campus 1 and Campus 2, Campus 3 is significantly smaller and can only be rented in limited time, resulting in high density and noise. It is difficult to create a “long corridor” that encourages children to run and move around. On the other hand, to ensure the safety of the children, the stairs and small lobbies need to be fenced off to protect the children between the different floors (Figure). The interior spaces need to provide plenty of space for social interaction, such as the stairs, the main lobby or connected corridors (Figure). In addition, the change in spatial form in the design must be consistent with the existing form of the building and the design of the spatial function or order. The layers of function and order must adhere to the building structure to meet the basic requirements of children's developmental needs. Thus, the interior form of the Pho Quang campus must follow the form of the existing building.

In terms of social factors, the preschool classrooms are too small, so the school can only accommodate a limited number of preschoolers to meet design

and teaching standards. This causes inconvenience for parents who want to send their children there. At the HaHuyGiap campus, for example, children have plenty of space to move around freely and socialize with others. When it's time to eat, the children can go from the classroom to the kitchen and dining room. This teaches children to move politely, to queue up and follow the teacher, and gives them the opportunity to observe their surroundings, not just in their own classroom. The large space can help children develop their physical development and build on this to further their understanding of people and the environment as they move around. Meanwhile, the proposal garden at the TL13 campus at 230 Street provides a great opportunity for children to interact with and learn from the natural environment and develop their love for nature. Although the area of Pho Quang campus is limited, it is not easy for children to move or run, but children can focus more on fine motor skills or individual development. Therefore, it is crucial not only for architects and designers but also for teachers and educators to understand the interior space of the preschool and how many layers there are and which layers can change and which cannot.

As a result, the design of the spatial function and the spatial order depend on the location of the plot and the average of the building. The characteristics of the location also lead to the design direction of the architecture and interior design for the entire space in general and the interior design for the preschool classroom in particular. At the same time, the color, material, furniture and form of the room can be easily changed and used in different locations.

To summarize, function, form and order can be seen as “core layers” or “hard layers” – which are difficult to change and need to be established from the first steps of the design process and depend heavily on the location. In contrast, color, materials and furniture could be considered “sub-layers” or “soft layers” that are flexible and easily adaptable and can be changed by teachers in their teaching process month after month, year after year. The environment could serve as a “transition layer” that is a transition or mediator between the more rigid, functional aspects and the more flexible, esthetic aspects, it suggests a blending or integration

or a result of both types of soft and hard layers. In order to achieve an optimal interior design for children, you must therefore carry out a site check as a first step and design the spatial function and spatial order or spatial form so that they meet the standard requirements as well as possible. In this phase, consider how function and order can contribute to creating a positive environment. Then develop the design further by incorporating additional layers.

The task of an interior designer is to identify a building's existing features as "hard layers," "soft layers," or "transition layers." They must then address core issues to align these features with basic design requirements, first adjusting the main elements of preschool classroom interiors. From there, they can gradually address other layers, working within the budget and aligned with the educational vision. When spatial function, order, or form are part of the "hard layers" and cannot be significantly altered, architects, designers, or teachers should focus on modifying "soft layers" to improve the space and better support children's developmental needs.

3.2.2 Questionnaire

3.2.2.1 Data and results of questionnaire

The questionnaire was created to conduct a quantitative survey with a large number of participants from the fields of design, architecture and interior design to find the answers to the research questions in this study, including the following questions:

1. What key components of interior design contribute to creating optimal classrooms specifically tailored to the developmental stages and needs of preschoolers?
2. How do specific spatial layers within physical classrooms meet the physical, socio-emotional, and cognitive needs of preschoolers, and how can these spaces be designed to support children's growth and learning?

3. What furnishing guidelines are recommended for the design of classrooms in a preschool environment and how can these guidelines be effectively applied and adapted to the context of preschool education in Vietnam?

To answer the research questions, the questionnaire consists of three main sections. The first section focuses on collecting participants' demographic information, including age, gender, academic background, parental status, and experience working with children. (See **Appendix C** for more information)

The second section examines the relationship between the interior, child development, and pedagogy. The aim is to show the interrelation of these three factors within the theoretical model for the design of preschool classroom interiors.

The final section examines the relationship between seven inner collaborative layers and preschoolers in the classroom. The goal of this section is to identify how these layers impact preschoolers' development and to make decisions about which key interior design components are best suited to create optimal classrooms tailored to preschoolers' developmental stages and needs.

Part 1: INFORMATION OF PARTICIPATE

Of the 52 respondents who completed the questionnaire, the majority were from Vietnam, with some participants coming from other countries.

1- Of the 52 participants who completed the questionnaire, a significant proportion (50%) fell into the 30-35 age group, indicating a high level of representation in this age group. In addition, 19.2% of participants were between 35 and 40 years old, while 13.55% were in the 20-25 age group. These results suggest that the survey data is predominantly from people with considerable life experience. Furthermore, these results suggest that the survey data is not skewed towards a specific age group, as participants from a range of age groups took part. This diverse participation helps to mitigate any potential bias in the research findings.

2- Approximately 59.6% of participants reported having children, suggesting that a significant portion of the sample population has some first-hand experience of raising and working with children.

3- In terms of the participant groups that responded to the survey, a wide range of fields were represented, including urban planning, architecture, interior design, preschool education, parenting, medicine, university students, and office work. Specifically, 32.7% of respondents indicated that they were parents with a background in other fields, 26.9% were preschool educators, and 25% were interior designers. The remaining percentage was split between urban planners and doctors.

PART 2: QUESTIONS ABOUT THE RELATIONSHIP BETWEEN THE INTERIOR SPACE, CHILDREN'S DEVELOPMENT, AND EDUCATIONAL PEDAGOGY

The results of the survey show that many participants (98.1%) believe that the design of the classroom interior influences children's development and their learning processes. This result is in line with the conclusions drawn from the literature review.

1- Regarding the ideal number of preschool children (aged 4-5) to be placed in a classroom with two teachers, the majority of respondents agreed that 10-15 children is optimal, followed by around 15-20 children. Conversely, there were no suggestions for class sizes of 25-30 or 30-45 children. This result is consistent with the literature review conducted in Chapter 2.

2- The reality in Vietnam, particularly in public preschools, often exceeds these ideal numbers, with classrooms accommodating more than 25-30 children depending on the preschool. This observation highlights a significant discrepancy between the survey results and the actual conditions in the classrooms. It shows that the number of children enrolled in these facilities is significantly higher than what was considered ideal by survey respondents.

3- The survey results showed that the ideal minimum space per child in a preschool classroom is around 2.0-2.5 m², as indicated by 34.6% of respondents, closely followed by 2.5-3.0 m², preferred by 32.7% of participants. In contrast, the standard in Vietnam is 1.5 m² per child, indicating a significant discrepancy. This suggests that parents and designers are striving to provide sufficient space for young

children in the classroom, which is reflected in their preferences for larger spaces per child.

4- Regarding the perceived impact of classroom interiors on children's physical development, the scores were graded from 1 to 5, from very low to very high. The results show that 40.4% of respondents rated the impact on children's physical development as level 4, while 30.8% rated it as level 3. For cognitive development, 58.8% of respondents rated the impact as level 4. For socio-emotional development, 44.2% rated the impact as level 4 and 38.5% as level 5.

5- In terms of impact on children's development, most participants agree that the interior design of the classroom has a significant impact on development, with ratings predominantly at level 4, almost reaching level 5 (very high). The greatest influence is observed on children's cognitive development. The socio-emotional development of the children is also significantly influenced by the design of the interior spaces, with 44.2% rating this at level 4 and 38.5% at level 5. Most participants agreed with the statement that socio-emotional development is strongly influenced by the design of the spaces.

6- The results show that the perceived impact of indoor environments on children's development is highest for socio-emotional development, followed by cognitive development and lastly physical development.

The following group of questions relates to the relationship between the factors within the seven spatial cooperation layers of classroom interior design and children's development. Participants were asked to give their opinion on which factors they thought were important to support aspects of children's development, including physical, cognitive and socio-emotional development.

7-The first question is about choosing the three most important spatial factors in the classroom that affect children's physical development? And categorize these factors.

	Number 1	Number 2	Number 3
Spatial Function	21	15	22

Spatial Form	12	26	18
Spatial Order	13	21	20
Spatial Color	16	18	22
Spatial Material & Texture	14	16	26
Spatial Furniture	22	17	17
Spatial Environment	17	18	20

Data of this question point out the most important factors influencing the physical development of children are spatial arrangement (furniture's arrangement), closely followed by spatial function. In second place is the spatial form and in last place the material and the nature of the space.

Spatial furniture/Spatial Function, Spatial Form, Spatial Material & Texture in order from number 1 to number 3.

8-The next question is about choosing the three most important spatial factors in the classroom that affect children's cognitive development? And categorize these factors.

	Number 1	Number 2	Number 3
Spatial Function	20	16	18
Spatial Form	13	25	18
Spatial Order	16	21	20
Spatial Color	19	18	20
Spatial Material & Texture	11	26	18
Spatial Furniture	16	23	17
Spatial Environment	15	23	18

As for opinions on which spatial factors among the seven layers in the inner classroom influence children's cognitive development, there is a remarkable

similarity in the selection between the layers. The only exception is spatial function, which ranks first with 20 mentions, clearly different from the other strata, with no significant differences between them.

In the 2nd position, there is a similarity in the choice between spatial form and spatial color, with 25 and 26 choices respectively, as well as spatial furniture and spatial environment, both with 23 choices. The situation is similar in the 3rd position: spatial order and spatial color each received 20 mentions; spatial function, spatial form, spatial material & texture and spatial environment each received 18 mentions; followed by spatial furniture with 17 mentions.

These findings suggest that the effects of spatial factors on children's cognitive development vary, with most factors influencing children's cognition in multiple ways rather than a single factor dominating. **This variability suggests that it was challenging for participants to choose just one factor as the most influential.** In summary, the spatial levels that affect children's cognitive development include spatial function/color, spatial material & texture/ spatial form, order, and color.

9-The last question of Part 2 is about choosing the three most important spatial factors in the classroom interior that affect children's socio-emotional development? And categorize these factors.

	Number 1	Number 2	Number 3
Spatial Function	22	23	10
Spatial Form	15	23	17
Spatial Order	13	24	19
Spatial Color	17	18	23
Spatial Material & Texture	12	26	19
Spatial Furniture	14	20	22
Spatial Environment	17	17	21

In contrast to the results on the factors affecting children's cognitive development, which showed a certain indecisiveness among the participants, the results on the influences on children's socio-emotional development showed a high level of agreement. Spatial function was chosen most frequently for position 1 with 22 selections, while spatial color was chosen most frequently for position 3 with 23 selections. The 2nd position showed a slight difference, with spatial material and texture being the most frequently mentioned with 26 selections and spatial order with 24 selections. In summary, the spatial layers that have an impact on children's socio-emotional development are primarily spatial function, followed by spatial material and texture, spatial order and spatial color.

10. In your opinion, does educational pedagogy relate to the interior design process?

Regarding the relationship between pedagogy and interior space, 96.2% of participants agreed that pedagogy is related to the interior design process. This suggests that interior designers should consider pedagogy, educational programs and teaching methods in preschool classrooms during the design process in order to develop effective design solutions.

11. In your opinion, what specific elements or principles of educational pedagogy do you believe should be prioritized or considered when developing interior design strategies for classroom spaces?

When asked about the specific elements of pedagogical principles that should be considered in classroom design strategies, 26 responses were received, in both Vietnamese and English. These elements include teaching methods, learning materials, the arrangement and positioning of materials, technology and support facilities. In addition, emphasis is placed on understanding the program of learning activities of each class in order to develop appropriate facility strategies. In addition, respondents highlighted features of the space such as safety, interactivity, use of natural local materials, open space, good temperature control and proximity to nature.

PART 3 - THE CORRELATION OF 7 INTERIOR COLLABORATIVE LAYERS AND PRESCHOOL CHILDREN IN CLASSROOM INTERIOR SPACE

The questions in Part 3 focus on the components of each spatial layer in the design of preschool classroom interiors. The sequence of spatial layers includes spatial function, spatial order, spatial form, spatial color, spatial material and texture, spatial furniture, and spatial environment. The characteristics of the interior space are examined to determine the most important features of the interior design of preschool classrooms.

1. Which factors of spatial function (density, boundaries, organization, architectural elements) should be considered in preschool classroom design? (There is more than one answer)

Density	15 - 28,8%
Boundaries	6 - 11,5%
Organization (Plan, Zones)	21 - 40,4%
Interior Architecture Elements	7 - 13,5%
All of them	27 - 51,9%

Regarding the factors of spatial function that should be considered in the design of preschool classroom interiors, the highest selection was the opinion that all factors are important, with 51.9% agreeing. The most important specific factor is organization, which includes space layout and zoning within the classroom and received 40.4% of selections. The next most important factors are density, interior design elements (such as ceilings, windows, doors and flooring) and boundaries.

2. In your opinion, which factors of spatial order do you think should be applied in the interior composition design of preschool classroom spaces?

Balance	15 - 28,8%
Harmony	13 - 25%
Unity and Variety	11 - 21,2%
Emphasis	3 - 5,8%
Rhythm	6 - 11,5%

All of them	28 – 53,8%
-------------	------------

The results for the most important elements of spatial organization in the interior design of preschool classrooms show that 53.8% of participants believe that all elements (balance, harmony, unity and diversity, emphasis, rhythm) should be considered. Maintaining the balance of the composition received the highest individual selection at 28.8%. Conversely, emphasis was considered the least important. Only 5.8% (3 responses) agreed that it was important.

3. In your opinion, what types of spatial forms should be used for the interior design of preschool classroom spaces?

Vertical Line	14 – 26,9%
Horizontal Line	9 – 17,3%
Diagonal Line	5 – 9,6%
Zigzag Line	4 – 7,7%
Curved Line	19 – 36,5%
Rectangle shape	11 – 21,2%
Triangle shape	7 – 13,5%
Square shape	11 – 21,2%
Circle shape	19 – 36,5%
Natural shape	10 – 19,2%
Nonobjective shape	4 – 7,7%
Sphere	7 – 13,5%
Cylinder	5 – 9,6%
Cone	2 – 3,8%
Cube	6 – 11,5%
Pyramid	4 – 7,7%
Irregular form	7 – 13,5%
All of them	23 – 44,2%

Regarding the type of spatial form to be used in the interior design of preschool classrooms, the survey results showed that the highest choice was 'all components'

at 44.2%. When looking at the individual components of spatial form, the majority of respondents preferred curved lines (36.5%), circular shapes (36.5%) and spherical/irregular forms (13.5%). These results suggest that respondents prefer forms that are smooth, dynamic, continuous and provide a sense of softness for children's spaces.

4. In your opinion, what spatial colors should be used in interior design of preschool classroom spaces?

Primary Color	29 – 55,8%
Secondary Color	19 – 36,5%
Tertiary Color	21 – 40,4%
Analogous Color	17 – 32,7%
Complementary Color	16 – 30,8%
Neutral Color	23 – 44,2%
Black	6 – 11,5%
White	10 – 19,2%

Regarding the colors that should be used in preschool classroom spaces, the survey results showed that the majority of participants chose primary colors as their highest preference at 55.8%. Neutral colors (44.2%) and tertiary colors (40.4%) were chosen second most often. Black and white were chosen the least frequently at 11.5% and 19.2% respectively.

These results indicate three main groups of color preferences among the participants: The first group prefers primary colors (55.8%), tertiary colors, and neutral colors; the second group prefers secondary colors (36.5%), complementary colors, and analogous colors; and the last group prefers black and white, with black being the least preferred.

5. In your opinion, which colors should be used in these below areas?

	Prim ary Colo	Secon dary Color	Terti ary Colo	Analog ous Color	Com ple- ment	Neut ral Colo	Bla ck	Wh ite	All of th
--	---------------------	------------------------	----------------------	------------------------	---------------------	---------------------	-----------	-----------	-----------------

	r		r		ary Color	r			em
Quiet Area	5	1	8	10	5	24	4	15	6
Activ e Area	26	19	16	8	11	10	3	6	12
Learni ng Area	16	12	16	19	12	12	8	7	10
Sleep ing Area	1	6	2	8	2	25	5	6	4
Playin g Area	12	9	11	6	7	3	0	3	8
Toilet s	6	7	7	3	5	6	1	13	5
Corrid ors	2	5	11	5	2	7	1	2	10

In terms of color choices for specific areas in preschool classrooms, including quiet areas, active areas, learning areas, sleeping areas, play areas, restrooms, and hallways, the survey results provided specific color recommendations for each area.

In detail:

Primary colors are recommended for active areas (26 selections) and learning areas (16 selections), but not for sleeping areas.

Secondary colors are recommended for active areas (19 selections) and learning areas (12 selections), with only 1 vote for quiet areas.

Tertiary colors are recommended for both active areas and learning areas (16 selections each), as well as play areas and hallways (11 selections each).

Analogous colors are recommended for learning areas (19 selections), while complementary colors are recommended for learning areas (12 selections).

The use of neutral colors as recommended for quiet areas (24 selections) and sleeping areas (25 selections).

6. In your opinion, which colors do you think children prefer for their classroom space?

Red	15 - 28,8%
Blue	24 - 46,2%
Yellow	21 - 40,4%
Orange	17 - 32,7%
Green	21 - 40,4%
Violet	12 - 23,1%
Black	3 - 5,8%
White	15 - 28,8%
All of them	18 - 34,6%

The answers regarding the colors that the participants prefer for their children's spaces are similar. The choices are quite similar for blue, yellow and green. The highest choice is blue with 46.2%, followed by yellow and green with 40.4% each. The lowest choice is black with only 5.8%. Preferences for orange, red, white and purple are equal at 32.7%, 28.8%, 28.8%, and 23.1% respectively. It can be seen from the results that the cool colors group is preferred over the warm colors.

7. In your opinion, what is the reason for your color selection for the interior design of preschool classrooms?

When asked about the reasons for color choice in preschool classrooms, participants' responses focus on the following main themes: Children's emotions, children's preferences, children's visual stimulation, characteristics of colors, and educational methods. The majority of responses agreed that color selection should

be based on children's psychological development, pedagogy, children's age, function, ...etc.

8. In your opinion, what type of spatial finish material should be used for the interior design of preschool classroom spaces?

	Ceiling	Wall	Floor	Bathroom	Shelves	Table	Chair	Partition	Don't use
Paint	31	24	10	12	6	8	7	8	2
Wall paper	8	31	6	4	4	1	2	6	4
Wood	8	11	31	4	23	25	24	18	2
Ceramic	3	7	14	32	0	1	1	3	4
Glass	2	10	8	14	1	1	1	3	20
Metal	8	9	7	8	3	3	1	4	22
Acrylic	5	16	10	4	9	8	7	7	14
Carpet/Rugs	6	5	26	6	3	0	2	3	9

The next question refers to the layer of spatial material and specific areas in the preschool classroom. Surface materials in the survey include paint, wallpaper, wood, ceramic, glass, metal, acrylic and carpeting in specific areas such as ceiling, wall, floor, bathroom, shelves, table, chair and partition.

For ceiling areas, most participants recommended the use of paint with 31 selections, making it the preferred material compared to other options. For walls,

paint, wallpaper and acrylic were recommended. For floors, wood and carpet or rugs are recommended. Ceramic is only recommended for bathrooms.

Wood is highly recommended for shelves, tables, chairs and partitions. The majority of respondents (20) believe that glass should not be used in preschool classroom interiors, with only 10 selections for walls and 14 selections for bathrooms. Metal received the fewest selections of the eight material types. 22 respondents agreed that it should not be used in preschool classroom interiors.

Acrylic is recommended for walls with 16 selections, for shelving with 9 selections, for desks with 8 selections, and for chairs and partitions with 7 selections each, although 14 respondents stated that it should not be used. For floors, carpeting or rugs are highly recommended with 26 selections.

To summarize, three materials are not highly recommended for preschool classroom interiors: Glass, metal and acrylic. Other finish materials are recommended depending on the specific areas.

9. In your opinion, which main characteristics of spatial layers should designers consider for the interior design of preschool classroom spaces?

Safety	38 – 73,1%
Comfort	33 – 63,5%
Flexibility	30 – 57,7%
Complexity	7 – 13,5%
Legibility	22 – 42,3%
Privacy	6 – 11,5%
Publicity	7 – 13,5%
Attention	12 – 23,1%
Accessibility	21 – 40,4%
Social Engagement	16 – 30,8%
Connect to Outdoor Spaces	21 – 40,4%
All of them	12 – 23,1%

As for the most important features of furniture that should be considered when designing the interior of a preschool classroom, safety, comfort, flexibility, legibility, accessibility and connection to the outdoors are top of the list.

10. In your opinion, which environmental factors should designers consider for interior design of preschool classroom spaces?

Lighting	25 – 48,1%
Noise	21 – 40,4%
Ambiance	24 – 46,2%
Cultural Factors	10 – 19,2%
All of them	28 – 53,8%

More than 50% of respondents believe that all environmental factors should be carefully considered when designing a classroom for preschool children. The most important factors are lighting, ambience and noise.

11. Do you have any suggestions for environmental factors that designers should consider for the interior design of preschool classroom spaces?

Suggested environmental factors that designers should consider during the design process include temperature, air quality, ventilation, natural lighting, plants, water, animals and seasons. Among these factors, the connection between outdoor and indoor spaces is cited as a priority.

12. In your opinion, which spatial layer do you think is the most important?

In terms of opinions on which spatial layer is most important, spatial function comes first, followed by spatial order and spatial environment. This is followed by spatial furniture, spatial materials, spatial form and finally spatial color. It is surprising that spatial color is considered the least important factor.

13. Other suggestion

Based on the survey suggestions for researchers, there are some important recommendations. The most important aspect of designing preschool spaces is to create a stimulating environment. It is not necessary to adhere strictly to educational pedagogy or to ensure uniformity in the design of the furniture. Socio-

emotional learning is considered to be the most important aspect of children's holistic development as it shapes their future. In contrast, cognitive development can take place in different environments, not just the preschool setting, and physical development can be encouraged later in life. It is also highly recommended to incorporate more plants into classrooms and preschools.

14. Do you think this research topic is considered valuable?

98% with 49 responses this topic is considered value.

3.3 Phase III – Design Evaluation

Phase 3 involves two steps: a pilot study and an in-depth interview. The pilot study is crucial because it "provides valuable information not only for the researcher's main study but also for other similar studies, offering insights into the study's feasibility" (In, 2017). The research outcomes include a model design for children's spaces, a theoretical model for preschool classroom interiors, a design framework with 7 spatial layers, and a design tool called "7 Spatial Collaborative Layers and Feeling Scale."

A workshop is conducted, inviting five participants from different disciplines, all of whom have children aged 4-5 years old. The participants include an interior designer with 15 years of experience and a 4-year-old daughter, an architect with 5 years of experience and a 4.5-year-old son, a parent of a 4.5-year-old boy, a preschool teacher with over 10 years of experience, and an educator with a background in architecture who manages a Montessori kindergarten for children aged 2 to 6. During the workshop, participants are introduced to the theory of interior design for preschool spaces using the 7 layers and the design tool. The session demonstrates how the tool can be practically applied, not only by interior designers but also by parents and educators with limited design experience who want to create optimal learning spaces for children.

The study used the in-depth interview method to elicit stakeholders' thoughts on the relationship between the indoor space, children's developmental needs and

pedagogy in the preschool learning space (See **Appendix D** for more information).. The group of interviewers, which is from HCMC, Vietnam, includes 5 people from different fields who have similar aspects related to the topic: Designers, educators or people who have experience with children, especially preschool children.

3.3.1 Workshop: Exploring how to apply “feeling scale” in designing interior preschool space following the theory of “seven spatial collaborative layers”

3.3.1.1 Preparation

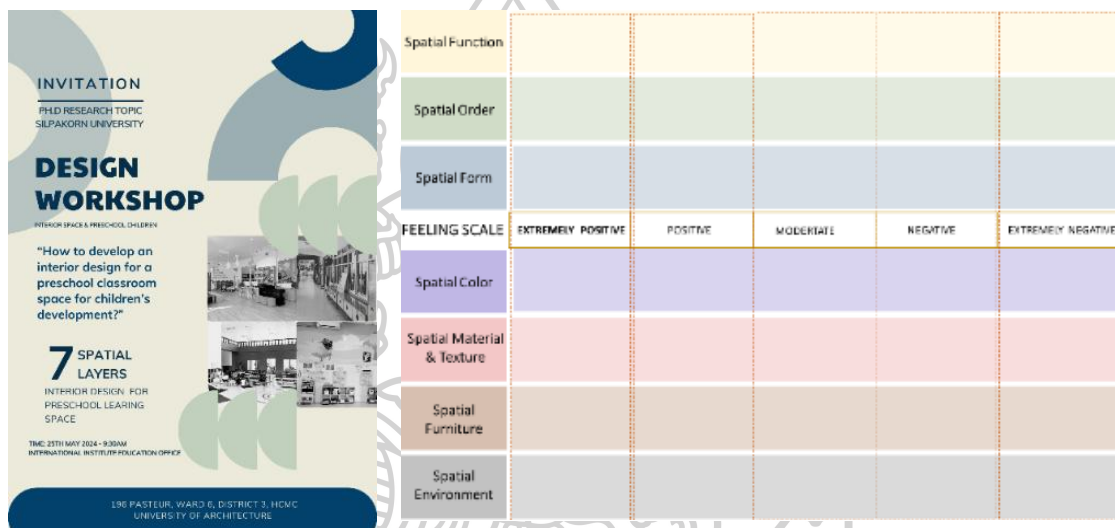


Figure 79: Design of workshop's poster and feeling wheel tool

Conduct a workshop in the office space “Designing Interior Preschool Learning Spaces” with about 5 participants at the University of Architecture Ho Chi Minh City to collect and analyze the visual artworks such as spatial drawing, design mood board, 7 layers and feeling scale board with 5 participants.

A - (parent) – 34 years old, mother of a 4.5 year old boy (born in 2020), currently works as a lecturer at the University. Her 4.5 year old boy goes to a public kindergarten in HCMC, Vietnam.

B - (architect, urban designer) – 32 years old, mother of a 4.5 year old boy (born in 2020), works as a lecturer in urban planning at the University and has about 10

years of professional experience in design. Her 4.5 year old boy goes to a private kindergarten in HCMC, Vietnam.

C - (interior designer) – 40 years old, mother of a 4.5 year old girl (born in 2020) studying in a private kindergarten in HCMC, Vietnam. She works as an interior designer and has about 17 years of professional experience in the design field.

D - (preschool teacher) – 37 years old, mother of a 7-year-old boy (born in 2016), works as a preschool teacher in a public preschool in HCMC, Vietnam, and has about 10 years of professional experience in the education field in public preschool and national pedagogy.

E - (educator, preschool teacher) – 35 years old, mother of a 5-year-old girl (born in 2018), founder of a private Montessori kindergarten and 10 years of professional experience as an architect. To open and run a Montessori kindergarten in HCMC, Vietnam, she took some courses about Montessori philosophy.

Involving parents, educators, and designers ensures a well-rounded approach to classroom design. Parents offer insights into children's needs, educators share firsthand experience of classroom dynamics, and designers provide technical expertise to create functional spaces. Participants were selected through purposive sampling, including parents of young children, educators with at least three years of experience, and designers specializing in educational spaces. Recruitment occurred via schools, parent associations, and professional networks. While not aiming for statistical generalization, the diverse sample enhances the transferability of findings across educational settings.

3.3.1.2. Process of workshop



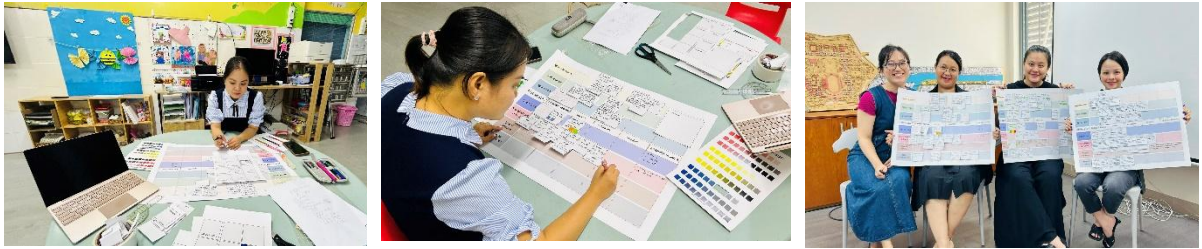
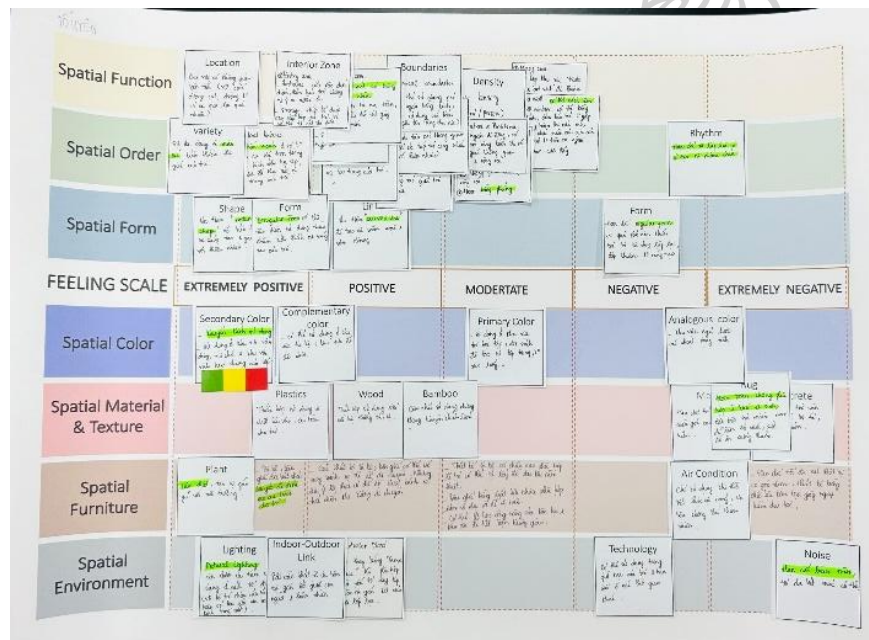


Figure 80: Workshop.

The participant using feeling scale board to analysis interior classroom space of their children in preschool environment after supplying the information about the guidelines for designing interior space of preschool classroom. After finishing the analysis process, the participants have more understanding about their space, not only that, they feedback that they can use the “feeling scale board” as tool to brainstorming or concepting for interior design of preschool classroom. They know how many layers in space and how can use them to create positive effects to children.

Figure 81: Results of the “Feeling scale” boards





3.3.1.3 Thought and feedback of participants

A – The research is not only useful for designers, but also for parents who want to create a space for their children at home. Through workshops, research and hands-on practice with the tools presented, parents will gain a clearer understanding of what they and their children want in terms of interior spaces. The results of the research can be applied in small spaces such as homes as well as larger settings such as schools or playgrounds. The workshop activities are practical, direct and easy to understand and encourage interaction and exchange of ideas between parents with children of similar ages. The authors can also consider economic factors when applying these designs.

B – Research has the potential to promote implementation values for many disciplines such as interior design, architecture, interior design, urban development, education, etc. The research provides insightful knowledge about interior design for non-designers who either want to design their own homes or develop educational facilities.

As a participant of the research workshop, I appreciate the program and practices developed by the researcher. As a mother, I learned more about designing spaces,

and as a practitioner, I learned more. The research not only sheds light on how designers should design children's rooms, but is also helpful to the field of psychology/education. This makes it a valuable piece of social knowledge from which our children will benefit immensely for the good of society.

C – The workshop gave me more knowledge about the necessary, safe and best spaces for children's development and helped me gain more experience in choosing better learning spaces for children and improving their spaces at home. As an interior designer, "I have learned some very useful knowledge and tools for space analysis and future design/development through the hands-on process with the "7 layers" tool and workshop members.

I thank the researcher and author for choosing such a great and useful topic and giving me further experience and insight. This topic is extremely important and of interest to many families with young children to help them optimize their early development.

Suggestion: Designers should pay more attention to emergency exits, fire safety and firefighting – factors that are currently lacking in the design and operation of childcare centers. Regarding future research books: use language that is generally understandable and not too academic so that readers can easily understand it. There should be plenty of examples and illustrations to help readers visualize. Use diagrams and key words to make them memorable and clearly indicate which problems to avoid and limit.

D – I am very excited to learn more about a new field today – interior design for children. Today's interview and advice from the experts has helped me a lot in designing my classroom for the next few years.

Suggestion: Designers or experts can research more about materials – eco-friendly materials that are safe for children, especially at reasonable prices so that teachers can easily find and use designed items and toys for children.

E – The research on children's interior design benefits both designers and parents looking to create better spaces for kids. Through workshops and hands-on practice, parents can better understand their children's needs, applying insights to homes,

schools, and playgrounds. This research is valuable across various fields like interior design, architecture, and education, helping non-designers create better environments for children. As a workshop participant, I gained useful knowledge on space design and analysis, benefiting both my role as a parent and professional. The topic is essential for optimizing early childhood development, and I appreciate the researcher's work in this area.

3.3.2.1 Transcription and familiarization with the in-depth interview

1. What is the key element of interior space impact to children's physical development?

A – Dimension of space, spatial density. Safety of interior design elements (doors, windows, corridors); traffic flow of children.

B – Dimension of space, spatial density. The classroom provides enough space for children to move and run around comfortably, with a logical flow of traffic; the second element is the lighting system.

C – Dimension of space, spatial density” 2-3 m² per child. The classroom has enough space for the children to walk and move around comfortably, with a logical flow of traffic; there is also a clear view so that they can observe easily. Sufficient light enters the classroom.

Logical and clear spatial arrangement. Modular furniture, flexible spatial design.

D – Good spatial density, with 40-50m² (20-25) or 25-30m² (15-20) per classroom. Good ventilation, appropriate spatial layout and arrangement (each zone separate in 1000MM), easy movement for the children, separate quiet areas – active areas. Natural light and artificial lighting.

E – Dimension of space, spatial density. Classrooms have enough space for children to walk and move around comfortably, with logical traffic flow. Should be 3.7 m²/child, maximum 30-35 children in a preschool classroom with 2-3 teachers, about 100 m² classroom space.

Lighting system and ventilation. Lighting for motor and fine motor skills.

2. What influence do key elements of the interior space have on children's cognitive development?

A – Social interaction with peers and teachers, study material = spatial organization, arrangement of study material.

B – Color and material. Color creates an immediate visual impression, while texture appeals to the sense of touch — both are crucial elements of human perception.

C – Design to stimulate children's sense of touch and sight.

Vision: Spatial color and spatial order shape daily activity habits. Clean and well-organized spatial arrangements can help shape children's organizational habits. Color and shape are essential elements to promote the development of esthetic thinking.



Tactile: A variety of materials and textures should be used. Materials with 3D textures in the environment can encourage both visual and tactile interactions.

D – Stimulate children's imagination by creating and decorating corners in the preschool classroom that stimulate children's curiosity to explore. The focus is on the play or block area.



Using color to promote children's cognitive development -> using pastel/neutral colors for outstanding learning material so that children can discover it more easily.

3. What influence do the key elements of the interior space have on the socio-emotional development of children?

A – Familiar environmental factors through sense of place, sense of belonging, and belongingness to place. Peers interact and share similar interests across zones.

B – Spatial function includes the layout, spatial organization and arrangement of furniture in classrooms and preschools that promote good circulation and encourage social interaction between children, peers and teachers, even across different classes. For example: the playground area, the corridor and the lobby.

C – Spatial function: layout and composition, both in public and social spaces and in intimate spaces in a classroom. Encourage modular furniture to increase flexibility in changing spatial design and encourage social interaction.

Space is the key social factor for connection between teachers and children.

D – Large space, enough for public space -> social space -> personal space -> and intimate space, each group has its own space, and individual space.

E – Spatial layout and spatial order, spatial furniture. Separate group area and individual area.

Easy to observe for adults and children. Different functional areas so that the children learn how to share the space with others.

4. What influence does pedagogy have on the interior design of learning spaces, especially classrooms? What specific elements or principles of pedagogy do you think should be prioritized or considered when developing interior design strategies for such spaces?

A – The difference between public and private preschool, national and international curriculum

B – Pedagogy leads to the shape of space. The main developmental factor that pedagogy wants to focus on is the impact on the curriculum and the plan of daily activities. This leads to changes in density, corridor connectivity, traffic flow, spatial organization and furniture arrangement.

C – Preschool culture, teaching methods, learning methods, facilities. Different teaching methods result in different spatial design and composition. Do not apply a pattern design for different spatial designs.

D – Should separate classrooms with different functions and not create multiple classrooms (lack of learning materials, facilities). The spatial design and arrangement should follow the pedagogy.

Simple furniture and materials that accumulate little dust. The furniture is light so that the children can put it together themselves.

The plan for the arrangement of games and activities in the classroom is developed based on the specific physical development conditions of the children in that class.

E – Very important -> has a significant impact on the room design. Basic requirement: size and safety of the children.

5. What is a good interior space for children to discover, experience and explore?

A - There are spaces like the Café-Kids, where there are several zones with different functional areas, where different activities can be experienced and which are easy to observe.

B - Large space, flexible layout, easy observation, connection of outside and inside, trees outside and plants inside, clean and clear, good ventilation and temperature.

C - Large space, modular furniture, color and shape follow each specific functional zone, natural light, open space and safe study material.

Space helps to enhance and promote imagination and should use 3D shape and form.

D - Natural connection, Various learning materials with specific storage -> Teacher can directly arrange and change the setting. The furniture can also serve as toys for the children.

E - Complexity in the space. Diversity on every layer.

6. What factors of spatial function (density, boundaries, organization, architectural factors) should be considered in the design? How should they be taken into account?

A - Visual elements of spatial function, guidelines for teachers, separate quiet zone - active zone, light furniture for easy arrangement by children.

B - Solid and empty space -> Spatial density. Boundaries to create good spatial experiences (inside-outside, top-bottom, left-right), spatial order in the spatial composition with furniture and the arrangement of study material.

C - Boundaries help to separate sight and smell -> use of mobile and stable partitions in integrated classrooms or separation of different classrooms. Consider safety in the architectural design: ensure good visibility, avoid slippery surfaces and provide clear exits and fire alarms.

D - Boundaries help children recognize the goals of space. Use color and shape to develop graphic signs that are easy for children to recognize and identify the space and its function. Use transparent material so adults can observe children for safety.

There should be room for the teacher in the preschool classroom: Teacher's cupboard, desks and chairs, toilet.

Use the solid wall to separate the classroom to avoid noise.

E – Boundaries -> open boundaries and close boundaries, connection within and without.

Separate function in space. Logical traffic flow, unrestricted circulation.

7. Which spatial factors of spatial order (balance, harmony, unity and variety, emphasis, rhythm) do you think should be applied in preschool learning spaces?

A – Center of gravity or unity and diversity for social activity zone. The spatial arrangement is based on the curriculum plan.

B – Based on the philosophy of educational pedagogy to create the main flow of traffic. The spatial arrangement helps children to improve their spatial experience skills through physical and sensory experiences.

C – Different spatial orders based on the different functions -> Use different ones to help children recognize the differences in space. Separate different orders with colors.

D – Different spatial arrangement based on the different function -> use different so that children can recognize the difference of space. A composition should be created based on the size and physical development of the children.

E – Depending on the spatial arrangement and location.

Prefer the octagonal floor plan in the interior design of preschools: focal point -> the center of the school; the edges of the octagon are functional areas. -> Have a focal point area to connect all classes.

Rhythm -> use for the corridor.

8. What types of spatial forms should be used for preschool learning spaces?

A - Prefer safety -> circle, curve, curved form, oval shape.

B – Prefer safety -> circle, curve, curved form. This group of shapes can encourage interaction between children.

C – Should be carefully considered. Focus on the form of the furniture: chair, table, shelf. Prioritize modular furniture with multifunction. Furniture should be considered as a learning material or teaching tool in the classroom.

Form in space: different shapes in different areas help children to recognize the space.

D – Use more shapes and forms in the space, not just geometric shapes. Spatial shapes help children to improve their spatial perception. Use simple abstract shapes or simulations to stimulate children's imagination. Avoid excessive decoration as it is difficult to clean, collects dust and takes up space.

E – Use a variety of shapes in children's spaces to accommodate different sizes while maintaining a connection to family and community. Designate a specific area as a focal point with unique features and keep the rest styled for everyday use.

9. Which spatial colors should be used for preschool learning spaces? Do you think bright colors should be preferred over dark colors, and why?

A – Prefer bright, highly saturated and vivid colors. Active zone: bright color; Quiet zone: dark color

B – Light colors, light shades, pastel shades.

C – Light colors -> easy to clean and clear space. Dark colors make the space darker and have a negative effect on the children's psyche.

D – Pastel colors, analogous colors, limited use of contrasting colors, more natural colors. Do not use black/gray or dark colors.

E – Light and soft colors: Beige, light gray, light colors. Do not use white paint.

10. Which spatial materials should be considered in preschool learning space design, and how?

A – Plastic. Not recommended material -> difficult to clean

B – Use hard and soft materials for different areas. Prefer wood.

C – Environmentally friendly materials: non-toxic, not too rough and dust-free

D – Prefer wood, natural materials and different materials. Ceramic and tiles for the walls -> easy to clean.

E – Provide variety, as different materials and textures can stimulate children's senses. Use natural and realistic materials, avoid plastic.

Natural material and texture -> as the studying material to teach children about nature.

Diverse surfaces and varying weights

11. In preschool learning space design, which characteristics of furniture should designers consider, and how should they be considered?

A – Vibrant colors and stimulating patterns, do not use a wheel on the furniture.

B – Support the teaching and learning process. Favor wooden chairs and tables over plastic or acrylic.

C – Mobile, flexible, modular furniture.

D – Orientate to the size of the children and use wheels for all shelves -> easy to move and change function. The shelf should consist of individual blocks -> the children can put together their own learning materials.

E – Depending on the items that are set, based on the function.

12. What are your thoughts on other environmental factors?

A – Temperature and lighting, air conditioning, position of doors, windows, ventilation

B – Ventilation

C – Connection between inside and outside, more green spaces in the interior. Noise in the environment.

D – Provide individual spaces, noise protection, a ceiling height of about 3,000 mm and lighting in all corners of the space to avoid dark areas.

13. Can you suggest some applications of the 7 interior collaborative layers in interior design strategies for preschool learning spaces?

A – Select the optimal spatial level for the design based on the different site conditions, site analysis and budget.

B – Apply all 7 layers in the design and help the children to have a good spatial perception by optimizing the interior design of the preschool classroom

C – Based on budget and location -> prioritize the necessary layers. Spatial Function -> Order -> Environment -> Color -> Furniture -> Material -> Form

D – Teachers should understand their preschool space and create an annual plan to adjust each layer based on budget or children's needs. They should use research tools for site review, analysis, and implementation of changes at each level.

E – Based on budget and location -> maximum the shifts with the hard characteristics.

14. In your opinion, which layer do you think is the most important?

A – Spatial function, spatial environment.

B – Function, order, color, environment, form, material, furniture.

C – Function, order

D – Color

E – Which layer has an influence on children's cognition.

15. Other suggestions

A – To improve children's learning spaces, the author should compare private and public preschools to identify differences and provide tailored guidelines for various pedagogies and budgets.

B – Enhance stakeholder value and children's spatial experiences in HCMC, Vietnam by reassessing design conditions. Identify underestimated spatial layers and prioritize their integration in future designs.

C – High value areas with seven layers should be made accessible to the public. Also consider exits and fire alarms for security.

D – High value for both private and public schools.

E – The value of this research is enhanced by its rarity in everyday life.

3.3.2.2 Analysis of the Results

Here is the result table after you have broken the text into smaller pieces and found the code for each segment. These codes are grouped into categories and you look for relationships and patterns between these codes. Finally, the main category is identified, which is the main topic of this investigation.

Question	Main themes	Category and Main Codes	Sub-codes
1	Spatial Function Spatial Environment	Main goal: Promote children's physical activities, easy movement, run, and interaction together Spatial Function: - Dimension of Space - Density - Logical traffic flow in spatial layout, good circulation - Clear observation for both adults and children - Spatial Organization: Separate Quiet Zone – Active Zone - Natural Ventilation	Lighting Natural Ventilation 2-3m ² per child 15-20 child/class 20-25 child/class with 2 teachers 30-35 child/class with 3 teachers S=100m ² (benefit for economy, too)
2	Spatial Color Spatial Material Spatial Organization (Layout and Composition)	Main goal: Stimulate children's sense (vision and tactile) Sense of vision: color Sense of tactile: material (natural material) Clear and well-organized spatial arrangements help to enhance good habits in arrangement Place belongs	Furniture Natural connection
3	Spatial environment Spatial Function	Sense of belongingness Spatial Organization -> Flexible Proximities, Layout & Furniture Arrangement.	Social interaction Space is considered as a

	Furniture	well Circulation to Social connection	tool
4	Pedagogy	Difference educational approaches: National curriculum or International Curriculum. Leads to Interior design -> Layout/Arrangement/Organization -> Teaching methods -> Material/Furniture	Daily activities plan
5	Good interior space for children	Safety Multi-zone, Diversity and separate areas, Complexity, Flexibility, Stimulation Easy to Observe for both adults and kids Clear and well-designed circulation for movement Well organization and arrangement Natural connection, Outdoor and Indoor Integration, have green space	3ds material 3ds shapes & forms
6	Spatial Function	Visual elements Spatial Organization -> Quiet zone + active Zone/ Teacher areas Boundaries: In-out, Top-bottom, Left-right, blur, integration Traffic Flow, Circulation (Corridor)	Order – Composition (Solid and Void)
7	Oder -> Spatial Perception in Visual	Based on the Curriculum Plan, Educational Orientation; Different function – different order; Depends on the Layout and Site; Oder follow function	No information
8	Form	Safety, Dynamic; Prefer Curved line, Curved shape, Curve, Circle Diversity Shapes and Forms; Abstract Image -> Not too much Focal Point	Form follow functional zones
9	Color	Bright color. Analogous color, Soft color Focal Point: Strong color, Contemporary color	Wall

		No use white or black; Color follow Function	
10	Material	Hard material - Soft material Environmental Friend Materials Diversity Texture and Surface	Prefer Wood Limitation use in plastic
11	Furniture	Vibrant color Light weight Smart and Flexible Children's size Follow Function	Using wheel Material
12	Environment	Ventilation; Temperature; Lighting; Indoor and Outdoor Integration; Green space Sense of belonging, Signature zone	Air condition Position of interior architecture elements
13	Application	Location – Site; Budget; Pedagogy; Improving Spatial ability of teacher Application all layers	
14	Most important	Function -> Order -> Environment -> Color	
15	Suggestion	Further research on Public – Private Preschool	

Table 23: Analysis of the Results in Survey Questionnaire

3.4 Summary Findings

After three phases in Chapter 3, there are findings are presented:

First, there is a binding relationship between children – space – and pedagogy in the preschool learning space, each subject affects the other subjects in many ways. The role of this relationship in the interior design process is not underestimated. Interior design for preschool learning spaces must consider the basic requirements of both the children and the teachers – the end users – in order to achieve an optimal design. At the same time, a deep understanding of the philosophy of pedagogy is an essential prerequisite for proposing an optimal interior design for preschool spaces. The interior designer must place the position of pedagogy on an equal footing with the requirements of the end users (teachers and children) in that space. The role and influence of pedagogical philosophy in the design of interior spaces for physical preschool classrooms is not underestimated. This includes teaching methods, learning materials, material arrangement and positioning, technology and support facilities, curriculum, daily activity plan and outdoor activities. Key terms for the characteristics of the interior design of preschool classrooms include safety, interactivity, natural material, open space, temperature control, natural connection, logical arrangement in the space and material.

The arrangement of the classroom has the greatest impact on the socio-emotional development of children, followed by the physical development of children and finally the physical development of children. Children's physical development could be influenced by spatial function and spatial furniture, next by spatial form and spatial materials & textures, children's cognitive development could be influenced by spatial function or spatial color, spatial materials & textures; children's socio-emotional development could be influenced by spatial function, spatial materials & textures and spatial order & color. Function, material & texture and color are the three prominent layers that affect children's developmental needs.

When furnishing preschool learning interior spaces, especially classrooms, 7 spatial layers are collaborative to create a unique space. The core layers are spatial function, spatial form and spatial order, which are important and difficult to change or replace. Subordinate layers are spatial colors, spatial materials and spatial furniture, which are movable and can be easily changed after prolonged use. The spatial environment is a combination of core layers and sub-layers. Therefore, the characteristics of the spatial environment can depend on the design of the core layers and sub-layers. In spatial function, the most important component is spatial organization, followed by density, interior design elements and boundaries. The most important layer in the group of core layers is the spatial function and in the group of sub-core layers the color.

In **spatial order**, the most frequently suggested components for the interior design of preschool classrooms are balance and harmony, followed by unity and variety, and finally emphasis. This suggests that interior designers should ensure that the entire classroom follows a composition of balance and harmony. Unity and diversity should be carefully considered and limited to certain areas, while emphasis should only be placed in very few specific places.

In **spatial form**, all components are recommended for the design of preschool interiors. However, there are some key components that should be prioritized, namely curved lines/curvy shapes/ or spherical/irregular forms that convey a sense of softness and dynamism and are continuous for each area to create an intimate space.

In **spatial colors**, primary colors, neutral colors and tertiary colors are particularly recommended for classroom space, followed by secondary colors, complementary colors and analogous colors. Black and white are not recommended for preschool rooms but should be used as a concept for lightness and darkness. Primary colors are recommended for active areas and learning areas, not for sleeping areas. Tertiary colors are recommended first for active and learning areas, then for play areas and corridors. Analogous colors are recommended for learning areas. Complementary colors are recommended for learning areas. Neutral colors should

be used for resting and sleeping areas. More specifically, the color group blue – yellow – green is preferred for children's rooms, followed by orange – red – white – violet. Black should not be used in children's rooms. The result here shows that warm colors are preferred for children's rooms, more than blue colors.

When selecting colors for preschool classrooms, consider factors such as children's emotions, perception, age, preferences, psychology, and stimulation needs. Additionally, consider the pedagogical approach, the space's function, sense of place, and overall spatial arrangement.

Spatial materials in preschool classrooms ceilings should be painted.

Preschool classroom ceilings should be painted, while walls can be finished with paint, wallpaper, ceramic tile, fabric, or acrylic. Wood, carpet, or rugs are ideal for floors, with ceramic recommended for bathrooms. Wood is best for furnishings like shelves, tables, chairs, and partitions. Glass should be used cautiously, particularly in walls or bathrooms, due to safety concerns in children's spaces. Metal should be used sparingly, and acrylic or plastic can be used for walls and furniture but are not recommended if the budget allows for better options. In summary, glass, metal, and acrylic should be carefully considered and selected based on their function within the space.

Based on this result, the characteristics of the space should be safety, comfort, flexibility, legibility, accessibility and natural connection. All **spatial environmental** factors should be carefully considered, with a focus on lighting, followed by atmosphere, noise and cultural factors. Temperature, air quality, ventilation, natural lighting, plants, water, animals and the changing seasons should also be considered. The priority of the environment is a natural connection, the connection between indoors and outdoors.

CHAPTER 4

DESIGN DEVELOPMENT

Based on the results presented in chapter 3, chapter 4 focuses on design development and the implementation of these results in design solutions. This chapter describes the process of translating the research findings into practical concepts and prototypes for preschool classrooms. A theoretical design model for preschool classroom interiors is developed, the concept of 7 spatial layers is presented with detailed design guidelines through 7-layer boards, a design guideline book and a sensing wheel, and some other prototypes are presented in an exhibition.

It is clear that much of children's cognitive development is the result of routine experiences in a confined space. A well-designed space can help young children unconsciously form good habits and develop long-term habits through daily interaction activities. Consequently, the design of the preschool interior and classroom can be seen as a "pedagogical tool" in the role of the "fourth teacher" in children's learning life. The interior of the classroom is a holistic system structured by different spatial layers that have different influences on the children. This 'pedagogical tool' is developed in this dissertation as a theoretical conceptual framework. It serves as a 'lodestar' for subsequent interior design guidelines structured together with the concept of the "seven spatial layers" and is intended to guide and inform future learning space development outcomes.

An exhibition called "COME TO UNLOCK" will be held to express the concept of the 7 spatial layers and the human experience with these layers and "guidelines" and to collect data to be evaluated for research and further developed in future research.

4.1 Research Results

4.1.1 Results of Design Thinking Phase

Results of comparative analysis boards presents that the limitation of total area may lead to differences in the design of spatial function in terms of location, density, interior design elements, spatial organization, spatial order, and spatial form. It is limited to create public transition areas inside the classrooms or to establish the connection between classrooms, such as a long and connecting corridor, a lobby to promote children's physical activities or the social connection of children – peers – teachers and parents between different classes. In particular, it is evident that the green spaces in the preschools are very limited with their limited total area, resulting in a restriction in creating connections between indoor and outdoor spaces and interaction with the natural environment through plants and trees. The three public preschools have large areas that allow them to create green spaces with many trees and large outdoor playgrounds, well-connected indoor and outdoor spaces, especially public spaces that promote social life and social interaction between children - peers – teachers – parents in a public area, such as the corridor, lobby before and after classes. The public preschools have location advantages and a large total area, so these preschools can determine the design options for classrooms, functional spaces and other areas from architecture to interior design.

Private preschools like The Maitri and The CKP excel in low student density and creating cohesive interior themes through spatial furniture, colors, and materials. In all five preschools, furniture is sized appropriately for the children, though variations in color and material reflect differences in budget and the educators' preferences. Most private school furniture is made of wood or other materials, doubling as toys for children to explore. With fewer classes and students, private schools can invest in higher quality and aesthetically pleasing furniture at reasonable prices. The smaller, unified classroom space allows teachers to give more individual attention to each child. While children in private preschools may

have less social interaction and limited outdoor physical activity space, they can develop fine motor skills and have more social and emotional engagement with teachers, potentially making them more centered than children in public preschools. Furthermore, the layer, of spatial color, is based on the visual tastes of educators and teachers. As the site analysis above shows, color in public preschools follows the outdated trend of using bright and colorful paintings to decorate the walls not only within the classroom, but also the interior of the entire preschool. The use of color in public preschool classrooms is less uniform, the main colors or decorative drawings are too overloaded. Compared with the use of color in CKC and Maitri kindergarten, the interiors are uniform in color and material choices, which creates a sense of uniformity in design and is not overstimulated by the children's visual impressions. An interesting point is that blue and green are popular colors that are often used in both private and public preschools for specific reasons.

The spatial forms of the above five preschools, both public and private, are quite simple. They primarily use geometric shapes such as rectangles, squares, circles and simple forms such as vertical space. Various abstract shapes in 2D form are drawn as decorative elements on the interior walls.

All the differences in the above layers lead to variations in the spatial environment, including noise levels, connections between indoor and outdoor spaces, and sense of place. However, technology and air conditioning are essential elements that preschool classrooms can no longer be imagined without. Above all, the sense of place is created by the combination of all other spatial layers, and not only that, it also shapes the learning and teaching process and the social interaction between teachers – children – peers that creates the culture in the classroom, which is mainly based on the teachers. The on-site analysis and the author's observations have revealed that the differences in pedagogy affect the interior design of preschool classrooms in public and private preschools differently. These differences primarily affect the architectural design of the preschool rather than the interior design of the

classrooms. Above all, the room layout and the arrangement of shelves, chairs and tables... in relation to the size of the children and their developmental needs are often similar in different preschools. However, the interior design of public preschool classrooms suggests a stronger role for teachers. This is evident in classrooms where daily activities such as sleeping, eating and learning take place in a single space. In addition, other teaching and educational areas could be added to the private preschool so that it has more functional spaces for the children to explore, not just in the main classroom.

In summary, the results of this phase have shown that the key layer in influencing the interior design of preschools in general and classrooms in particular is the layer of spatial function, followed by spatial order and spatial form. Starting from the specific spatial function, which includes the analysis of the location, the number of children and teachers in a class, the elements of interior design and the spatial organization, the function is followed by spatial order and form. This is followed by spatial color, spatial furniture and spatial material. These are flexible layers that can be mixed and changed depending on the different groups of children in the class, the budget of the preschool and the choice of teachers. The last spatial layer – the spatial environment – serves as a transitional layer that is derived from the meaning of the other six layers. It can change from month to month or year to year based on the influences of weather (temperature, ventilation, outdoor-indoor connection), a particular group of students or teachers, the culture imprinted in the classroom, the nature of the social environment, and the amount of technology investment in the classroom. Public preschools have the advantage of having a large plot of land, which favors their spatial function, spatial order and form. However, the high number of students leads to high density, which requires consideration of noise levels and teacher stress. Therefore, future designs should carefully consider these aspects to understand the differences and find design solutions tailored to each site.

4.1.2 Results of Design Process

The results of the questionnaire survey with 52 participants from different working areas, mainly interior designers, parents and educators who have experience with toddlers or preschool children, provided valuable insights into three main points of this study: first, what key components in interior design help to optimize the classroom for the holistic developmental needs of children; second, how these specific spatial layers support the physical, cognitive and socio-emotional development of preschoolers; and third, what considerations should be made when designing the interior of learning spaces for preschoolers.

Spatial function: The ideal number of preschool children in a classroom could be 10-15 children or 15-20 children with two teachers; and there is no suggestion for a number of 25-45 children per classroom. The ideal value for the minimum area per child in a classroom is about 2.0-2.5 m² per child, the next value could be 2.5-3.0 m² per child. The interior design of the classroom has the greatest impact on the socio-emotional development of children, followed by the cognitive development of children and then the physical development of children. Children's physical development is therefore strongly influenced by furniture and spatial function, followed by spatial form and spatial materials and textures. Children's cognitive development can be significantly influenced by spatial function or spatial color, spatial materials and textures, and then spatial order or color. In addition, children's socio-emotional development may be primarily influenced by spatial function, spatial materials and textures, and spatial order or color. These results suggest that spatial function, spatial materials and textures, and spatial color are the three most important factors among the seven spatial cooperation layers that influence children's holistic development. The results of the survey indicate that there is a close relationship between pedagogy and interior space, which is consistent with the findings from the literature review. Therefore, the interior designer must place pedagogy on a par with the needs of the end users (teachers and children) in the space. The role and influence of pedagogical philosophy in the design of interior spaces for physical preschool classrooms is not underestimated.

This includes teaching methods, learning materials, the arrangement and positioning of materials, technology and supporting facilities, the curriculum, the plan for daily activities and outdoor activities. There are some key words for the characteristics of the interior design of preschool classrooms, including safety, interactivity, natural material, open space, temperature control, natural connection, logical arrangement in the space and material.

In terms of **spatial function**, the most important component is spatial organization, followed by density, interior design elements and boundaries.

In terms of **spatial order**, the most frequently suggested components for the interior design of preschool classrooms are balance and harmony, followed by unity and variety, and finally emphasis. This suggests that interior designers should ensure that the entire classroom area follows a composition of balance and harmony. Unity and variety should be carefully considered and limited to specific areas, while emphasis should only be used in very few specific places.

In **spatial form**, all components are recommended for the design of preschool interiors. However, there are some key components that should be prioritized, namely curved lines/curvy shapes/ or spherical/irregular forms that convey a sense of softness and dynamism and are continuous for each area to create an intimate space.



In terms of **spatial colors**, primary colors, neutral colors and tertiary colors are highly recommended for classrooms, followed by a group of secondary colors, complementary colors and analogous colors. Black and white are not recommended for preschool spaces and should be used as a concept for lightness and darkness. Primary colors are mainly recommended for active areas and learning areas, not for sleeping areas. Tertiary colors are recommended first for active and learning areas, then for play areas and hallways. Analogous colors are recommended for learning areas. Complementary colors are recommended for learning areas. Neutral colors should be used for resting and sleeping areas. In particular, the blue–yellow–green color group is preferred for children's areas, followed by orange–red–white–violet. Black should not be used in children's space.

The result shows that warm colors are preferred for children's space, more than blue colors.

When choosing colors for the interior design of preschool classrooms, you should consider several factors: the children's emotions, perception and senses, their age, preferences, psychology and stimulation needs. In addition, you should also consider the educational focus, the characteristics and function of the space, the sense of place and the spatial arrangement of the environment.

Spatial materials in preschool classrooms and ceilings should be painted. Walls can be painted with paint, wallpaper, ceramic tile, fabric or acrylic. Wood, carpet or rugs are best for floors. Ceramic is recommended for bathrooms, while wood is ideal for furniture such as shelves, tables, chairs and partitions. Glass should be used with caution, possibly for walls and bathrooms, but with care in children's spaces. Metal should only be used for specific reasons and is not highly recommended. Acrylic or plastic can be used for walls, shelves, tables, chairs and partitions, but are not recommended if a higher budget is available. Carpets or rugs are highly recommended for floors. To summarize, glass, metal and acrylic should be carefully considered when designing preschool spaces. They are not highly recommended and should be chosen wisely and in conjunction with the function of the **spatial furniture**.

Based on the result, the characteristics of the space should be safety, comfort, flexibility, legibility, accessibility and natural connection.

Spatial environmental factors should be carefully considered, with the focus on lighting, followed by ambience, noise and finally cultural factors. Then there are temperature, air quality, ventilation, natural light, plants, water, animals and the changing seasons. The priority of the environment is a natural connection, a connection between indoors and outdoors.

Finally, the most important spatial layers in furnishing strategies are probably spatial function, spatial order and spatial environment. This is followed by spatial furniture, spatial materials, spatial forms and finally spatial colors. These results are consistent with the findings on the importance of spatial layers for children's

environmental factors. Therefore, spatial function should be a top priority in the interior design of learning spaces for children.

The most important developmental process for children may be socio-emotional development. This is also related to the result of the literature review, the most important developmental factors in 21st century children. Consequently, the design model for preschool learning spaces for 21st century children should be developed with the priority of promoting socio-emotional development, and then in parallel with cognitive and physical development.

4.1.3 Results of Design Evaluation

Data on this phase suggest that children's physical development needs are primarily influenced by spatial function (size of space, density, traffic flow, spatial organization) and spatial environment (natural ventilation and connection between outdoors and indoors). Many responses recommended that the average area per child in the class should be around 2-3m², 15-20-25 children with 2 teachers and 30-35 children with 3 teachers.

Secondly, children's cognitive developmental needs are influenced by spatial colors, spatial materials and elements of spatial function – spatial organization includes layout and order. It turns out that the sense of color and material influences children's visual and tactile skills, which in turn affects children's cognitive development. Meanwhile, well-organized spatial organization (layout, clear traffic flow) can have an impact on children's cognition through daily activities with good habits of layout and movement, which is linked to the theory of literature review (...). An interesting point when discussing this question is the concept of place belonging that appears in the responses, which is related to the spatial environment and also has an impact on children's cognitive development. This result confirms once again that the spatial environment is the result of other layers. If these layers are well designed, they will bring benefits to the end users.

Thirdly, spatial function, spatial furniture, spatial environment, and pedagogy are seen as conducive to children's socio-emotional developmental needs. The spatial

function is mentioned with a well-functioning circulation and the arrangement of furniture that can change the process of social bonding. This is related to the results of phase 2, when the on-site analysis was conducted in the preschools. In addition, the results once again emphasize the importance of the concept of sense of belonging. In addition, pedagogy also has an impact on children's social emotions through the role of teachers and peers in daily social activities.

A good indoor space for children prioritizes safety, offers complexity and flexibility, provides stimulation and diversity (including separate and public zones), features multiple well-defined zones, ensures organized circulation, and establishes a natural connection with green spaces. It is implied that important elements you should pay attention to in **spatial function** are spatial organization/spatial arrangement and boundaries as well as traffic flow. **Spatial form** is dynamic design vocabulary such as curved lines, sweeping shapes, circular shapes, varied shapes and forms, and abstract shapes that create focal points to stimulate. **Spatial colors** follow functional areas, bright colors or soft colors for the entire space with analogous colors, contemporary colors/strong colors for focal points. For **spatial materials**, use different textures and finishes by combining hard and soft materials and favor eco-friendly materials. For **spatial furniture**, use lightweight furniture that is smart and flexible to the size of the children and follows the right function. The furniture can be used in bright colors so that the children can easily distinguish the different functions. Ventilation, temperature, lighting, integration of indoor and outdoor areas, green spaces and creating a sense of belonging to a particular area are the most important elements of the spatial environment that should be considered when designing the interiors of a classroom. In the layers of interior space, the answer for spatial arrangement is not clear as to which elements, but all responses agreed that the spatial arrangement should be designed based on the curriculum and pedagogical orientation with a specific pedagogy that fits a different spatial arrangement. These findings are consistent with the results of the comparative analysis in Phase I, which compared public preschools and private preschools. Finally, when applying these 7 spatial layers in designing the interior of

the preschool classroom, attention should be paid to the location, budget, pedagogy, and teachers, and the entire level should be analyzed and designed. Results suggest that the most important is Function, Order, Environment, and Color.

4.2 Theoretical Conceptual Framework for Interior Design of the Preschool Learning Space

The above analysis clearly shows how important the interior design of the classroom is for the holistic development of children. The findings of Chapter 3 in the three phases are consistent with the findings from the literature review on the significant influences and important role of classroom interior design on children's physical development, children's cognitive development and children's socio-emotional development.

It is important to fully understand their properties, structures and effects on children's development so that these layers become "real tools" that can have a positive impact on children's cognition and habits.

4.2.1 Theoretical conceptual framework of "educational-tool" with "7 layers"

The author develops the theoretical conceptual framework of interior design for learning spaces (Figure) as the foundational knowledge for the design guidelines of the "7 spatial collaborative layers", which are explained in detail later in order to understand the interrelationship and influences between the design of the physical interior of the classroom space, the spatial layers, the pedagogy, and children's developmental needs; and to clarify the important interior spatial layers that are vital in designing a physical learning space to promote children's learning and play and to support the children's developmental needs of the preschool children. In this model, each component is broken down into smaller factors to gain a deeper understanding. In addition, the model also shows how the factors in each component interact. The theoretical model consists of three sub-models, including the model of child development with developmental needs (Figure 92), the conceptual model of the characteristics of the interior learning space (Figure 93), and the model of "7 spatial collaborative layers" (Figure 91).

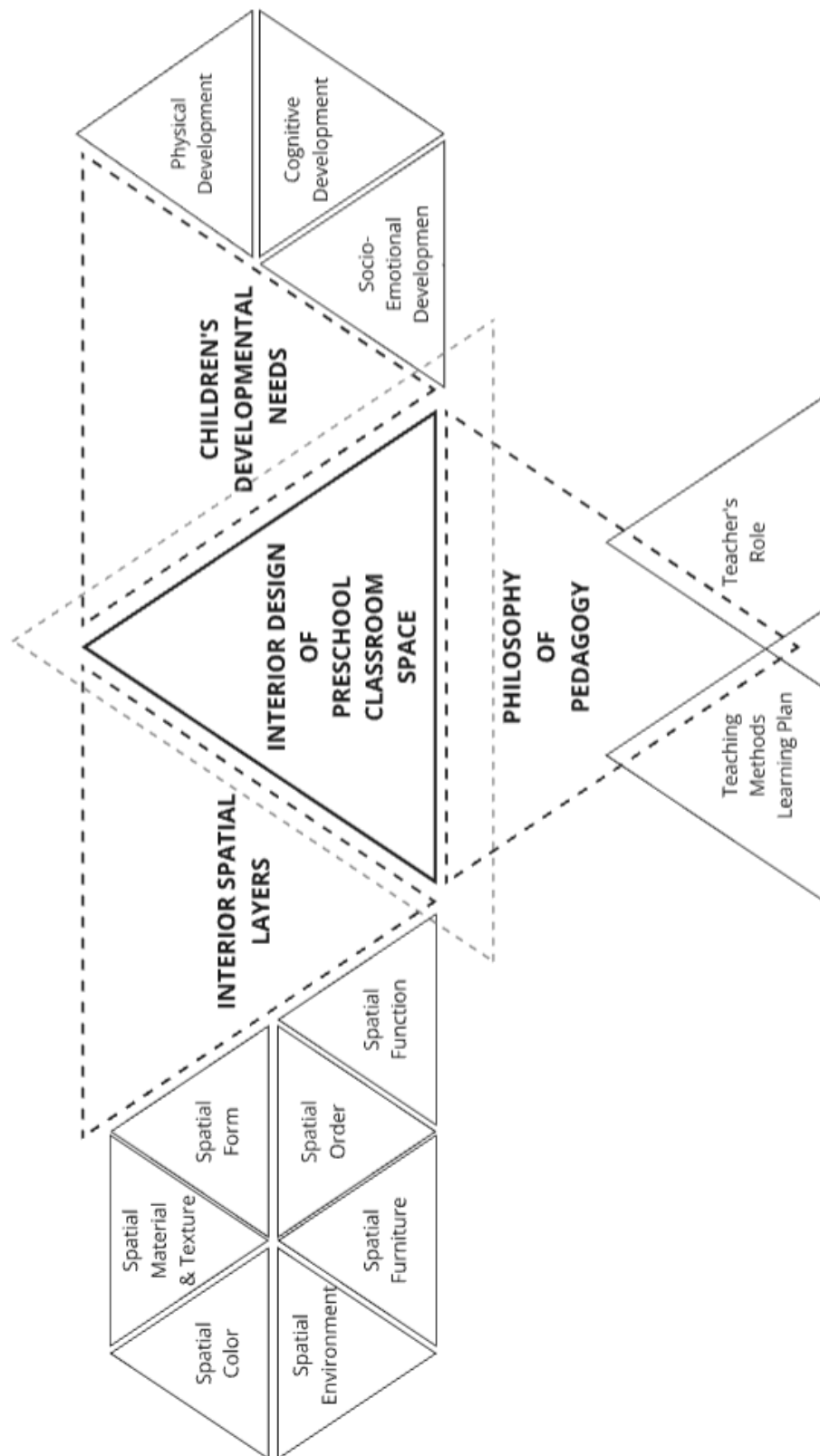


Figure 82: Theoretical Conceptual Framework for Interior Preschool Classroom Space with three main domains

Firstly, the model of child development with developmental needs (Figure 91) addresses is about the holistic child development, including the children's physical development with the development of Gross and Fine motor skills; the children's cognitive development with two three main themes: Exploration and Organization skills (exploration, classification, mental ordering), Executive functions and Problem-solving skills (planning, problem-solving, behavior and imagination), language development and symbolic thinking (level of language development, symbolic thinking through pretend play, behavior); children's socio-emotional development with three main themes: individual development and awareness, social interaction and understanding, and environmental awareness. Each developmental skill within the developmental system is influenced by spatial elements. When these spatial layers have positive long-term effects, they can contribute to the positive development of young children. The Children's socio-emotional development could be significantly influenced by interior design, followed by the children's cognitive development, and finally the children's physical development.

Children's physical development could be significant impact by spatial function and spatial furniture, followed by spatial form, spatial material & texture. Children's cognitive development can be significantly influenced by spatial function or spatial color, spatial material and texture, spatial order and form. And children's socio-emotional development, which is considered that the most important developmental skill of the 21st children, could be significantly changed by spatial function, spatial material and texture, spatial order and color.

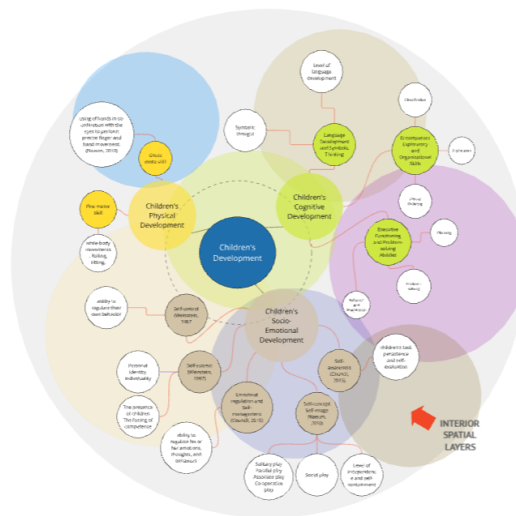


Figure 83: The model of children's development with developmental needs

Secondly, in order to meet the basic requirements of children and their developmental needs, the interior space of the learning space must also be adapted to the basic requirements. Follow the findings from the literature review that point to various characteristics of leaning spaces (privacy, public, comfortable, engaging, organized, clean, inviting, emotional intimacy) and the results of the qualitative analysis show that the essential requirements of learning interior spaces for children are safety, interactivity, natural material, open space, temperature control, natural connection, spatial arrangement, comfort, flexibility, accessibility, natural connection.



Figure 84: The conceptual model of characteristic of interior learning space.

The author clarifies which important characteristic themes in the design of interior spaces for children's learning are expressed by analyzing and coding all the results of the data in the conceptual model of characteristics of interior learning space (Figure). These themes serve as basic requirements for the seven spatial layers that need to be designed according to these requirements. The themes are **Safety** (safe environment, security, observation, health), **Comfort** (comfortable, pleasant, inviting), **Esthetics** (stimulation, attractive, sense of place, emotional), **Privacy** (sense of autonomy and control, privacy), **Engagement** (engaging, interactivity, rich in experiences, learner-centered), **Flexibility** (adaptability, encouraging independence, responsive to children's needs, encourage collaboration), **Legibility** (spatial arrangement, natural connection, scale, organization), **Exploration** (creativity, complexity, imagination).

Finally, the model of "7 interior spatial layers" (Figure) is about detailed analysis and interactive correlation with the concept of 7 spatial layers in the interior learning space, including spatial function, spatial order, spatial form, spatial color, spatial material, spatial furniture, spatial environment with the detail factors of each layer. There are various factors in each component, and they also have important differences. Here is the list of key factors in each layer. Spatial organization, density, interior architecture elements, boundaries in the Space Function; balance and harmony, unity and diversity, emphasis in the Space Order; curved lines/curved shapes/spheres/irregular forms are primary elements in the layer of Spatial Form; primary color (active area + learning area), tertiary color, and neutral color, bright color are recommended in the layer of Spatial Color; various selection in the layers of Spatial Material and Space Furniture, which follow the different areas and also the furnishings; a parallel can be drawn between the components in the layers of the Spatial Environment, which are all important and essential. As described above, the most important layers are space function, order, color and environment.

4.2.2 The 7 Interior Spatial Layers and the Feeling Scale in Learning Interior Classroom Space

It is crucial to understand the seven spatial collaborative layers and their characteristics, particularly their positive or negative effects on children. This knowledge allows interior designers to make informed design decisions. By using the "feeling scale" tool, which includes three main levels of children's feelings—positive, negative, and moderate—and two sub-levels—extremely positive and extremely negative—designers can assess the emotional impact of each component. Each layer has both positive and negative potential, as too much or too little of any element can lead to extreme emotions. Additionally, combining components can create different sensory and visual effects. To assist designers, a qualitative evaluation table is provided, categorizing the components of each layer based on these emotional stages, offering a general guide for effective design combinations. **Positive feelings** might include happy, delighted, hopeful, excited, joyful, amused, affectionate, grateful, confident, calm, proud, satisfied, enthusiastic, trusting, fulfilled, cheerful, engaged, loving, loved, interested, silly (Charles E. Schaefer & Athena A. Drewes, 2016); joy, interest, satisfaction, love (Fredrickson, 2014)



Negative feelings could include anger, sadness, and fear (Geunyoung Kim et al, 2007); dissatisfaction, anxiety, depression and pain (Grinde, 2016); sadness, jealousy, anxiety, devaluation, fear, anger, disgust, boredom, passivity (Slușnienî, 2019).

Moderate feelings could include indifference, apathy, serenity, ambivalence...the feeling between the level of positive feelings and negative feelings that is not extreme or excessive.

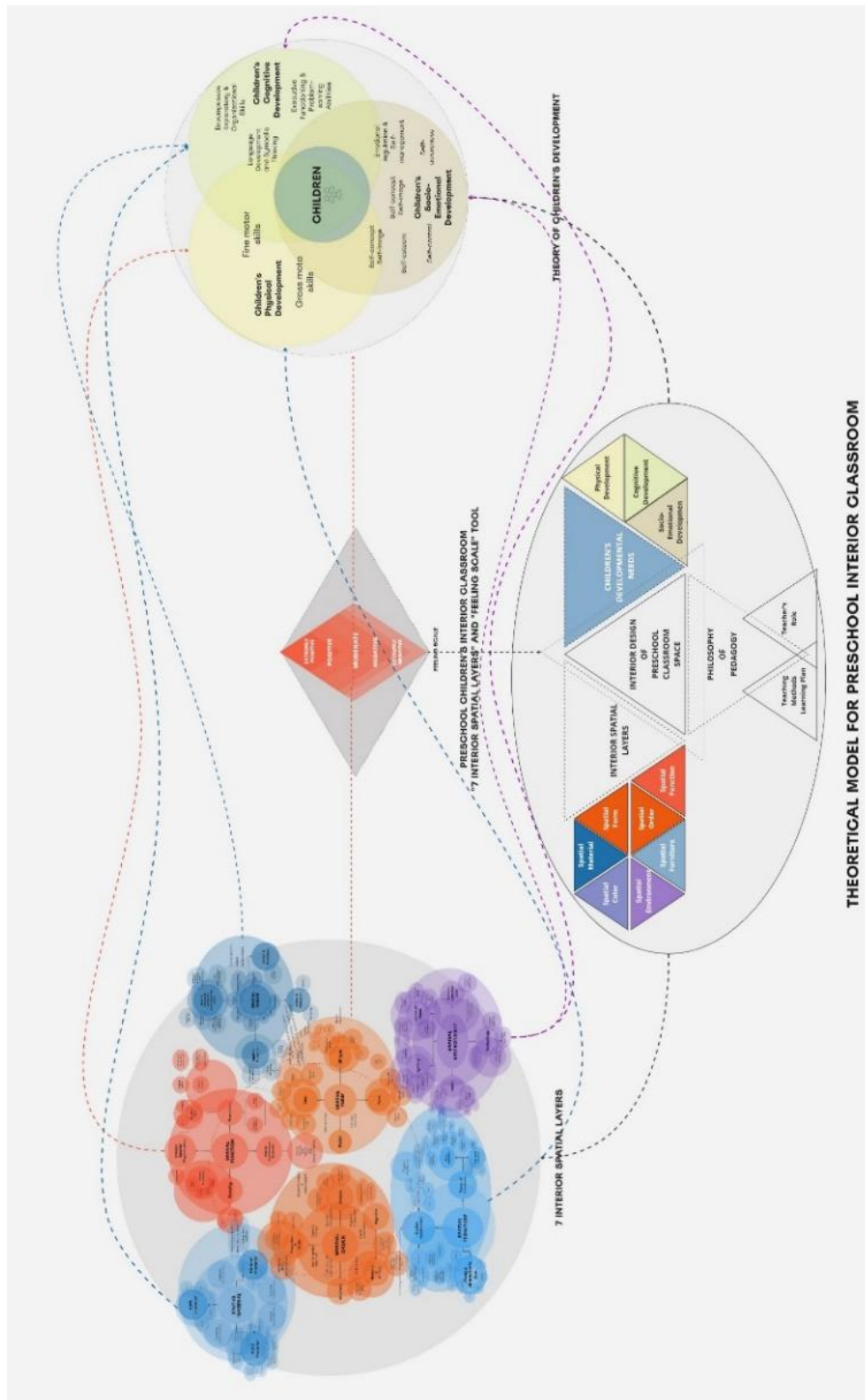


Figure 85: The developed model with the 7 Interior Spatial Layers and the Feeling Scale in Learning Interior Classroom Space

4.2.2.1 Spatial function

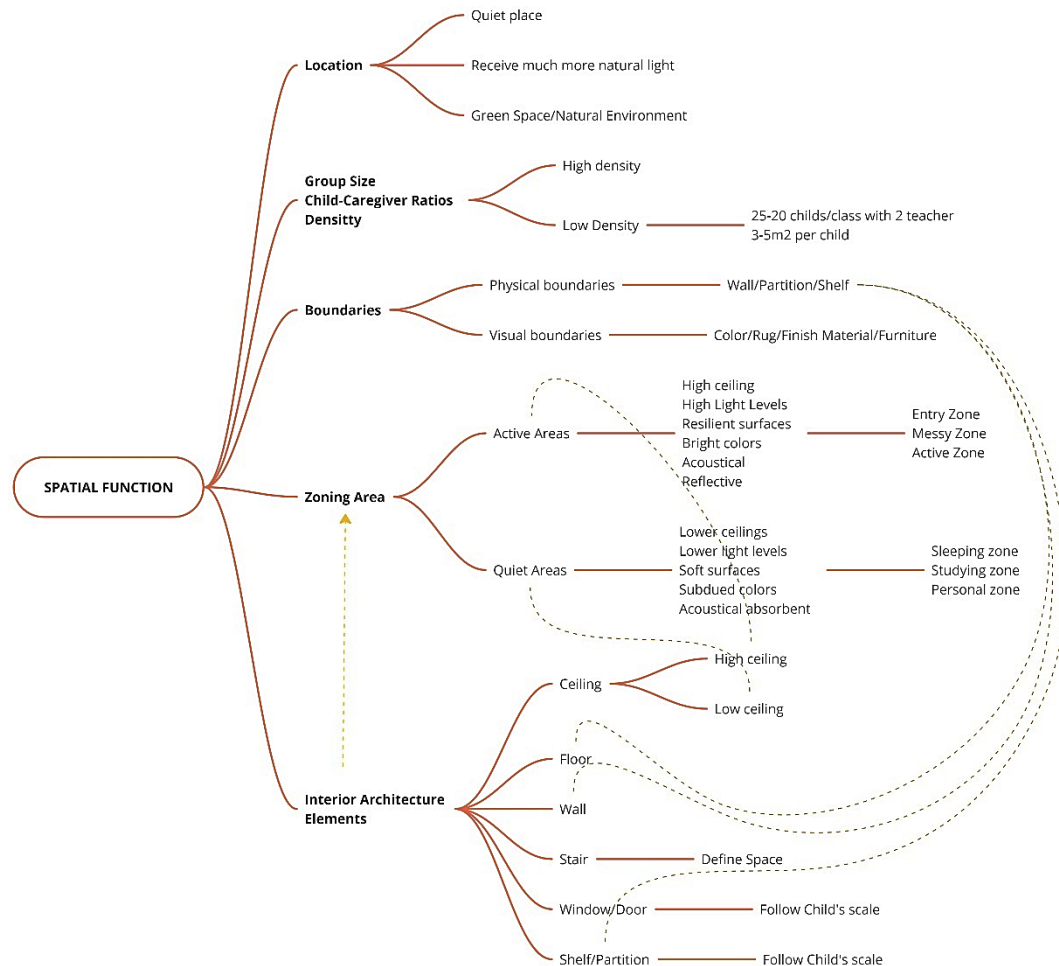


Figure 86: The main components of spatial function layers and their relationship

Spatial Function	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Location	Far from main street and main gate, noisy areas Along the exterior perimeter of the buildings Has Windows Maximum amount of natural light Close to nature and offering green outdoor view	Not too close main street or main gate, noisy areas Along the open corridor Has windows and enough natural light Close to outdoor environment Green outdoor view	Not too close main street or main gate, noisy areas Along the open corridor Has windows and enough natural light Green outdoor view	Close noisy street, or main gate Enclosed corridor with no natural light Few windows, full of four solid interior walls Not enough natural light No green view Far natural space	Too close noisy public areas No corridor No windows No natural light Enclosed space with full solid walls/doors No green view No natural space
	Low density 14-16 students with 2 teachers 3-5m ² /child Small group sizes Effective interaction between the intimate zone, personal space, and social zone Balance in individual's space and social space	Low density 16-20 students with 2 teachers 3-5m ² /child Small group sizes Good interaction between the intimate zone, personal space, and social zone	Moderate density 20-25 students with 2 teachers and 1 nanny 2-3m ² /child Moderate group size Have enough zone for intimate zone, personal space, and social zone.	High density 25-30 students with 2 teachers >3m ² /child Large group size Blurred boundaries between the intimate zone, personal space, and social zone	Too high density Over 35 students with 2 teachers 1,0-1,5m ² /child Large group sizes No have enough space for intimate zone, personal space, and social zone
Physical Boundaries	Clear and Clean Solid and Transparent Safety and Complexity Safe structure and material. Clear observation	Clear and Clean Solid and Transparent Safety and Complexity Safe structure and material. Clear observation	Clear Solid and Transparent Safety Simple Easy to observation	Blur, not clear. Ambiguity Or just solid/enclosed space Not safe structure and material Hard to observation	Blur and Messy Solid/Enclosed Dangerous Ambiguity
Visual Boundaries	Easy to recognize by visual and touch High stimulation Various design elements: Color, Graphic drawings, Material, Lighting	Easy to recognize by visual and touch High stimulation Various design elements: Color, Graphic drawings, Material, Lighting	Easy to recognize by visual stimulation Limited design elements	Few visual boundaries Messy and chaotic design elements.	No visual boundaries or overstimulation. Ambiguity Messy and chaotic classroom interior or environment

Spatial Function	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Interior Plan	Modified open-plan Support for teaching and learning activities Following psychology of pedagogy	Modified open-plan Open plan	Modified open-plan Open plan Closed plan	No plan	No plan
Spatial Zones	Clear division between wet region and dry region. Logic arrangements Have enough space and areas for entry zone, messy zone, active zone, quiet zone. Clear traffic flow Clear	Clear traffic flow Clear circulation Logic arrangements	Clear traffic flow Circulation Logic arrangements	Unlogic traffic flow Messy plan and functional areas. Difficult movement	Unlogic traffic flow Messy plan and functional areas. Difficult movement
	Active zone: High ceilings, high light levels, resilient surfaces, bright colors, acoustical, reflective. Quiet zone: Lower ceilings, lower light levels, soft surfaces, subdued colors, acoustical absorbent.		The design vocabularies are not followed to function of different areas.		
Interior Architectural Elements	Good proportion in space with height of ceiling. Flat floor, safe various material. Movable walls Large (horizontal) windows in children's eye scale. Observation doors Movable partitions in child-scale. IAE could be designed as physical boundaries	Good proportion in space with height of ceiling. Flat floor, safe various material. Movable walls Large (horizontal) windows in children's eye scale. Observation doors	Good proportion in space with height of ceiling. Safe material Safe walls Have windows in children's eyes scale. Observation doors	Too height or too low ceiling Enclosed solid walls Poor material on walls and floor Few windows Solid doors	Too height or too low ceiling Enclosed solid walls Poor and dangerous material on walls and floor No windows Solid doors

Table 24: Categorize the Main components of Spatial Function Layers according to the Feeling Scale

4.2.2.2 Spatial form

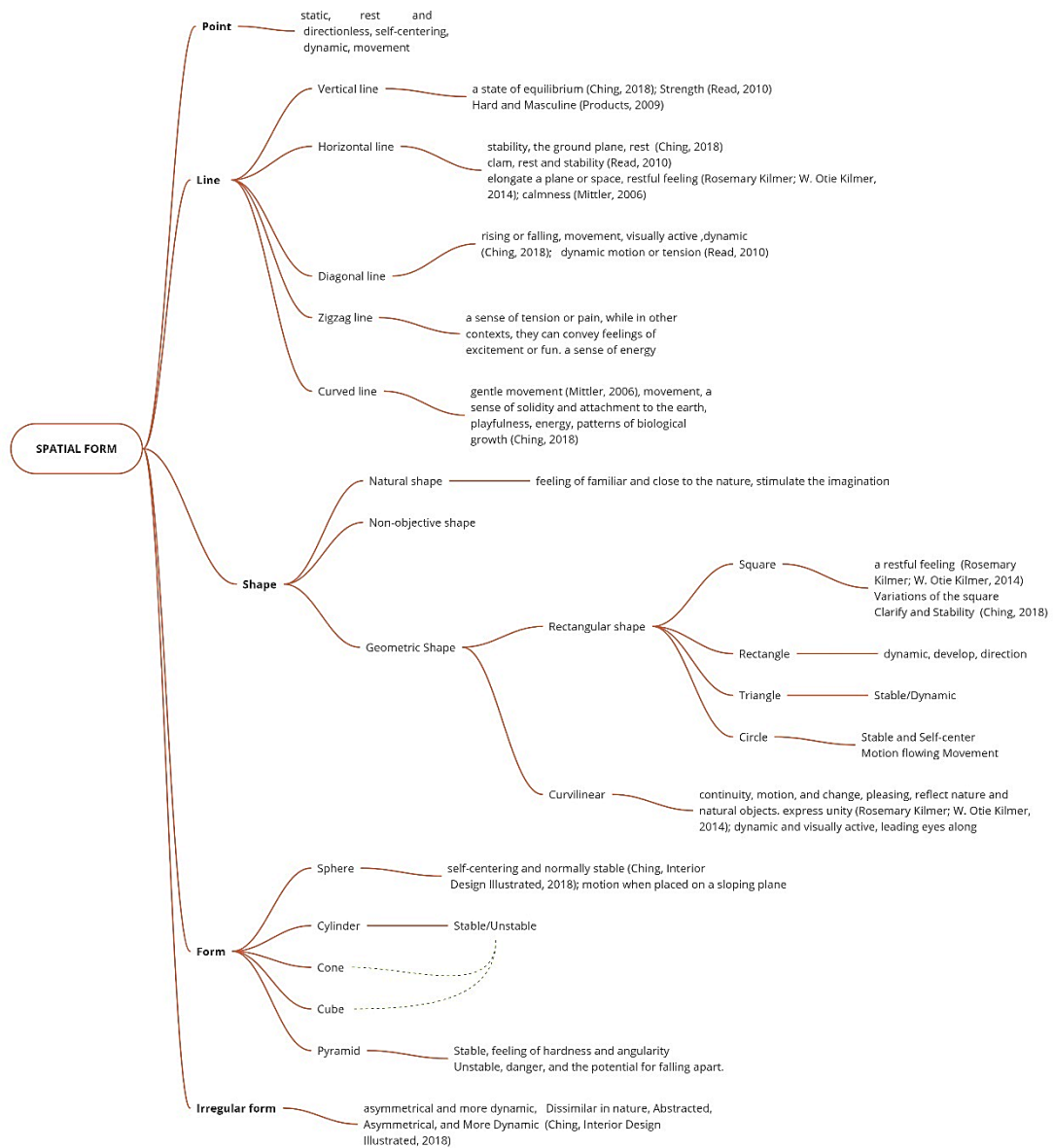


Figure 87: The main components of spatial form layers and their relationship

Spatial Form	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Point	Moving points -> dynamic, movement		Standing point -> static, rest, directionless, self-centering		
Vertical line	Hard and Masculine	Directional	State of equilibrium	Too hard/ Too bold/ Too Masculine	
Horizontal line			Stability, the ground plane, rest, clam, rest and stability, calmness		
Diagonal line	Dynamic motion visually high active	Dynamic, active		rising or falling	Tension
Zigzag line	Feelings of excitement or fun. a sense of energy				
Curved line	Gentle movement, playfulness, energy, visual motion, flowing movement	playfulness, energy, patterns of biological growth, continuous relaxation, have a sense of soft, has a flow or rhythm Warm and feminine	a sense of solidity and attachment to the earth sense of soft, relaxation, have a sense of soft, has a flow or rhythm, feeling of pleasant	undirected	
Rectangular shape	sense of dynamic	a restful feeling a restful feeling Clarity and Stability			
Triangle shape	Dynamic		Stable		
Square shape	Dynamic, movement, interesting, flow of moving	regularity and visual clarity			

Spatial Form	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Curvilinear	express unity dynamic and visually active, leading eyes along their curvature	continuity, motion, and change, pleasing, reflect nature and natural objects. softness of form, fluidity of move- ment, or the essence of biological growth	Sense of softness	Undirected	
Natural shapes	feeling of familiar and close to the nature, stimulate the imagination			Overstimulation if too much Too abstract	
Nonobjective shapes	meaning as symbols in space			Not clearly	Messy if using too much
Sphere	motion when placed on a sloping plane		self-centering and normally stable	Unstable	
Cylinder			Stable	Unstable	
Cone			Stable	Unstable	Dangerous in sharp point
Cube	Suggesting movement			Stable	Unstable
Pyramic			Stable	feeling of hardness and angularity danger, and the potential for falling apart.	Dangerous in sharp point
Irregular forms	asymmetrical and more dynamic, Dissimilar in nature, Abstracted, Asymmetrical, and More Dynamic	Stimulate children's imagination		Messy if using too much	Messy if using too much

Table 25: Categorize the Main Components of Spatial Form Layers according to the Feeling Scale

2.2.3 Spatial order

257

In terms of component of spatial order components, the level of feeling scale might depend on the characteristics of each component and sense of place they create to. Changing of the feeling scale from extremely positive to extremely negative would be changed slightly based on the percentage of using each component in overall design, making it is complicated and challenging to categorize these components precisely. Different combinations will create different feelings. However, the assessment table could be used as a fundamental guideline to understand about the characteristic and how to apply this layer.

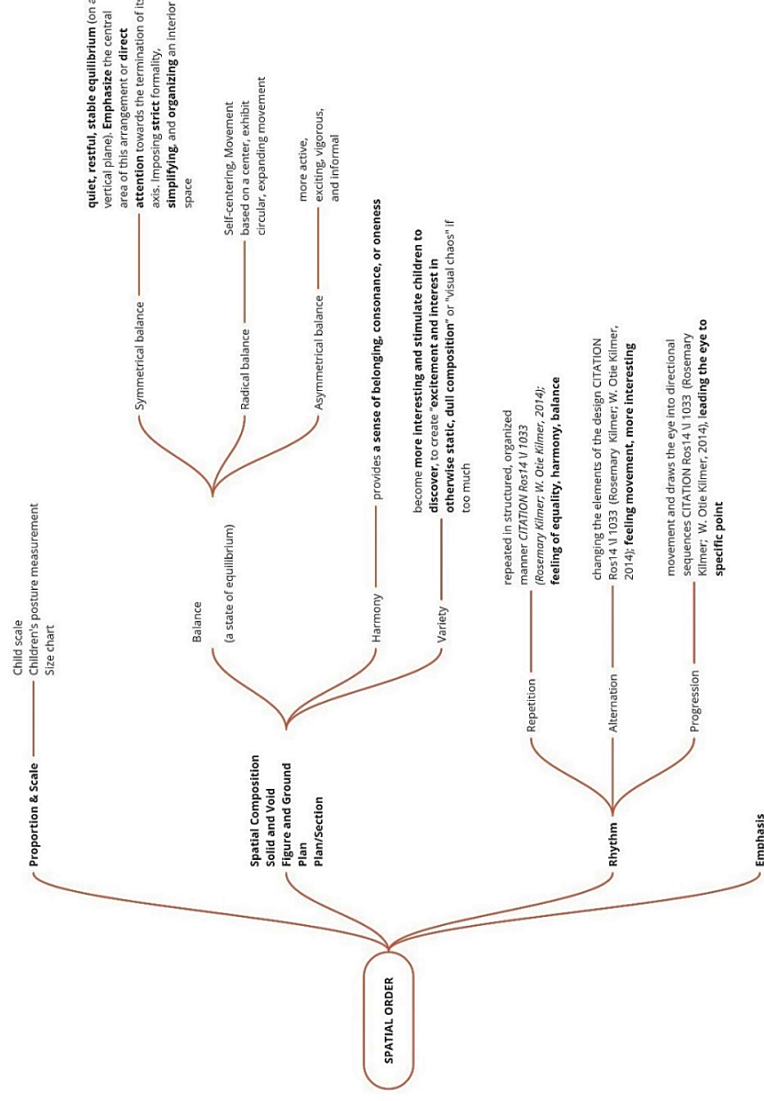


Figure 88: The main components of spatial order layers and their relationship

Spatial Order	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Proportion	Yes	Yes	Yes	No	No
Scale	Children's scale – Children's size chart Teacher's scale	Children's scale – Children's size chart Teacher's scale	Children's scale – Children's size chart Teacher's scale	No	No
Mechanical Scale	Yes	Yes	Yes	No	No
Visual Scale	Yes	Yes	Yes	No	No
Human Scale	Yes	Yes	Yes	Yes	No
Visual Balance			A state of equilibrium		
Symmetrical Balance	Emphasize the center. Direct attention towards the termination of its axis.	Emphasize the center Imposing strict formality, simplifying, organizing stable, static, and dignified; sense of formal, stately impression	quiet, restful, stable equilibrium Imposing strict formality, simplifying, organizing stable, static, and dignified; sense of formal, stately impression	Too much formal symmetry can result in dull, static arrangements	
Radial Balance	expanding continuous movement	Centralized composition Self-centering	Centralized composition Self-centering	Too much can lead to chaotic	

Spatial Form	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Curvilinear	express unity dynamic and visually active, leading eyes along their curvature	continuity, motion, and change, pleasing, reflect nature and natural objects. softness of form, fluidity of move- ment, or the essence of biological growth	Sense of softness	Undirected	
Natural shapes	feeling of familiar and close to the nature, stimulate the imagination			Overstimulation if too much Too abstract	
Nonobjective shapes	meaning as symbols in space			Not clearly	Messy if using too much
Sphere	motion when placed on a sloping plane		self-centering and normally stable	Unstable	
Cylinder			Stable	Unstable	
Cone			Stable	Unstable	Dangerous in sharp point
Cube	Suggesting movement			Stable	Unstable
Pyramic			Stable	feeling of hardness and angularity danger, and the potential for falling apart.	Dangerous in sharp point
Irregular forms	asymmetrical and more dynamic, Dissimilar in nature, Abstracted, Asymmetrical, and More Dynamic	Stimulate children's imagination		Messy if using too much	Messy if using too much

Table 26: Categorize the Main Components of Spatial Order Layers according to the Feeling Scale

4.2.2.4 Spatial color

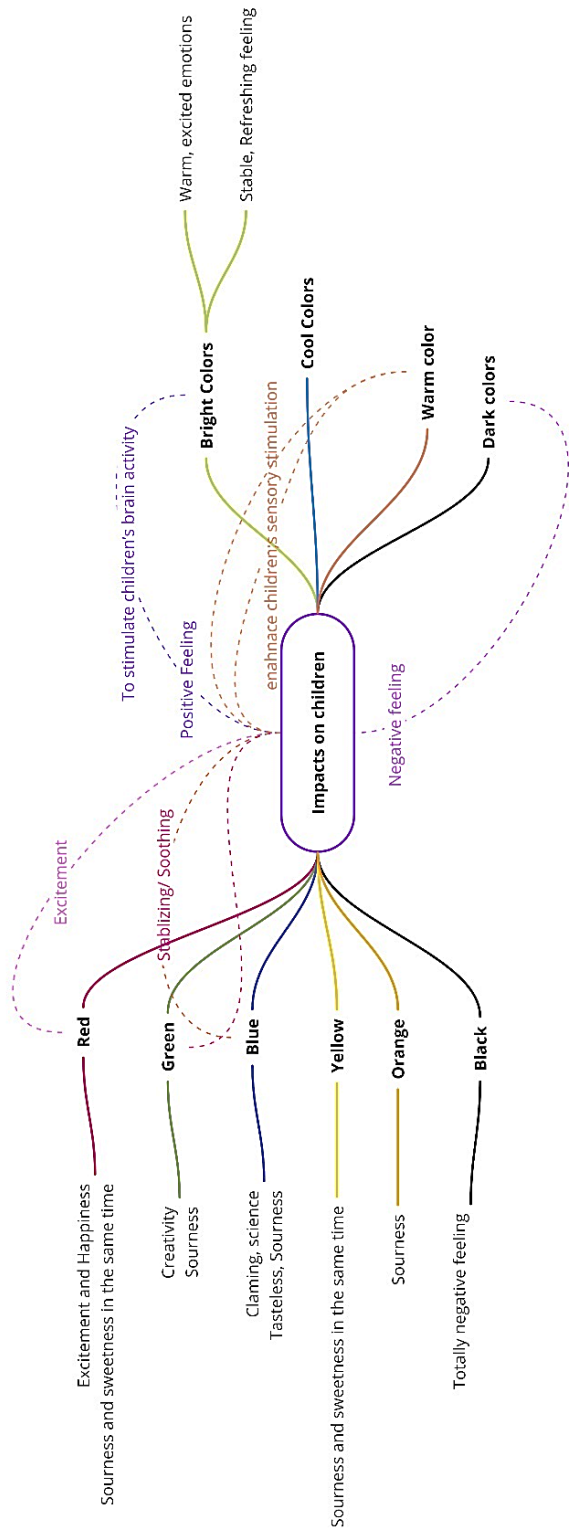


Figure 89: The main components of spatial function layers and their relationship

Spatial Color	Extremely Positive		Positive	Moderate	Negative	Extremely Negative
Bright colors	Preferred	Preferred		Preferred		
	To stimulate children's brain activity					
	Warm, excited emotions To stimulate children's brain activity To evoke the feeling of happiness and joy			Stable, Refreshing feeling		
Dark colors					Not preferred Gloomy feeling	Not preferred Gloomy feeling
Warm colors	Battle, blood, fire, passion, love, excitement High intensities, Sense of warmth Active and stimulating Light – tend to expand space and size of object. Similar to sunlight -> Raise blood pressure speed up respiration and heartbeat. Increase alertness					
Cold colors	Creativity		Subdued and relaxing Deep – appear to contract Sense of nature such as the ocean, sky, grass. Stable, Refreshing feeling			
Reds	Excitement Battle, blood, fire, passion, love, excitement		Happiness			
Oranges			friendliness, pride, ambition, warmth, and relaxation, and is stimulating		Less preference	

Spatial Color	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Yellows	Sunlight, springtime, cheerfulness, and optimism.	the feeling of safety	Less preference		
Greens	Innovation	nature and the feeling of calmness, friendliness, and freshness.			
Blues	Creativity	Calmness, science			
Violet		nature and the feeling of calmness, friendliness, and freshness.			
Pink				Not preferred	Not preferred
Browns				Not preferred	Not preferred
Greys					Totally negative
Black				Not preferred	
White				Not preferred	
Neutral Color			Less forceful		

Table 27: Categorize the Main Components of Spatial Color Layers according to the Feeling Scale

4.2.2.5 Spatial Material & Texture

263

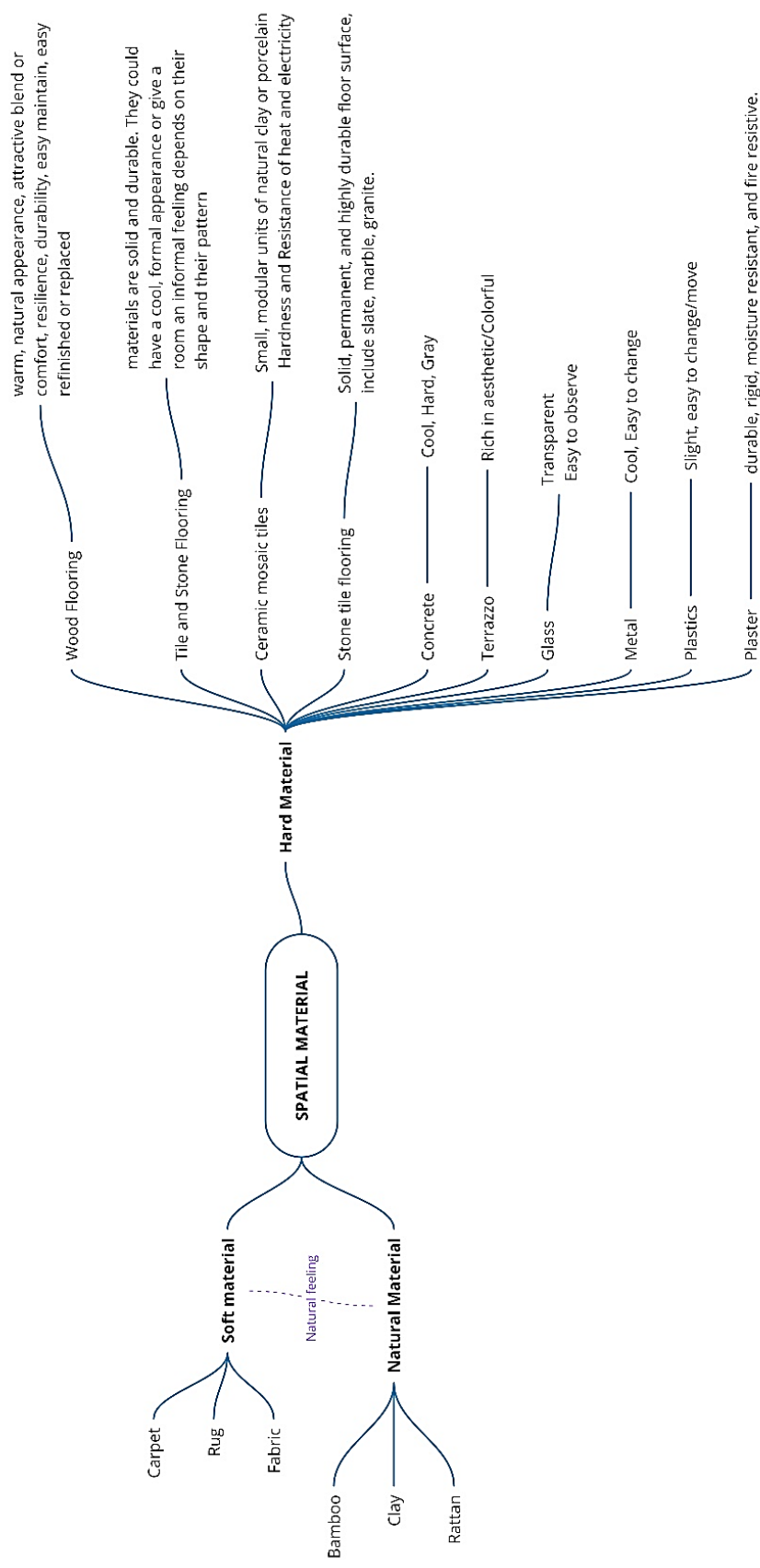


Figure 90: The main components of spatial material & texture layers and their relationship

Spatial Material	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Hard materials					
Wood	Wood: warm, natural appearance, attractive blend or comfort, resilience, durability, easy maintain, easy refinished or replaced (D.K.Ching, 2018).				Slippery surface and too much rough texture
Tile and Stone		Tile and Stone: materials are solid and durable. They could have a cool, formal appearance or give a room an informal feeling depends on their shape and their pattern.		Slippery	Slippery
	Stone tile flooring: Solid, permanent, and highly durable floor surface, include slate, marble, granite.				
Ceramic	Ceramic mosaic tiles: High aesthetic and stimulate visual			Hard to clean Easy to get dirty	
Concrete Surface	Concrete: Cool, Hard, Gray			Cool, too solid, hardness	
Terrazo	Terrazzo: High aesthetic and stimulate visual				
Porcelain		Resilient flooring materials Safe, good durability Ease of maintenance.			
Glass		Glass: Transparent Easy to observe		Easy to broken	
Metal				Metal: sense of coolness	Sharp corners

Spatial Material	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Soft material					
Carpet		Carpet: Soft characteristic Create comfort and safety for children Easy change and arrangement			
Rug		Rug: Patterned, textured Visual diversity, softness			
Paint	colorful or stimulate texture, strong color texture		Positive color texture paint	Neutral color paint	Negative colors paint

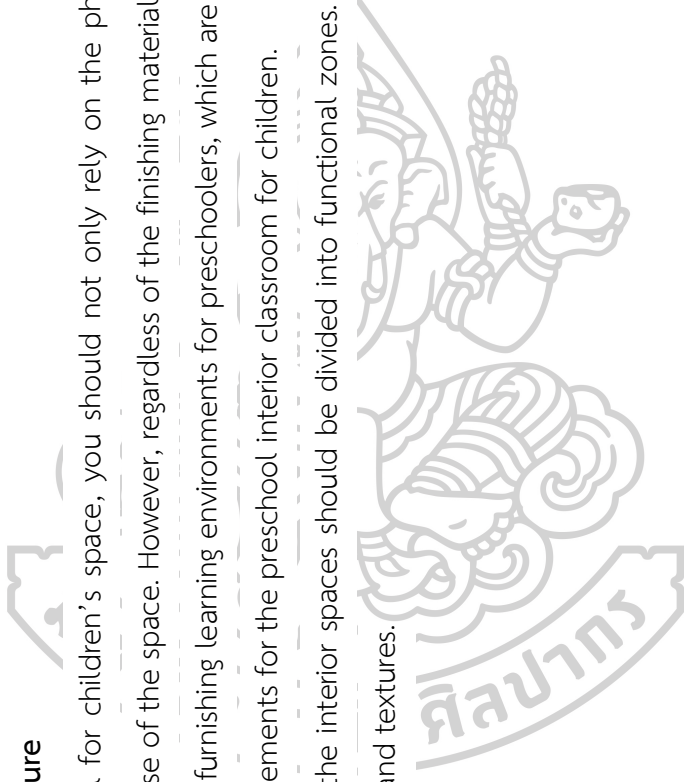
Table 28: Categorize the Main Components of Spatial Material & Texture Layers according to the Feeling



4.2.2.6 Spatial furniture

When choosing finishing material for children's space, you should not only rely on the physical properties, but also on the visual properties that influence the sense of the space. However, regardless of the finishing materials chosen, there are some basic principles that should be considered when furnishing learning environments for preschoolers, which are presented in detail in the next section.

- Adapting the basic design requirements for the preschool interior classroom for children.
- Based on the spatial function, the interior spaces should be divided into functional zones. The different zones should be furnished with different finishing materials and textures.
(like colors)



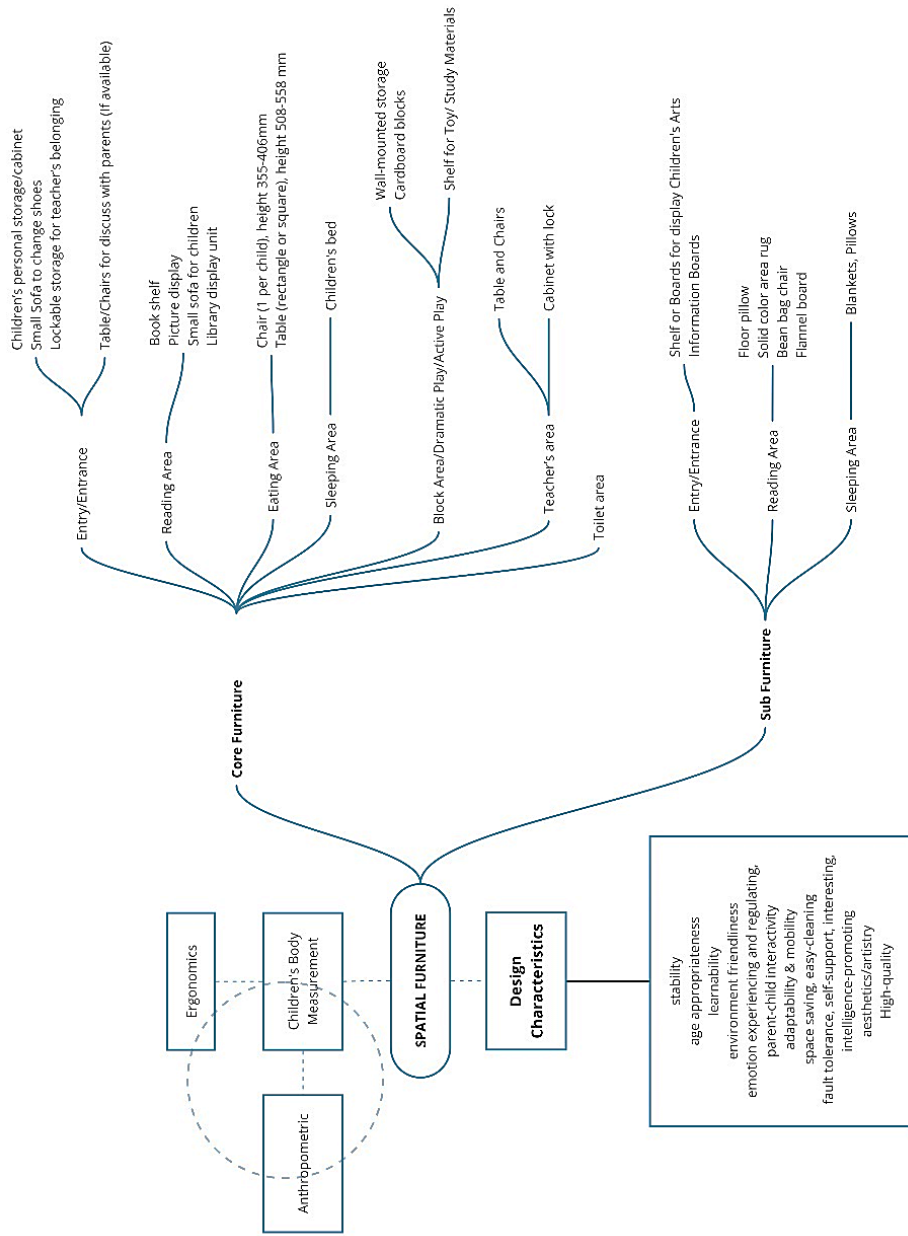


Figure 91: The main components of spatial furniture layers and their relationship

Spatial Furniture (Include Furniture's Setting and Arrangement)	Extremely Positive			Moderate	Negative	Extremely Negative
	Extremely Positive	Positive				
Entrance Area	Close to the natural environment Width of corridor >1800mm Have area for meeting and welcoming children and parents. Have children's cabinet, Have large windows to get natural light, An aesthetically pleasing atmosphere that fosters welcoming socialization,	Have natural light, Width of corridor >= 1800mm Have windows, Have nature lighting, Have area for meeting and welcoming children and parents, Have children's cabinet, Bright and Welcoming atmosphere in design, Clean and clear visual design Have space for children moving freedom under adult's observation		Have windows Have natural light, Width of corridor >=1200- 1800mm, Natural light, Have children's cabinet, Welcoming atmosphere in design, Have space for children moving freedom under adult's observation	No window Few natural light Width of corridor <1200mm or difficult movement No children's cabinets No social zones Messy atmosphere in interior space	No window or natural light, Width of corridor <1000mm Cramped and difficult to move around No children's cabinets No social zones Messy and chaotic atmosphere in interior space
Children's Storage	Well-organized arrangement Automatic doors Using color and material as coding and sign Multi-Function As "teaching tool" help to teach how to arrange their stuffs. Color coding High quality material: wood High-quality accessories	Well-arrangements Have doors Easy to open Easy to recognized and help children to store their stuffs Easy for teacher to take children's stuff High quality material: wood, plastic		Good – arrangements Easy to store and take out stuffs Good quality material: wood, plastic, aluminum	Cabinet without doors Have not enough space to store Out of children's body measurement Not safe for children	Hazardous metal fittings Too heavy (without being fixed to the wall) or too light (prone to breaking or falling over). Out of children's body measurement Not safe for children
	Lockable storage for teachers			Shelf or storage to store teacher's stuff	Have no storages for teachers or other material	
Table	Children's size Light weight Flexible Module As "toy" or "teaching tools" children can arrange by children Stackable Flat surface Not over-stimulation color	Children's size Light weight Module Multi-function Stackable Flat surface Not over-stimulation color		Children's size Adapt right function	No children's size or wrong size Heavy weight Overstimulation color Difficult to arrange for both children and adults	No children's size or wrong size Heavy weight Messy or overstimulation color Difficult to arrange for both children and adults

Spatial Furniture (Include Furniture's Setting and Arrangement)	Extremely Positive		Positive	Moderate	Negative	Extremely Negative
Chairs	Children's size Light weight Flexible Module As "toy" or "teaching tools" children can arrange by children Stackable	Children's size Light weight Module Multi-function Stackable	Children's size Adapt right function	No children's size Heavy weight Messy color	No children's size Heavy weight	No children's size Heavy weight Messy color
Shelf (Blocking Area)	In children's size Have lock wheel, flexible function Lightweight and safe for children Safe finishing material Complex material Follow color theme in interior space	In children's size, have enough space to store material Have lock wheel, flexible function Lightweight and safe for children Safe finishing material Complex material Not overstimulated color	In children's size Have wheel or not Not too heavy so that children can arrange by them self Good material Not overstimulated color	Not in children's size Heavy Difficult arrange Too colorful Too colorful or too dark color	Not in children's size Heavy Difficult arrange Too colorful	Not in children's size Heavy Difficult arrange Too colorful or too dark color
Curtain	Two layers or Easily adjustable curtains, especially for children Neutral or soft color, Minimal dust and easy to clean, Style matching with interior design of classroom	Easily adjustable curtains, especially for children, Minimal dust and easy to clean, Neutral or soft colors	Minimal dust and easy to clean, Neutral or soft colors	Prone to accumulating dust, Difficult to adjust Too overstimulated colors or dark colors,	Prone to accumulating dust, Difficult to adjust Dark colors	Prone to accumulating dust, Difficult to adjust Dark colors
Rug/Carpet (At least at WC must have)	No dust or minimal dust, easy to clean Various material Various shapes/form or images to stimulate children's imagination Color follow functional areas or Interior design concept	Minimal dust, easy to clean, Various material Bright or soft colors, not too much stimulation	Minimal dust, easy to clean, Bright colors	Prone to accumulating dust, Dark colors	Prone to accumulating dust, Dark colors	Prone to accumulating dust, Too dark colors

Table 29: Categorize the Main Components of Spatial Furniture Layers according to the Feeling Scale

4.2.2.7 Spatial environment

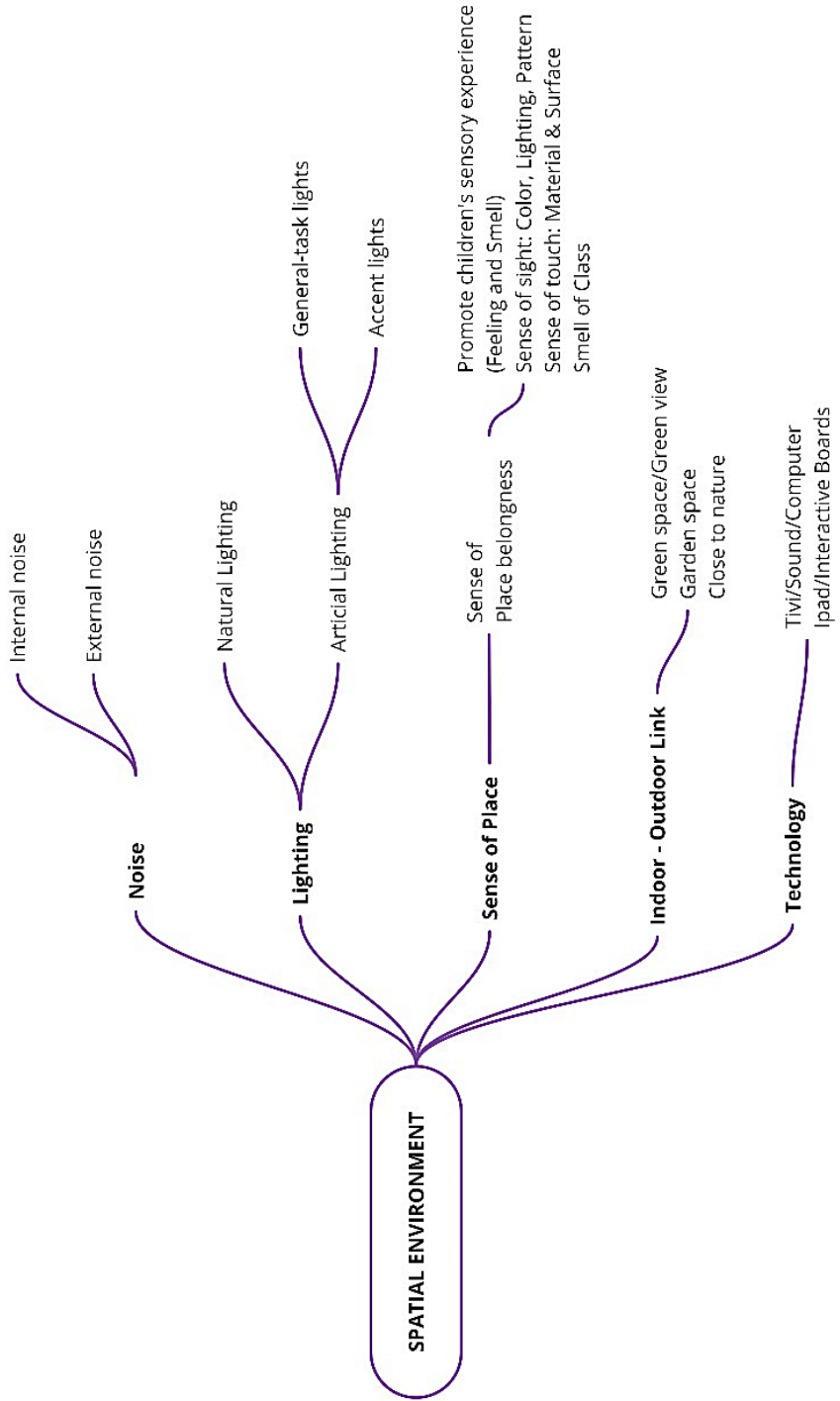


Figure 92: The main components of spatial environment layers and their relationship

Spatial Environment	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
Noise & Acoustics	<p>Not too noisy or not too quiet.</p> <p>In control between noise indoor and outdoor</p> <p>Children can listen to teacher's voice and teacher can easy to teach them by their natural voice</p> <p>Acoustic panels, rugs, and other materials to manage noise levels and create a quiet, focused environment.</p> <p>Techniques to reduce external noise and prevent distractions.</p>				Too noisy or too quiet
Lighting	<p>Enough natural lighting, artificial lighting in classroom</p> <p>Lighting follow functional areas in interior design, especially in learning area.</p> <p>Safe lighting technique for children, such as fluorescent lights</p> <p>Lamps resistant to dust accumulation, Lighting system that is easy to adjust follow requirements</p>	<p>Enough natural lighting, artificial lighting,</p> <p>Lighting follow functional areas in interior design, especially in learning area.</p> <p>Lighting system that is easy to adjust follow requirements,</p> <p>Lamps resistant to dust accumulation,</p>	<p>Have natural light and artificial light, Enough light for important areas in classroom, Lighting system that is easy to adjust</p>	<p>Few natural light</p> <p>Over stimulation in using artificial light</p> <p>Unsafe light's quality to children's eyes</p>	<p>Have no natural light, no daylight come into classroom space</p> <p>Just use only artificial light</p> <p>Unsafe light's quality to children's eyes</p>
Ventilation	Must have	Must have	Must have	No	No
Sense of Place	<p>Creating the feeling of belongingness (placing belongings) for children through physical and emotional factors in space, through impact on children's sensory experiences.</p> <p>Rich aesthetic in interior design</p> <p>Rich materials and textures</p> <p>Aesthetic setting and arrangements</p> <p>Decorative items by children and teacher</p> <p>Good smell</p> <p>Decor and Artwork: Displays that enhance learning and create an engaging environment.</p> <p>Sensory Areas: Spaces with different textures, colors, and materials to stimulate the senses.</p>		Creating a good connection between children and space		<p>Messy arrangements</p> <p>Chaotic atmosphere in visual and surface</p> <p>Creating negative feelings in children, such as a lack of welcome, stress, and annoyance.</p> <p>Bad smell</p>

Spatial Environment	Extremely Positive	Positive	Moderate	Negative	Extremely Negative
In-door and Outdoor link	Have outdoor area, green space Have garden in preschool environment Have indoor plants or indoor trees in class	Close to outdoor area, green space Close to natural environment Have indoor plants or indoor trees in class	Have outdoor view, green view Have indoor plants or indoor trees in class	Not have	Not have
Technology	Facilitate enough essential technological devices for children's learning activities as well as support for teaching's process of teachers. Interactive whiteboards, computers, and tablets to support learning and engagement.	Facilitate enough essential technological devices and modern digital devices for children's learning activities as well as support for teaching's process of teachers. Interactive whiteboards, computers, and tablets to support learning and engagement.	Have essential technological devices for teaching and learning activities. Interactive whiteboards, computers, and tablets to support learning and engagement.	Not have	Not have
Temperature and Air Quality	Climate Control: Heating, ventilation, and air conditioning (HVAC) systems to maintain a comfortable temperature. Air Quality: Use of air purifiers, ventilation systems, and plants to ensure a healthy indoor environment.				

Table 30: Categorize the Main Components of Spatial Environment Layers according to the Feeling Scale



4.3 Design Guidelines for the 7 Collaborative Layers in the Interior Space of the Preschool Classroom

Based on the above findings, the author develops design guidelines for 7 spatial collaborative layers in the interior space of preschool classroom, specifically for Vietnamese preschool children in HCMC. These guidelines for each layer are based on the factors that can create positive spatial experiences for the users of the space, both children and teachers. Designers or people who care about children spaces can take a step-by step, layer-by-layer approach to creating an optimal physical learning space for children. The tool, namely. “7 layers and the feeling scale”, can be used as a design tool for analyzing interior site to evaluate the interior site whether positive or negative to get a deep understanding of the space, or to find new ideas for the space. It is essential to remember that the interior design of preschool classrooms, and the overall environment is a complicated and challenging task. The following guidelines focus on the classroom to create an optimal space. In addition, designer must follow the standard requirements for preschool and children’s room design to achieve a comprehensive design solution.

First, the design process should prioritize understanding the developmental model of children and their developmental needs to evaluate the relationship between children’s needs and spatial layers. Next, be guided by the basic requirements outlined in the conceptual model of the characteristics of learning spaces to customize the essential factors. Finally, explore the “7 spatial collaborative layers ” model of the preschool classroom interior space to understand the characteristics of the components of each layer’s components. Combine this understanding with the feeling scale, and use these insights to develop a comprehensive design solution.

There are several general factors to be considered when designing classroom spaces, *“the classrooms themselves should be as open as possible, to allow for supervision and the penetration of natural light”*, they contain the required spaces

for all recommended activities, as well as spaces for personal care (Administration, 2003).

4.3.1 Spatial function

The most important components of the spatial function of a classroom include location, density, boundaries, spatial plan, spatial zone, and interior architectural elements.

The number of children and teachers and the average size of a classroom is not only a matter for architects or designers, but also a problem for educators to solve. It is a question of economics, of the fee between preschool and parents. Finding a solution that strikes a balance between the cost to educators and the ability to attract parents and their children to the school is a challenge for all stakeholders. Too few students with 2 teachers in a classroom can reduce preschool operating costs. Also, the average classroom is too large relative to the number of students, which is not beneficial. A large space can make children feel lost, and it can be difficult for teachers to use their voice effectively to communicate with the children. It is crucial to find a balance between the optimal space density and the cost per child that the preschool has to manage. The number of students also depends on the type of preschool. It is indicated that public preschools usually have a larger number of students than private preschools. However, in general, it can be said that the density of classroom space depends on these factors:

- Operating costs of the preschool
- Adequate number of students
- Necessary number of teachers and Nancy
- The average classroom space density per room should be in a moderate range and not fall into the negative or extremely negative range.

1. Location

- ✓ Locate far from noisy areas such as main gates or busy streets.
- ✓ Position near a green space or outdoor playground.
- ✓ Open the space to provide views of the outdoors or greenery.

- ✓ Select a location on the building's exterior to maximize access to natural light.
- ✓ Situate near corridors with ample space for social activities, such as greeting or welcoming.
- ✓ Arrange classrooms to face each other along the corridor to encourage social interaction.

2. Group size, child-caregiver ratios, and density

- ✓ Depends on the budget and educator's vision for the preschool and each classroom with how many children and teachers in a class.
- ✓ Depends on how many children and teachers are taught in a classroom.
- ✓ Should have enough space for different group sizes for different activities: large groups – small groups -individuals.
- ✓ There should be enough space or zones to fit the basic requirements of “closeness” inside the classroom, including four zones: intimate zone, personal space, social zone, and public zone (Caan, 2011) to properly divide the group sizes by understanding the teaching and learning plans of pedagogy.
- ✓ Low density is more beneficial than high density.
- ✓ 3-5 m² per child, no smaller than 1.5 m²
- ✓ Maintain an ideal classroom size of 14–16 children with 2 adults in a space of 60–100 m²
- ✓ For 17–25 children, provide 3 adults in the classroom
- ✓ Limit the number of children to no more than 30 per classroom

3. Boundaries

- ✓ Applicable both in preschools and classrooms
- ✓ Clear, clean, and safe.

- ✓ Consistent design themes for different zones (color coding, materials, graphics, symbols, lighting)
- ✓ Use of physical and visual boundaries to influence the five senses of children with different characteristics in terms of height, mass, permeability, transparency, and rigidity.
- ✓ Physical boundaries: well, solid or clear, high or dear physical objects, such as changing flooring, sliding doors, fixed walls, movable walls, partitions, secure fences, bookshelves, bookcases, storage units, and furniture.
- ✓ Visual boundaries: color, finishing material, texture, lighting...

4. Interior spatial plan

- ✓ Simple connection with the corridor and the outdoor environment.
- ✓ Based on the teaching and learning plan of pedagogy.
- ✓ A modified open-plan is better than an open-and closed plan
- ✓ Windows or open-green spaces to get natural light into the classroom.
- ✓ Clear circulation routes, functional areas, and traffic flow.
- ✓ Open observation for adults.
- ✓ Flexibility in planning to easily change and adapt specific goals.
- ✓ Multipurpose functions within the floor plan.
- ✓ Develop planning solutions to accommodate children between intimate zones, personal spaces, social zones, and public zones. There should be “individual corners” in the classroom for children.
- ✓ Should limit the use of solid and stable walls.
- ✓ Should avoid the use of codes in the classroom.
- ✓ Should have separate toilets for children and adults.
- ✓ Should have a storage room in the classroom to store things.
- ✓ Should have an outside area (if possible).
- ✓ Should have a loft in the classroom (if possible).

5. Interior spatial zones

- ✓ Have a wet and a dry region.

- ✓ Wet region: the entry zone (welcome area, children's cupboard, storage), and the messy zone (tables, chairs, easels, wooden workbenches, sand and water stations, nature study, sink, and a kitchen area)
- ✓ Dry region: the active zone (supports large motor play, wheeled vehicles, music and movement, climbing and dramatic play, dramatic/imaginative play, block play, reading center, computer station, fine motor toys and manipulatives, art, sensory tables, and food), and the quiet zone (includes blocks, manipulatives, construction toys, puzzles, books, games or just places to get cozy, sleeping and napping areas)
- ✓ The active zone and the quiet zone should be separated both physically and visually.
- ✓ The active zone could be located near social or public areas, such as theater/pretend play, block play, a reading center, a computer station, fine motor toys and manipulatives, art, sensory tables, and food.
- ✓ Active zone: active and quite noisy, take full advantage of the natural light in the class schedule. Higher activity levels with higher ceiling heights, resilient surfaces, bright colors, acoustical, and reflective.
- ✓ Quiet zone: quiet, focused area, sleeping and nap areas do not need much natural light, with lower ceiling heights, soft surfaces, muted colors, and acoustically absorbent.

6. Interior architecture elements

Ceiling

- ✓ Ceilings help to demarcate areas, and diffuse light. Higher activity with higher ceiling heights; quieter areas with lower ceiling heights.
- ✓ Flat ceilings to minimize dust accumulation.
- ✓ Light colors to increase the brightness and perceived size of the space.

Floor

- ✓ As boundaries to define areas in the classroom space.

- ✓ You should use finishing material and textures according to the function of each area.
- ✓ Avoid coding in the classroom.
- ✓ Consider that children may be wearing sandals or walking barefoot.

Wall

- ✓ The height of the wall depends on the spatial proportions.
- ✓ Consider different wall designs.
- ✓ Use both types of fixed or movable walls in the space, maintaining visibility of all areas for teacher observation and children's vision.
- ✓ Flexible design of the walls, movable walls with sliding doors can be used in the interior, which can be easily opened and expanded, and separate the space when needed.
- ✓ Decorate walls thoughtfully or use light colors.
- ✓ Tile walls up to 900mm to maintain cleanliness.

Stair

- ✓ Size of stairs right size for children and adults.
- ✓ The width is about 1,200-1,500 mm.
- ✓ Clear visual boundary.
- ✓ Install a fence to ensure safety.

Doors

- ✓ The number of height and width measurements in the design standard.
- ✓ Doors have locks.
- ✓ Use non-solid materials for the door system to enhance functionality.
- ✓ Include a fence to enhance security.

Windows

- ✓ To plan for large windows to have a view to the outside and natural light.
- ✓ Horizontal windows are recommended for interior classrooms, windows at children's eye level. Avoid windows that are too high for the children to see.

- ✓ 460 mm below the window sills (measured to the classroom finish floor) so that furniture and equipment can be easily placed against the exterior walls.
- ✓ 460 mm to 610 mm above the floor so that the children can see outside.
- ✓ Window is suggested with two layers of curtains.
- ✓ Include fence if the classroom is at ground level.

Shelves & partitions

- ✓ Shelving and storage units are used as partitions between activity centers.
- ✓ Shelves and partitions are child-size.
- ✓ Consider design movable partitions/ movable walls.
- ✓ Consider design low shelves with wheels so that they can be moved easily and the teacher can observe them well.
- ✓ Pay attention to the dimensions of the compartments in the shelves or cabinets, be based on the needs of the teachers, toys, play materials, and learning materials used in the classroom.

4.3.2 Spatial form

The main components of spatial form include point, line, shape, and form. These components create a solid void in the interior space that children experience directly. Therefore, the characteristics of these elements also shape the overall character of the space, and thus influence children's experiences of space in various ways. Design spatial form with careful consideration of proportions to create a well-organized environment that supports children both physically and visually. This means that a clear flow of traffic should be created and overly stimulating visual elements avoided.

1. Point

- ✓ The sense of stability and directionlessness.
- ✓ Create features of self-centering quality such as standing, suggest areas for design that need to be emphasized or focused and connected.
- ✓ Create features of dynamism or movement such as moving.

- ✓ A point can be designed as a focal point or as a highlighted area

2. Line

- ✓ Use curved lines/curved shapes/ or spheres/irregular forms in children's space to create a sense of softness and dynamism.
- ✓ Vertical lines convey a state of balance or strength.
- ✓ Horizontal lines convey a state of stability.
- ✓ Diagonal lines convey a sense of movement and dynamism, tension, danger.
- ✓ Curved lines convey a sense of movement, continuity, softness, and safety
- ✓ Zigzag lines convey a sense of tension or momentum, a feeling of excitement or fun.
- ✓ The group of analogous lines suggests a feeling of balance and harmony
- ✓ The group of contrasting lines suggests the feeling of excitement and fun.

3. Plane & shape

- ✓ - Rectangular shape
- ✓ - Triangle shape
- ✓ - Circle shape
- ✓ - Curvilinear shape
- ✓ - Natural shape could create a connection with nature.

4. Volume & form

- ✓ Sphere
- ✓ Cylinder
- ✓ Cone
- ✓ Cube
- ✓ Pyramid

4.3.3 Spatial order

Spatial order is about the arrangement and organization of space, both the large and small elements in the interior space. The order of the space should not only

be designed on the floor plan or in section but also from the perspective of the entire space. A well-organized order in the space can create as much as empty space for children's joint activities or among children's interaction with peers or teachers.

1. Proportion & scale

- ✓ Follow the table with the body measurements of preschool children and the anthropometric data of children.
- ✓ Base the design on the developmental measurements of preschool children.

2. Balance

- ✓ Apply the balance in quiet areas where children need to focus.
- ✓ Symmetrical balance conveys a sense of calm, relaxation, and balance. Use of symmetrical balance to emphasize the central area in the spatial arrangement to draw attention to the completion of the axis.
- ✓ Symmetrical balance is suggested for applying in public and social zones to create good organization for a clear overall visual space and traffic flow.
- ✓ Radial balance conveys a sense of self-centeredness. Suggest for application of radial balance for spaces that need to create a connection or movement based on a center.
- ✓ Radial balance is suggested for design quiet areas
- ✓ Asymmetrical balance conveys the sense of visual activity and dynamism, movement, change, exuberance, flexibility, and adaptability. Suggestion for use of asymmetrical balance for spaces to create a highly positive feeling, stimulate children's participation, and encourage their imagination.
- ✓ Asymmetric is suggested for active spaces.

3. Harmony & variety

- ✓ Apply to spaces that have various components that share a common feature or property of components.
- ✓ Convey sense of belonging, consonance, or unity in the space.

- ✓ Variety creates a sense of interest and stimulation through different orientation, size, features, texture, and color.

4. Rhythm

- ✓ Include structural rhythm, vertical rhythm, and horizontal rhythm.
- ✓ Categorized into repetition, alternation, and progression.
- ✓ Structural rhythm helps to emphasize and highlight the structure of the space.
- ✓ Vertical rhythm helps to expand the height of the space.
- ✓ Horizontal rhythm helps to expand the strangeness of the space.
- ✓ Structural rhythm, vertical rhythm, and horizontal rhythm.
- ✓ The rhythmic composition conveys a sense of rhythm, and thus a basic order in space which helps to subconsciously promote children's spatial perception.
- ✓ Repetition conveys a sense of sameness, harmony, and balance.
- ✓ Variety conveys a sense of movement and make the space more interesting.
- ✓ Progression conveys direction for the eye by leading the eye to a specific point. Suggest for draw the eye to a focal point or key area.

5. Emphasis

- ✓ Emphasis conveys a relationship of dominance and subordination, is more attractive, and grabs attention.
- ✓ Emphasize key areas or focal points based on the spatial functions and design concept.
- ✓ Focal points or prominent features are suggested throughout the space for easily recognize the role of different spatial zones.
- ✓ Focus on important areas or key elements.

4.3.4 Spatial color

If it's not possible to alter the position or form of a long corridor, it's essential to break up its length visually by using different colors for the doors or windows of each classroom. Additionally, redesigning subspaces with varying shapes outside

classrooms can help children identify their own spaces. Choosing colors for preschools is a complex task, is suggested based on key points:

1.: Color choices should account for children's physiological, psychological, and cultural needs. Young children generally prefer bright colors like red, blue, pink, and purple, while they tend to dislike darker tones like gray and brown. Light colors are more appealing as they evoke positive emotions.

2. Functionality and Spatial Composition: Colors should align with the function of each space, helping to define boundaries and support spatial perception. Different colors can be used to distinguish functional areas, aiding both children and teachers in navigating and using the space effectively.

3. Relation to Environment: Color choices should complement the physical environment, objects, and themes in the space, such as furniture, learning materials, and decor. Additionally, the clothing of children and teachers contributes to the overall color scheme of the environment.

4. Proportion of Colors: Designers must carefully balance the use of background, main, and accent colors. The proportion of each color impacts the overall mood, influencing children's behavior and emotions.

5. Cultural and Socio-Emotional Context: Colors have different meanings across cultures and climates, affecting the socio-emotional environment. Some colors may be perceived positively in one culture and negatively in another, so designers should consider regional and cultural differences when selecting colors.

Here are some guidelines for color design in classrooms:

- ✓ Colors are preferable to forms.
- ✓ Pay attention to how colors are used in architectural elements, furniture, finishing materials and textures, and lighting.
- ✓ Colors can evoke a sense of taste in children. Red and yellow convey a sense of sour and sweet at the same time; blue conveys a sense of sour or tasteless; green and orange convey a sense of sour; purple conveys a sense of bitter.

- ✓ Using colors as coding that is easy for children to recognize to categorize different functions in space.
- ✓ Light colors evoke positive feelings than dark colors.
- ✓ Light colors are preferred over dark colors.
- ✓ Warm colors create a feeling of warmth, activity and stimulation.
- ✓ -Warm colors help to emphasize the size of objects, and cool colors help to increase the size of the space.
- ✓ Cool colors convey a feeling of relaxation, nature and tranquility.
- ✓ Red, purple, pink and blue are preferred colors.
- ✓ Black, white, gray and brown are the least preferred colors.
- ✓ Yellow and orange are still considered colors that lie between preferred and not preferred.
- ✓ You should use light, soft and cool colors for large surfaces such as walls and ceilings.
- ✓ Use bold colors for focal points or key areas.
- ✓ Use colors to highlight the specific functions of each area, warm colors for active areas, cool colors for quiet areas.
- ✓ Predominant color should be a neutral color and more than 80% reflective.
- ✓ Stronger, more vibrant colors should make up 10-15% of the space.
- ✓ Encourage the use of natural color themes in children's rooms.
- ✓ Limit the use of primary colors on large walls to avoid overwhelming the space.
- ✓ Use simple patterns on walls and floors to prevent overstimulation.

4.3.5 Spatial, Material & Texture

- ✓ Finishing materials are durable and easy to clean.
- ✓ Different textures in a good scale and proportion in the space to enhance children's sensory experience. Ceramic tiles have a hard surface and are cold to touch, glass is also cold, fabric is soft and warm, and wood, although hard, gives a warm feeling.

- ✓ Ensure a balance between tactile and visual experiences by limiting the use of finishing materials to prevent overstimulation: Smooth porcelain, the surface of metal, and exquisite silk conveys the feeling of delicate and moist textures; Durian shells, viscous caterpillars or bushes convey a sense of resistance and discomfort; Line evokes a sense of nature and leisure; Silk conveys a feeling of delicacy and nobility; Leather conveys a feeling of a rustic atmosphere. Hard finishing materials convey feeling of strength and coldness, while soft finishing materials conveys a sense of softness and warmth. Wood conveys feeling of comfort.
- ✓ Use materials according to function for individual area. Easy-to-clean finishing materials are used in public areas, and vice versa. The selection of finishing material should follow the design concept.
- ✓ Use ceramic for the bathroom, with a rough texture on the floor.
- ✓ Wood is the ideal material for furniture.
- ✓ Acrylic is suggested for a low budget.
- ✓ Limitation in use of glass, metal

1. Ceiling

- ✓ Use light-colored finishing material to enlarge the space.
- ✓ Use finishing material to minimize dust accumulation.

2. Floor

- ✓ Attention the pattern of the finishing material when applying it to the wall in the classroom
- ✓ Suggestion for materials for flooring in large/public areas/ social areas: finished wood flooring, ceramic tile, porcelain, vinyl tile.
- ✓ Suggestion for materials for flooring in small areas/individual spaces/ intimate zones: short-pile rug or carpet.
- ✓ Use light-colored floor coverings to make the space appear larger and brighter while making dust easier to spot.

- ✓ Limit the use dark floor coving to give the space a sense of depth and heaviness, making the dust difficult to detect.

3. Wall:

- ✓ Pay attention to the pattern of the finishing material when applying it to the wall in the classroom
- ✓ Suggested finishing materials for the wall or part of the wall: paint, wallpaper, wood, tile, fabric, or acrylic.
- ✓ Placing the tile 900 mm from the wall to avoid dust for children
- ✓ Designing a “movable wall” with use different surface materials, such as soft material.
- ✓ Use natural materials and locally available materials.
- ✓ Use the material to limit noise in quiet areas.
- ✓ Restriction on the use of glass.

4.2.6 Spatial Furniture

- ✓ Key factors in design: safety, comfort, and developmental appropriateness.
- ✓ Design is based on the anthropometric data of children, specifically Vietnamese preschool children.
- ✓ Size of the furniture follows the children's scale or children's body measurements.
- ✓ Available measurements of a boy in the height of about 103.3 mm (4 years old) to 110.0 mm (5 years old) as information from WHO; girl in the height of about 102.7 mm (4 years old) to 109.4 mm (5 years old).
- ✓ Compartments for this classroom should be at least 305 x 305 x 1,220 mm (width x depth x height). The bench in this area should be approximately 255 mm high to sit on whilst putting on their outdoor clothing and boots.
- ✓ Use lightweight, movable, and easily adjustable elements for flexibility.
- ✓ Suggested that as an “educational tool” and support the teaching process.
- ✓ Designed to stimulate children's imagination and curiosity to explore and discover.

- ✓ Designed to easy to arrange and multifunctional is recommended.
- ✓ Wood as the primary material for furniture.

1. Table

- ✓ Design with children's scale. The available size of the seating is about 460mm high for group of 3-4 years old, and 530mm high for group of 4-6 years old.
- ✓ Design with geometric shapes is easy to arrange even when space is limited.
- ✓ Texture of the table is important.
- ✓ Color of the surfaces can affect children's eyes when they are working or learning at the table. Pay attention to the colors used for the table and chair.
- ✓ Designed in modular form with multiple functions.
- ✓ Use soft colors, not too dark and not too stimulating.

2. Chair

- ✓ Design with the children's scale. The available seating size is 260mm high for groups of 3-4 years old, and 310mm high for groups of 4-6 years old.
- ✓ Texture of chair to provide a comfortable feel.
- ✓ Should be lightweight.
- ✓ Use natural wood for chairs
- ✓ Use bright color in design

3. Shelves or Cabinets

- ✓ Design with the body measurements of children. Should be divided into different sizes depending on the objective.
- ✓ Design in both low and high shelves for different purposes. Low shelves should be around 900-1100mm so that they cannot be overlooked by adults. High shelves should be fixed to the wall for safety reasons.
- ✓ Design with multiple functions, such as shelves for storing books, learning materials or as physical boundaries.
- ✓ Designed with neutral colors to avoid visual overstimulation.

- ✓ Small shelves are suggested with wheels to be more flexible
- ✓ Large shelves are suggested to fix on the wall to ensure safety
- ✓ The cabinets are suggested with doors.
- ✓ Pay attention to the design and materials of cabinet accessories, such as handles and hinges, to ensure they are safe for children.

4.3.7 Spatial Environment

1. Noise & Acoustics

- ✓ Minimize noise levels to prevent negative effects on children and teachers
- ✓ Attention should be paid to both external noise and internal noise.
- ✓ Noise level should be different in the different functional areas.
- ✓ Attention should be paid to the negative impact of noise through the choice of different design layers: location, density, boundaries, materials and textures, and furniture.
- ✓ Use “sound absorbing materials” in interior space.
- ✓ The classroom should be located away from noisy areas such as the main gate or main street.
- ✓ Low density in the preschool classroom.
- ✓ Design physical/visual boundaries as “barrier walls” to prevent noise in physical and visual terms from outside

2. Lighting

- ✓ Light can be used to influence activities and moods.
- ✓ There must be natural light in the classroom.
- ✓ Consider the position of the windows as they can influence the direction of light. The height of the ceiling can influence the quality of light.
- ✓ Control the quality of natural light entering into the classroom through physical designs.
- ✓ Use natural and artificial light according to the interior space layout and spatial organization.

- ✓ Different types of lighting should be provided to allow for flexible spaces: general-ambient lighting, task-specific lighting, floor lighting, desk lighting, ceiling lighting, and wall lighting.
- ✓ Use lamps with a simple style to avoid dust accumulation.
- ✓ To strike a balance between functional and esthetic lighting design.

3. Sense of place (feel & smell)

- ✓ Incorporate sensory experiences that align with the individual characteristics of children into the space design.
- ✓ Create a unique sense of place and belonging for each classroom as spatial coding within the overall preschool environment.
- ✓ Have a display area for the children's art.
- ✓ Enhance the design of the children's cabinets with abstract and playful images connected to each child's personality.
- ✓ Enhance the esthetics of the classroom space through layers of color, materials and textures or furniture design.
- ✓ Visual graphic designs should be designed based on a group of children in the classroom.
- ✓ Consider the use of plants, small trees, and flowers within available capacity.
- ✓ Limited in using artificial versions of natural elements
- ✓ Limitation in using too much detail in the design

4. Indoor-Outdoor Link

- ✓ Open or widen window and door system as much as possible
- ✓ Near a green vista or green space
- ✓ In limited cases, you could place some small trees, plants or flowers in the classroom
- ✓ Use abstract images (plants, flowers, animals) or colors (green, blue) inspired by the natural environment.

5. Technology

- ✓ Setting of technology in the classroom should depend on the pedagogy and needs of the preschool.
- ✓ Identify technology items that must be present in the classroom.
- ✓ Should set up a technology area in the classroom (if necessary).



4.4 Designs development

Building on the theory developed in this dissertation, the author implemented a comprehensive color-coding system for the core and sub-layers that allows these theoretical concepts to be effectively translated into visual representations for product development. This includes the guideline book, the exhibition proposal and the color system of the wheel. Color coding is an important tool in this dissertation, as shown in the accompanying figure. It allows the reader to intuitively grasp the complexity of the content and helps them retain the information through memorable visual cues. With this method, the theoretical framework is not only explained but also made accessible through visual design strategies that are seamlessly integrated into the learning experience.

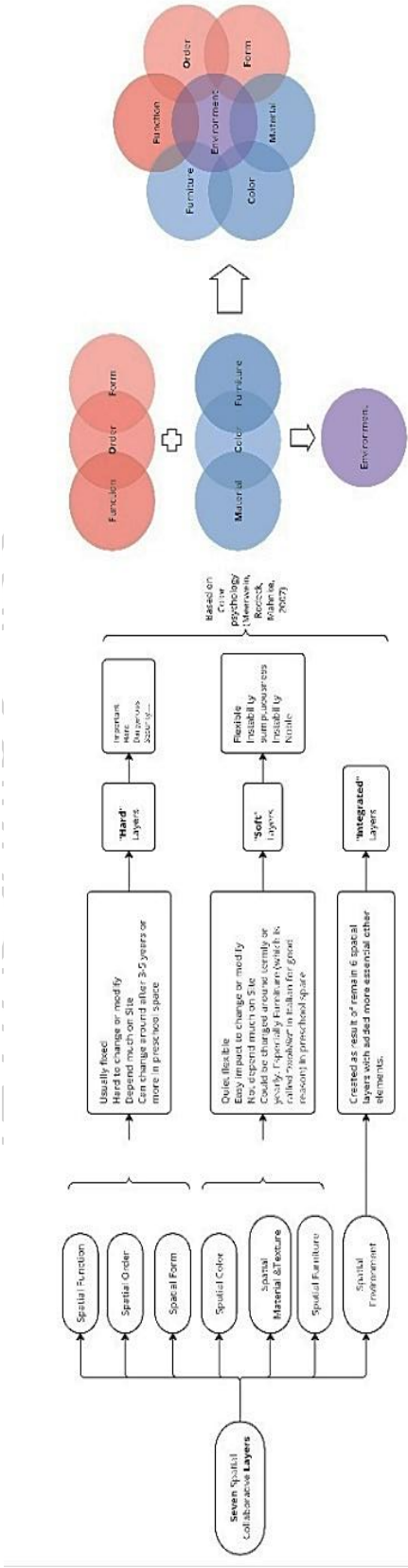


Figure: Spatial Layers Analysis Framework

Figure 93: Structure and Color Analysis for 7 Spatial Layers.

4.4.1 Interior Guidelines Book

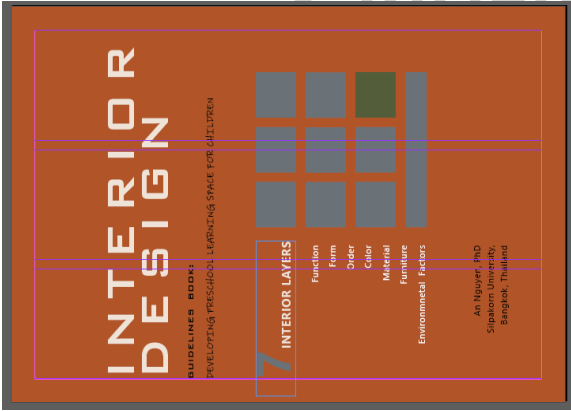
This book serves as a comprehensive guide for architects, interior designers and educators who want to create optimal learning environments for preschool children. Through extensive research and analysis, the book provides detailed insights into the design of interior spaces, focusing on the specific developmental needs of young children. It introduces a structured approach by examining seven different spatial layers in preschool environments, with each layer contributing to the overall atmosphere and functionality of the space. Drawing on both theoretical foundations and practical applications, the book includes step-by-step instructions that bridge the gap between academic research and practical design. Readers will learn how to apply these principles using a color-coding system and the innovative "feeling scale" that highlights children's emotional responses to different spatial configurations.

By navigating through these layers, readers will gain a deeper understanding of how to design environments that foster a sense of safety, stimulate creativity, and enhance social and spatial relationships among children. This book is a valuable resource for anyone committed to creating spaces that promote positive development and learning for young children.

The main idea of an interior design guidelines book is to create an interesting guidelines book where architects and designers can find the basic knowledge about the relationship between children and space and pedagogy; moreover, they can find many practical and useful design approaches and solutions for interior design elements for their design conditions. Above all, parents can find inspiration on how to design their children's learning space or corner by using some of the tools contained in this book to play with their children at home.

4.3.1.1 Designing process

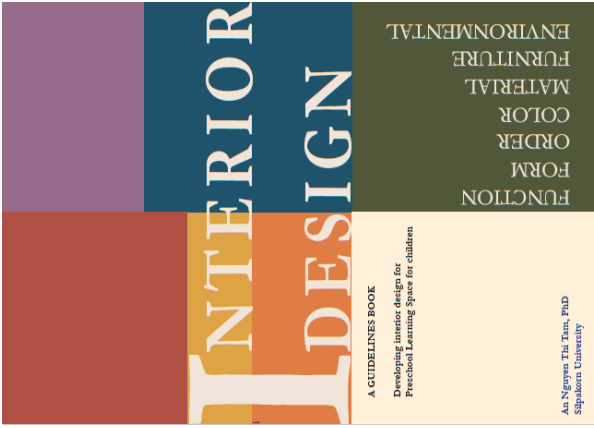
Many bindings are designed based on the idea of 7 spatial layers with some key words: layers, interior space, transparent layers, overlapping, children's space. The last option is developed based on the concept of a key letter from each layer.



Feb 2024 -1st version



March 2024 - 2nd version



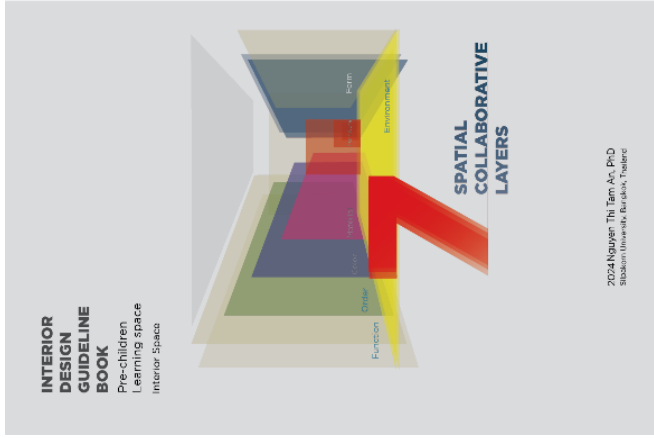
March 2024 - 3rd version



May 2024 - 4th version



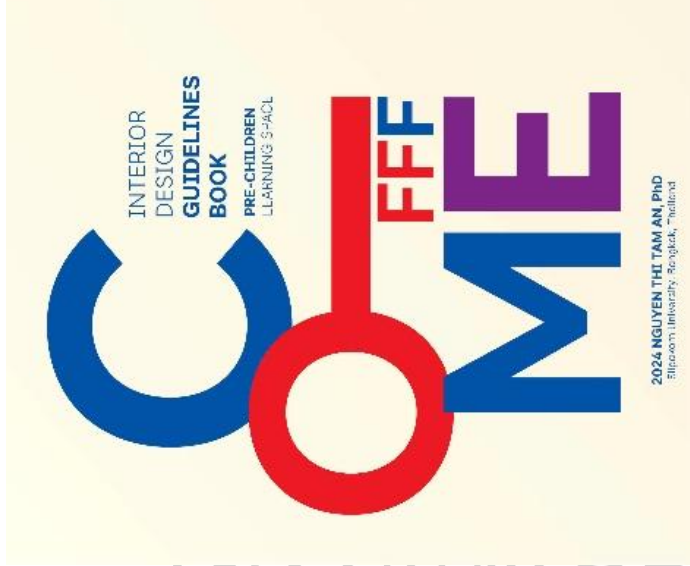
June 2024- 5th version



June 2024-6th version



August2024-9th version



August 2024-8th version



July 2024 -7th version

Figure 94: Drafts of Cover book of Interior Design Guidelines book

- Final version of Guidelines book

The final version is developed by idea of layers by layers create to space with five keywords for design book: space, layer, dynamic, transparent, fun. By using the color coding based on core layers (red), sub layer (blue), and combine layers between core and sub is red + blue = purple.

In here, 7 keywords in spatial layers are used as keywords to development as inspiration for ideas of exhibition and cover book, with **F (Function)-F (Form) - O (Order) – C (Color) – M (Material & Texture) - F (Furniture) – E (Environment)**. They are come into **COME – 3F**, in which, **3F** is transfer into the image of a key – as guidelines for designers “read” and “unlock” the space in order to understand more about children and children’s space and create to an optimal space for young children.

The book is structured into six sections, with around 100 pages, which include:

A – Introduction

B – Space and Preschool Children

Learning environment and Preschool Children Development

Interior Design of Preschool Physical Learning Space

C – 7 Spatial Collaborative Layers in Preschool Physical Learning Space

Design Guidelines for the 7 Interior Spatial Layers in the Interior Space of Preschool Classroom

The 7 Interior Spatial Layers in Interior of Preschool Learning Space and Feeling Scale

D – Toward to Future Design Research

E – Conclusion

F – References



Abstract

Abstract text describing the book's content and objectives.

CONTENTS

06	A. INTRODUCTION
07	B. SPACE AND PHYSICAL CHILDREN
08	C. FUNCTIONAL AND PHYSICAL CHILDREN
09	D. PHYSICAL DEVELOPMENT
10	E. COGNITIVE DEVELOPMENT
11	F. EMOTIONAL DEVELOPMENT
12	G. SOCIAL DEVELOPMENT
13	H. DESIGN GUIDELINES FOR THE 7 COGNITIVE LAYERS
14	I. CONCLUSION AND FUTURE RESEARCH
15	J. REFERENCES



[illegible]

The main components of spatial function include location, density, boundaries, spatial use, interior architectural elements.

It is critical to balance optimal space density with the cost per child that the program needs to manage. The number of students also depends on type of program. It is critical that public preschools typically have a larger number of students compared to private preschools. However, in general view, better density in a classroom can result in considered based on these below factors.

- Open area of room of the preschool
- Seasonal number of students
- Average number of teacher and Nurse
- Economical classroom space per room should be assessed regularly, not in more on the column of negative or extremely negative.

[illegible][illegible]

4.4.2 The feelings wheel tool of seven spatial interior layer

The Feeling Wheel can be seen as both a toy and a tool to help readers better understand the theory of the 7 layers and how they work together to create either 'positive space design' or 'negative space design' The Feeling Wheel consists of two layers: The intermediate layer consists of eight different sections that correspond to eight different levels of feeling: moderate (appears twice, symmetrically aligned on the axis), extremely positive, positive, moderately positive, extremely negative, negative and moderately negative. Each emotional level is further divided into 7 layers that reflect the different emotional levels. The outer layer consists of 7 circles – 7 layers with keywords related to the most important elements belonging to each layer.

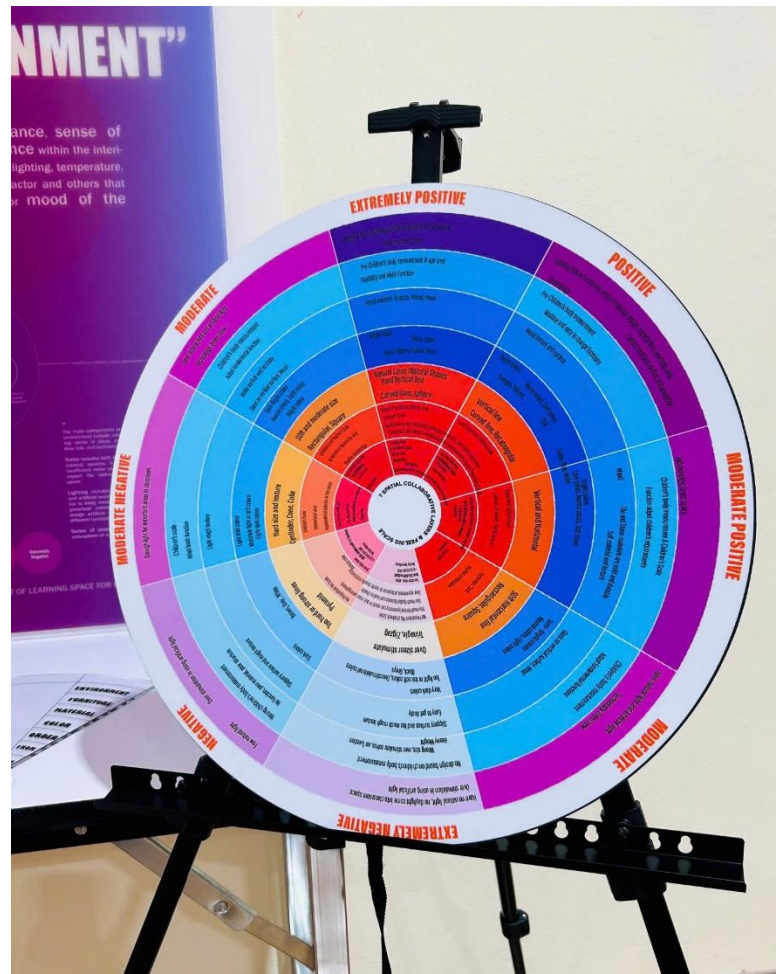


Figure 96: Prototype of Feeling Wheel of 7 Spatial Layers



Prototype of The 7 Interior Spatial Layers Boards

Figure 97: Prototype of The 7 Interior Spatial Layers Boards

4.3.3 “Come to Unlock” Exhibition

Theme of the exhibition: Human experience, Discovery, Multi-layered, Dynamic, Journey.

Name of the exhibition: COME TO UNLOCK

Ideas: COME TO UNLOCK the space by embarking on a journey through the layers, step by step (1-2-3-4-5-6-7), each revealing a deeper understanding of the design of preschool environments. Reach the final destination where the complete work of my thesis awaits you — a culmination of research, theory and practical guidelines. Engage with the Feeling Wheel of 7 layers, a dynamic tool that not only illustrates the relationship between space and emotion, but also encourages the reader to explore the intricate balance between positive and negative space design.

Each layer you uncover builds on the previous one, offering insights into how indoor spaces can foster a nurturing, stimulating and imaginative environment for young children. As you read the Guideline book, you will develop a deep understanding of the critical role that design plays in shaping the experiences and development of preschool-aged children. This book is an invitation to experiment, question and ultimately master the art of creating spaces that support and inspire the next generation.

Design of Exhibition Space



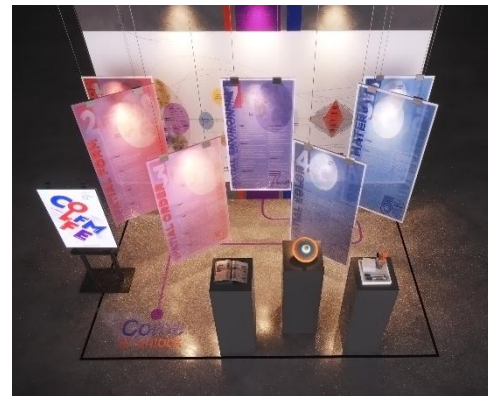
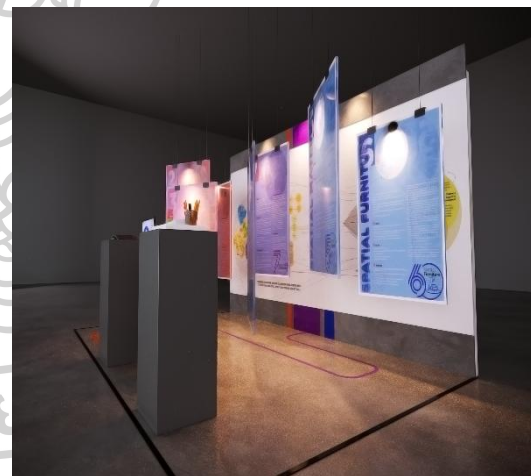
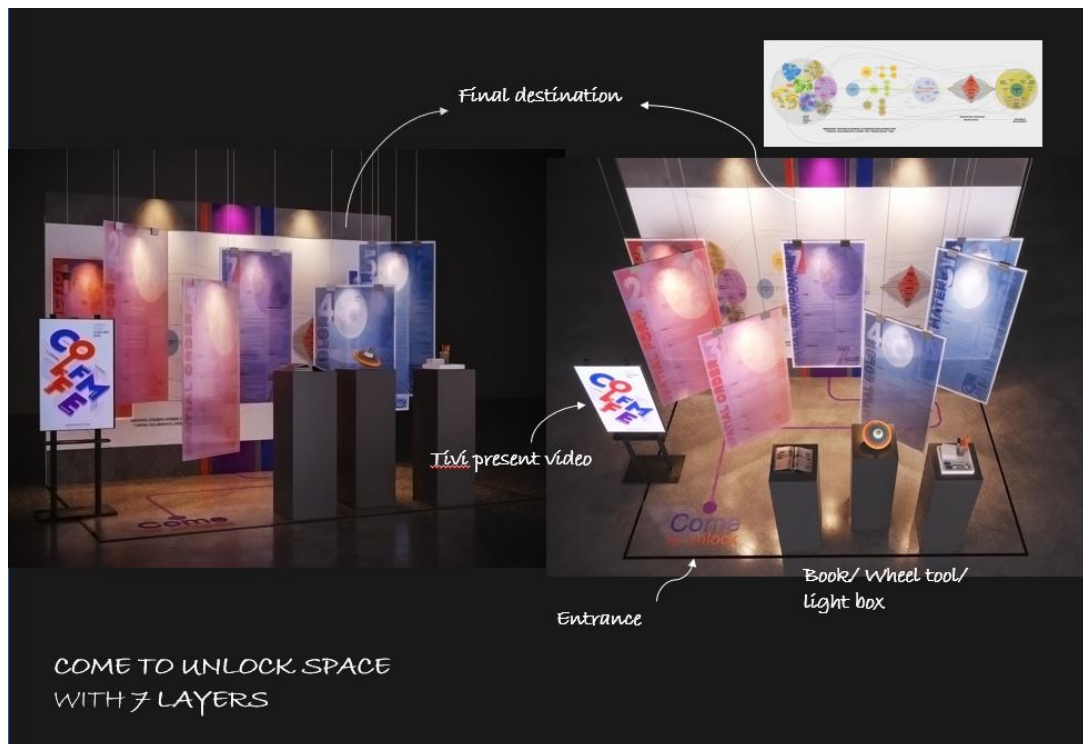


Figure 99: Floor plan of Exhibition and concept for Exhibition. By Author

1-Design of The 7 Interior Spatial Layers Boards _ Option 1



Figure 100: Design of The 7 Interior Spatial Layers Boards _ Option 1

1-Design of The 7 Interior Spatial Layers Boards _ Option2



Figure 101: Design of The 7 Interior Spatial Layers Boards _ Option 2

CHAPTER 5

CONCLUSION AND DISCUSSION

Interior design can have both positive and negative effects on children's characteristics. Children spend a lot of time in preschool and classrooms, more than 8 hours a day. Interior designers think about how people occupy and experience spaces, and how to arrange and use the objects that fill them in a way that allows us to recognize who we are as individuals and how we relate to others. They also create the many other qualities that make us successful through the success of our environments (Caan, 2011). It is clear that much of children's cognitive development is the result of routine experiences in a confined space. A well-designed space can help young children unconsciously form good habits and develop long-term habits through daily interaction activities. Consequently, the design of the preschool interior and classroom can be seen as a "pedagogical tool" in the role of the "fourth teacher" in children's learning life. The interior of the classroom is a holistic system structured by different spatial layers that have different influences on the children. This 'pedagogical tool' is developed in this dissertation as a theoretical conceptual framework. It serves as a 'lodestar' for subsequent interior design guidelines structured together with the concept of the "seven spatial layers" and is intended to guide and inform future learning space development outcomes.

The main research findings explored in this dissertation concern the Theoretical Conceptual Framework for the interior space of preschool classrooms with three main components in this model: children's developmental needs, spatial layers, and philosophy of pedagogy. By discovering the relationship between the interior of the physical learning space and children's development, the author finds the key insights into which main elements of the interior space influence children's developmental needs. The results of both the literature review and the qualitative analysis have shown that the elements in the classroom that play an important role in interior

design include objective components such as spatial layers and subjective components such as teachers and peers. When designing the interior of learning spaces, especially early childhood classrooms, the interior designer should obtain and analyze information from the main end users, not only from the children - the developmental needs of preschool children - but also from the preschool teachers, – who play a crucial role as the “second teacher” in teaching, interacting with the children and managing and designing the spatial organization of the classroom (parents are the “first teacher”, according to Reggio Emilia theory). Teachers are a subjective factor in pedagogy. They follow the philosophy of pedagogy, which is expressed in their teaching methods, lesson plans and learning plans. This approach influences the spatial arrangement, organization and planning as well as the overall spatial arrangement of the preschool and each classroom. Therefore, all these components are interrelated. In order to create an optimal learning space, no component should be underestimated and it is important to better understand the individual components and their interrelationships.

5.1 Discussion

Above findings of the thesis, within the scope of this study, have partially addressed the research objective, providing insights for further adaptation and consideration of the research goals.

1. What are the key interior elements and spatial levels in preschool classrooms that address the physical, socioemotional and cognitive developmental needs of children?

They are 1- children with focus on children’s developmental needs; 2- interior spatial layers with focus on 7 layers include spatial function, spatial form, spatial order, spatial color, spatial material, and spatial furniture; 3- pedagogy with focus on teaching and learning plans or activities. The concept of the three main themes is combined to create a theoretical model for the interior design of preschool learning spaces. This design model could be a basic concept for the design

of learning spaces for children. The three themes cannot be changed or replaced, but the content of each theme can be adapted to accommodate differences in culture, society, location, budgets, and educator orientation.

2. How can interior design guidelines be developed and adapted to optimize classroom environments for preschool education in Vietnam?

In order to create optimal classroom space, the 7 interior spatial layers should be designed to adapt the requirements of children's development and philosophy of pedagogy (Table 32). In the system of 7 interior spatial layers, include core layers – sub-core layers – integrated layers. Constructing and categorizing detailed components in each layer in the concept of 7 layers is important to gain a deep understanding of the role, characteristics and influences of each layer on the space itself and the children. Based on the real conditions, the designer can change or renovate one of the 7 interior spatial layers to suit the clients' requirements for children's room design.

In the core layers, spatial function is regarded as the key element. In the sub-core layers, spatial color is considered a highly influential factor, significantly impacting children's cognitive development and emotions.

Spatial function include location, density, boundary (visual boundary and physical boundary), interior spatial plan, spatial zones, interior architecture elements. In this layer, location plays a crucial role in enhancing interior spaces. There is limited opportunity to create public transition areas within the classrooms or establish connections between them, such as long connecting corridors or lobbies that encourage children's physical activities or foster social connections between children, peers, teachers, and parents. Additionally, the restricted total area of preschools limits the availability of green spaces, hindering the creation of connections between indoor and outdoor environments and reducing interaction with nature through plants and trees. The key elements such as density, spatial planning, layout, and architectural features must be carefully considered during the design process. Low or high density in classroom spaces significantly impacts children's socio-emotional

development and the effectiveness of teachers' activities. The ideal number of pre-school children in a classroom could be 10-15 children or 15-20 children with two teachers.

Spatial form includes factors shaping and forming to space, creating to form of space, solid and void, figure and ground. They are point, line, plane & shape, volume & form. Each factor will have various elements and each of them have thousand meaning when combine and style in design. It is essential to understand the meaning of each of them, which have negative or positive impacts on children's emotion, children's behaviors or children's emotion. Thesis findings highlights that curved lines, curvy shapes, spheres, and irregular forms convey a sense of softness and dynamism. Their continuous flow throughout each zone helps create an intimate and welcoming space for children.

Spatial order includes design principles in interior space, include proportion & scale, balance, harmony & variety, rhythm, emphasis. They are various and flexible in shaping and forming interior space. Combine with spatial form, they can create to form and order of space. Through embodied movement, spatial experiences are formed, and through daily spatial interactions, children develop spatial cognition and learn from their environment. Specially, proportion & scale should be based on children's scale and children's body measurement.

Spatial color includes many variables, due to of various characteristic of color, when applying color in interior space, should be based on 5 key points: children's psychology about color, such as children's preferences; color follow functionality and compositional space; color relation to surrounding environment; proportion of colors, cultural or socio-emotional context. Primary, neutral, and tertiary colors are highly recommended for classroom spaces, followed by secondary, complementary, and analogous colors. Black and white should be used sparingly as concepts for lightness and darkness and are not ideal for preschool environments. Primary colors are best suited for active and learning areas, while tertiary colors are recommended for active areas, play areas, and hallways. Analogous and complementary colors are

ideal for learning spaces, while neutral colors should be reserved for resting and sleeping areas. The blue-yellow-green color group is favored for children's spaces, with orange-red-white-violet as secondary preferences. Black is discouraged in children's environments, and warm colors are generally preferred over blue tones.

Spatial material, similar to spatial color, various components and flexible in application. Safety, sustainable are key words when considering about finishing material for children. This layer has close relationship with color and furniture, so that, beside of its function, designer also should consider about its aesthetic. Walls can be painted with paint, wallpaper, ceramic tile, fabric or acrylic. Wood, carpet or rugs are best for floors. Ceramic is recommended for bathrooms, while wood is ideal for furniture such as shelves, tables, chairs and partitions. Glass should be used with caution, possibly for walls and bathrooms, but with care in children's spaces. Metal should only be used for specific reasons and is not highly recommended. Acrylic or plastic can be used for walls, shelves, tables, chairs and partitions, but are not recommended if a higher budget is available. Carpets or rugs are highly recommended for floors. Glass, metal and acrylic should be carefully considered when designing preschool spaces.

Spatial furniture should be designed or selected with a focus on safety, ergonomics, and alignment with children's anthropometric measurements. Beyond shape, form, and color, the furniture's function should be flexible. In preschool classrooms, furniture should be multi-functional, serving not only as seating or storage but also as objects for learning and interaction, stimulating children's exploration and creativity.

Spatial environment acts as a transitional layer shaped by the other six layers. It can change periodically, influenced by factors such as weather (temperature, ventilation, indoor-outdoor connection), the specific group of students or teachers, the classroom's cultural influences, the nature of the social environment, and the level of technology integrated into the space. In this layer, the sense of place is

component in creating to place belonging of children. Future research can go further research with this variable.

The seven interior spatial layers work together, with each component supporting and interacting to create a cohesive space. As children study, live, and experience the interior of the preschool classroom day by day, year after year, their daily activities shape how they perceive the world and influence the formation of their habits.

The system of design guidelines was developed based on the individual components in each layer that have a positive impact on children. It is important to proceed step by step. Understanding the characteristics of each component in each layer, in relation to the arrangement of wheel 7 layers tool, is key to finding optimal design solutions and getting closer to them. Each component of the seven layers will have detailed guidelines. Depending on the specific site, conditions, and budget, clients or interior designers can develop their space step by step, layer by layer. They can prioritize certain components within each layer or focus on specific layers within the system of seven layers to guide the development process.



Children's development	Developmental requirements	Design requirements for Interior Space
<p>Physical development</p> <ul style="list-style-type: none"> - Gross motor skills are movements of the body. Rolling, sitting, crawling, standing, walking, running, hopping, jumping, etc. They all require strength, endurance and agility to improve coordination, balance, and judgment. - Fine motor skills involve using the hands in coordination with the eyes to perform precise finger and hand movements. 	<ul style="list-style-type: none"> - Work alone or together; - Work at their own pace to practice and consolidate their skills; - Extend their skills and progress in their development; - Make connections between skills acquired indoors and outdoors. - Have enough space to run, and easy and safe in movement - Have enough natural light to receive vitamin D and study in details 	<ul style="list-style-type: none"> - Clear and clean interior space with clear traffic flow - Well-organized spatial organization - Open window enough to have natural light - Open space to make good connection - Legibility in space with visual boundaries and physical boundaries - Connection to nature -> Focus on Spatial function, spatial form, spatial order, spatial furniture, and spatial environment
<p>Cognitive development</p> <p>Focus on Preoperational thinking with 2 sub-stages, namely the sub-stage of symbolic function and the sub-stage of intuitive thinking, be grouped to three themes:</p> <ul style="list-style-type: none"> - exploratory and organizational skills, including exploration, classification and mental ordering. - executive functions and problem-solving skills - language development and symbolic thinking 	<p>Promote indicators belong to cognitive skills</p> <ul style="list-style-type: none"> - exploration, classification and mental ordering - planning, problem solving, behavior, and imagination - level of language development, symbolic thinking through pretending, and behavior 	<ul style="list-style-type: none"> - Enrich interior space with all 7 layers - Be designed in such a way that children's imagination is encouraged through the use of designed symbols. - To embrace abstract concepts to nurture their imagination, to stimulate their curiosity and encourage them to ask more questions, exploration. -> Focus on spatial form, spatial order, spatial furniture, spatial color,

		material, and spatial environment
<p>Socio development</p> <p>Focus on three main themes: individual development and awareness (self-esteem, self-concept, self-image, self-awareness, self-control, emotional regulation), social interaction and understanding (peer interaction, prosocial behavior, social behavior, contribution to relationships), and environmental awareness (safety and comfort, chronic stress and adversity).</p>	<ul style="list-style-type: none"> - Easy to have social interaction but also have personal/individual space in interior space of classroom - Encourage social participation - Enhance sense of familiar and connection between space and children - Feel safe and comfortable, feel active and calm - Easy make new friend, easy observation 	<ul style="list-style-type: none"> - A well-structured and predictable environment that supports children's self-regulation skills and provides safe and warm relationships with educator benefits children's social and emotional development. - Focus on concept of "proximity" -> Focus on spatial form, spatial order, spatial furniture, spatial color, spatial material, and spatial environment

Table 31: Relationship between children's development – requirements – interior design of space



The research results of this thesis have shown which and how spatial layers meet the physical, cognitive and socio-emotional developmental needs of children. Children's physical development could be influenced by spatial function and spatial furniture, next by spatial form and spatial materials & textures, children's cognitive development could be influenced by spatial function or spatial color, spatial materials & textures; children's socio-emotional development could be influenced by spatial function, spatial materials & textures and spatial order & color. Function, material & texture and color are the three prominent layers that affect children's developmental needs.

5.2 Conclusion



It is important to realize that children's development is holistic. This means that children's physical, cognitive, linguistic, emotional and social development are interconnected, inseparable and interdependent (Neaum, 2010). All aspects of young children's development occur simultaneously and each area of their development is influenced by the others. Children grow and develop through a complex interplay of all aspects of their development. Therefore, the learning environment and spaces must provide opportunities for play and exploration. An enriching environment is a showcase of values for children and a good place for them to foster their connection. Through physical play, children discover their movement skills, can explore the movement environment, have time to practice to improve basic motor skills and strengthen the cardiovascular system and muscles (Maude, 2006). The relationship between the physical school environment and pedagogy is reflected in the spatial organization (Brukštutė, 2019).

Children spend most of their time in care facilities, making it essential for the center to promote optimal development by providing a safe, stimulating, healthy, and developmentally appropriate environment. The physical learning environment plays a crucial role in children's holistic development, influencing cognitive, social, and physical growth. It offers opportunities for exploration, experimentation, and

discovery—key factors in basic cognitive development. A well-designed physical space also positively impacts learning by fostering independence, self-reflection, self-regulation, and a sense of competence.

The design of the physical environment can influence children's behavior and emotions, either positively or negatively. The classroom, as a vital part of the learning environment, directly affects children's cognitive development. This influence comes from both the subjective physical environment (teachers, pedagogy, and curriculum) and the objective physical environment (room structure, design, furniture, and materials). Analyzing the components of spatial structure and design, along with their effects on children's behavior, emotions, language development, and symbolic expression through play, is key to optimizing classroom design, as demonstrated in this study.

In summary, the classroom acts as a "micro-spatial factor" in the preschool environment and should be viewed as a "pedagogical tool" for young children. To clarify the term "pedagogical tool," this study explores the concepts of "Children's development and classroom interior space" and "Early childhood pedagogy and classroom interior space." The research introduces the 7 layers of interior spatial design—spatial function, form, order, color, material, furniture, and environmental elements—which are tied to pedagogy and children's developmental needs.

The study provides an overview of how these 7 layers impact children's physical, cognitive, and socio-emotional development, emphasizing the importance of the physical environment in influencing the developmental process, particularly for young children who spend most of their time interacting with the physical rather than the social environment (Weinstein & David, 1987). Observing children's interactions with the physical space allows for continuous improvement in room design for their benefit.

5.3 Limitation

First, the main limitation of this study is that its findings are primarily applicable to the context of Vietnam. This limitation stems from the fact that the case study and interviews were conducted exclusively in Vietnam, which makes it difficult to generalize the findings to other cultural or geographical settings. While the research provides valuable insights into the specific situation in Vietnam, caution should be exercised when attempting to generalize these findings to other regions with potentially different cultural, social and economic contexts.

Second, the limitation of this research is the lack of an experimental design to assess children's interaction with the physical and social aspects of the learning space. The lack of controlled experiments limits our ability to establish causal relationships and draw concrete conclusions about how children interact with their environment. Future research should consider experimental designs that allow a more detailed investigation of these interactions.

The limitations of the present study can be identified as follows

1. Geographical limitations: The results of the study are limited to selected preschool classrooms in Ho Chi Minh City to provide concrete and factual information about the relationship between designed learning environments and teaching methods in preschools.

2. Target population: The study focuses on young children aged 4 to 5-6 years, both genders, preschool teachers, interior designers, architects and parents who have children in the same age group.

3. Space limitations: The study is limited to analyzing the classroom in a preschool setting.

Hence, the scope is limited to establishing a framework through a pilot study, as it lacks concrete user evidence to validate the method or fully address the case study's problem. The study primarily describes the existing conditions of case study.

Due to time constraints and limited scope, this article primarily presents new findings on the concept of “7 interior spatial layers” and new findings on the

theoretical model for designing learning spaces for young children, with the aim of exploring the relationships and interactions between key factors throughout the space. Future work has the potential to delve deeper into each layer, providing more detailed explanations and exploring the micro-relationships between the individual elements within each layer. Each spatial layer, which is intricate and involves numerous details and micro-layers, could be explored as a potential main research topic in the future and placed in a different context, e.g. the environment of a house or a café.



As a result, future research efforts can utilize the results of the theoretical model of interior design and extend this theory to various interior design projects. Subsequent researchers can improve and refine the theoretical model by identifying the priority elements in different building types and among different end users. Future research can further develop the model. Additionally, future research should expand on this study by incorporating detailed floor plans to better analyze spatial function and order. Additionally, more empirical investigations should be conducted, using the Post-Occupancy Evaluation (POE) method to collect direct data from children and assess the applicability of this paper's framework. Research should also involve a larger sample of preschools and direct observations of children's interactions with these spaces, as well as examine the impact of other spatial elements such as lighting, location, temperature, and cultural context. Furthermore, testing the proposed framework across diverse cultural and educational settings will strengthen its validity and applicability.

5.4 Concluding thoughts

This research has provided extremely valuable insights into the field of interior design in particular and the design of children's rooms in general. It is an incontrovertible truth that children are the key factor for a developed country. Therefore, promoting children's development is not the responsibility of one individual, but belongs to all communities with different priorities.

As a mother and interior designer as well as a lecturer, the author knows how difficult it is to understand children and create a space that adapts to their needs and promotes their development as much as possible, and even more difficult to teach others – who are not in the design field - to create something for their children themselves. This is the real reason for the creation of this work. Following the step by step guidelines of the layers and having a deep understanding of the 7 layers in the space is a good way to get closer to a successful design.

5.5 Recommendation



Future research should explore the individual components of each layer more thoroughly, particularly through experimental studies involving Vietnamese children in various districts and communes of Ho Chi Minh City to gather more comprehensive data. Special attention should be given to the furniture and environment layers. Future studies could develop actual designs in real spaces and observe children's interactions to collect more accurate data. Additionally, the author plans to refine the methodology by incorporating the Post-Occupancy Evaluation (POE) concept, applying the "7 interior spatial layers" theory in real-world designs to gain more detailed user feedback, with a focus on children's experiences. Some layers in the 7 layers concept are very complicated and require more research and more accurate data. For example, at the furniture layer, future researchers can conduct more studies on the ergonomics and anthropometrics of Vietnamese preschool children. Although the anthropometric data is uniform for all children around the world and developed by WHO, the differences in culture, country, educational programs, diet, etc. may lead to different parameters in ergonomics and body measurement results, which affects the design of preschool furniture. During the research, it was difficult for the author to find any academic documents or research dealing with ergonomics or anthropometry of Vietnamese children, especially in Ho Chi Minh City. As a result, the guidelines for indoor

furniture are based on basic design requirements for selecting furniture that optimally adapts to the needs of children indoors.

APPENDIX

Appendix A: Design Requirement of Functional Zones in the Interior Classroom Space

Appendix B: Summary of Characteristics of Spatial Form

Appendix C: Measurement of development of children from 2,5 – 6 years old

Appendix D: Anthropometric of children from 2,5 – 6 years old

Appendix E: International early childhood education pedagogy

Appendix F: Vietnamese Early Childhood Education (ECE) Pedagogy

Appendix G: Comparative analysis board of classroom interiors in public and private preschools

Appendix H: Questionnaire Form and Result of Questionnaire

Appendix I: Questions of In-depth Interview



REFERENCES

- Abdel, H. (2021, 8 17). www.archdaily.com. Retrieved from www.archdaily.com:https://www.archdaily.com/941551/mmg-nil-my-montessori-garden-preschool-hgaa?ad_medium=gallery.
- Abdiyev H. Jalalovich, Tashmatova K. Sidikovna. (2022). THE IMPORTANCE OF FURNITURE IN THE INTERIOR OF PRESCHOOL INSTITUTIONS. British Journal of Global Ecology and Sustainable Development.
- Administration, U. G. (2003). Child Care Center Design Guide.
- Allen, L., & Kelly, B. B. (Eds.). (2015). Transforming the workforce for children birth through age 8: A unifying foundation. Committee on the Science of Children Birth to Age 8: Deepening and Broadening the Foundation for Success. Washington, DC: National Academies Press. <https://doi.org/10.17226/19401>.
- Ancheita, M. M. (2005). The impact of the learning environment on a child's behavior. University of Florida.
- Andrea Tamblin, Y. Sun, T. May, M. Evangelou, N. Godsmann. (2023). How do physical or sensory early childhood education and care environment factors affect children's social and emotional development? A systematic scoping review. Educational Research Review.
- Andrew J. Rotherham, Daniel Willingham. (September 2009). 21st century skills: The Challenges Ahead. Educational Leadership.
- Anna K. Kokko · L. Hirsto. (2020). From physical spaces to learning environments: processes in which physical spaces are transformed into learning environments. Learning Environments Research.
- ArchDaily. (2023). Toy Blocks Kindergarten / Blocher Partners India. Retrieved from ArchDaily: https://www.archdaily.com/1010642/toy-blocks-kindergarten-blocher-partners-india?ad_source=search&ad_medium=projects_tab.
- Asiyai, R. (2014). Students' Perception of the Condition of Their Classroom Physical

Learning Environment and Its Impact on Their Learning and Motivation. Education, Psychology.

- B Setiawan, N Abdullah, A F Pratama. (2020). Anthropometry in furniture design for early childhood school. International Conference on Biospheric Harmony Advanced Research.
- B. Ece ŞAHİN, Neslihan TÜRKÜN DOSTOĞLU. (2012). The importance of preschoolers' experience in kindergarten design . Journal of the Faculty of Architecture.
- B. Setiawan, N. Abdullah, A. Pratama. (2021). Anthropometry in furniture design for early childhood school in West Jakarta. International Conference on Biospheric Harmony Advanced Research (ICOBAR 2020) 23-24 June 2020, Jakarta, Indonesia, (p. Volume 729). doi:10.1088/1755-1315/729/1/012037.
- Berris, R & Miller, E. (2011). How design of the physical environment impacts early learning: Educators. Australasian Journal of Early Child.
- Boettger, T. (2014). Threshold Spaces. German National Library.
- Brand, S. (2007). Shearing layers . In M. C. Tiesdell, Urban Design Reader (pp. 302-306). Elsevier.
- Brukštutė, G. (2019). Physical Classroom Environment and Pedagogy. Architecture and Urban Planning.
- Burçak Altay, Elif Salcı. (2022). Exploring designers' finishing materials selection for residential interior spaces. Architectural Engineering and Design Management.
- Caan, S. (2011). Rethinking Design and Interior.
- Cameron, B. A., Brown, D. M., Carson, D. K., Meyer, S. S., & Bittner, M. T. . (1993). Children's Creative Thinking and Color Discrimination . 595-598.
- Caples, S. E. (1996). Some Guidelines for Preschool Design. How is your physical environment.
- Carol Weinstein, Thomas G. David. (1987). Spaces for Children.
- Carolyn Pope Edwards, Lella Gandini. (2018). The Reggio Emilia Approach to Early Childhood Education. In J. E. Jaipaul L. Roopnarine, Handbook of International Perspectives on Early Childhood Education (p. 14). New York: Routledge.
- Chiles, P. (2005). The classroom as an evolving. In M. Dudek, Children's Spaces.
- Chin Xing Thung, Hakimi Ahmad. (2021). Colour psychology in kindergarten classroom.

Artteks.

- Chris J. Boyatzis; Reenu Varghese. (2010). Children's Emotional Associations with color . The Journal of Genetic Psychology: Research and Theory on Human Development.
- Chu, W. (2014). Safety issues of children age 3-5 years in school. Iowa State University.
- Chuck Yu, Helena Yoon. (2010). The Role of Colour in 'Health and Wellbeing' of the Built Environment. *Indoor and Built Environment* , 403–404.
- Clement, J. (2019). Spatially Democratic Pedagogy: Children's Design and Co-Creation of Classroom space . *International Journal of Early Childhood*.
- Coralie Driscoll *, M. Carter. (2004). Spatial density as a setting event for the social interaction of preschool children. doi:<https://doi.org/10.1080/1034912042000182184>.
- CRAIG ZIMRING, RICHARD D. BARNES. (1987). Children's Environments:. In I. f. Research, Space for Children.
- Cyril Bertheaux et al. (2020). Emotion Measurements Through the Touch of Materials Surfaces. *Front. Hum. Neurosci*.
- D. A. Sugden, M. E. Chambers. (2006). Stability and change in children with Developmental Coordination Disorder. *Child: Care, healthy, and development*.
- D.K.Ching, F. (2018). *Interior Design Illustrated*. Wiley.
- DinhThiThu, H. (2019). Quality Matters in Vietnamese Early Childhood Education: The Situation and The Challenge. *The Annual Research on Early Childhood*, 15-21.
- Donia M Bettaieb, Raif B Malek and Abeer A Alawad. (2019). General and Special Materials Selection Criteria for Interior Design Projects. *International Journal of Structural and Civil Engineering*.
- Dudek, M. (2005). *Children's Spaces*. Linacre House, Jordan Hill, Oxford OX2 8DP: Linacre House, Jordan Hill, Oxford OX2 8DP.
- Duncan, S. (2011). Reframing children's spaces. Retrieved from www.ChildCareExchange.com.
- Durao, M. J. (2000). Colour and Space: An analysis of the relationships between colour meaning expression and the perception of space.
- E. Matthews & Peter C. Lippman. (2016). *The Physical Environment of Early Childhood*

- Centers: A Case Study in the use of Break-Out Spaces . International Journal for Cross-Disciplinary Subjects in Education (IJCDSE).
- Edwards, J. (2005). The classroom is a microcosm. In M. Dudek, Children's Space . Elsevier.
- Elizabeth Matthews, Peter C. Lippman. (2019). The Design and Evaluation of the Physical Environment of Young Children's Learning Settings. Early Childhood Education Journal. doi:<https://doi.org/10.1007/s10643-019-00993-x>.
- A. Elliot, Markus A. Maier . (2013). Color psychology: effects of perceiving color on psychological functioning in humans. The Annual Review of Psycholog.
- Evans, G. W., Lepore, S. J., & Schroeder, A. (1996). The role of interior design elements in human responses to crowding. Journal of Personality and Social Psychology, 70(1), 41–46. doi:<https://doi.org/10.1037/0022-3514.70.1.41>.
- Ferguson et al. (2013). The physical environment and child development: An international review. International Journal of Psychology.
- Forman, E. (1989). The role of peer interaction in the social construction of mathematical knowledge. International Journal of Educational Research.
- Francis D.K.Ching, Corky Binggeli. (2018). Interior Design Illustrated-4th Edition. Hoboken, New Jersey: John Wiley & Sons.
- Giáo Dục Thời Đại. (2022). TPHCM: Thêm 27 trường mầm non đạt chuẩn quốc gia trong năm học đặc biệt. Retrieved from <https://giaoducthoidai.vn/tphcm-them-27-truong-mam-non-dat-chuan-quoc-gia-trong-nam-hoc-dac-biet-post606081.html>.
- Graham, P. (2005). Design for adaptability - An introduction to the principles and basic strategies. Environment Design Guide, 1-9.
- Haiyan Duan, Wuliji. (2009). Creative design of intelligent children furniture. International Conference on Computer-Aided Industrial Design and Conceptual Design, CAIDCD, (pp. 1345-1348). Wenzhou, China. doi:doi:10.1109/CAIDCD.2009.5374971.
- Hall, D. J. (2019). Architectural Graphic Standards Reference || Functional Planning. doi:doi:10.1002/9781119648789.cags0101.

Hanh, L. T. (2018). Thực trạng tổ chức không gian vui chơi học tập của trường mầm non tại TP. Hồ Chí Minh. Retrieved from <https://www.tapchikientruc.com.vn/gioi-thieu/thuc-trang-to-chuc-khong-gian-vui-choi-hoc-tap-cua-truong-mam-non-tai-tp-ho-chi-minh.html>.

Härkönen, U. (2007). The Bronfenbrenner ecological systems theory of human development. Scientific Articles of V International Conference. Daugavpils University, Saule. Latvia.

Heidi Kaduson, Charles Schaefer. (2001). 101 More Favorite Play Therapy Techniques (Child Therapy). Jason Aronson, Inc.

Henao, M. T. (2017). Creating A 21St - Century Learning Space Creating A 21St - Century Learning Space. School of Education and Leadership Student Capstone Theses and Dissertations , Hamline University.

HGAA, M. M. (2021). <https://www.archdaily.com/941551/mmg-nil-my-montessori-garden-preschool-hgaa>. Retrieved from <https://www.archdaily.com/941551/mmg-nil-my-montessori-garden-preschool-hgaa>: <https://www.archdaily.com/941551/mmg-nil-my-montessori-garden-preschool-hga>.

Hill, M. (2011). Young Children and Their Perceptions of Colour: An Exploratory Study.

Hoda Jafarian; Claude M.H. Demers; Pierre Blanchet; Veronic Laundry. (2017). Effects of interior wood finishes on the lighting ambiance and materiality of architectural spaces. Indoor and Built Environment.

<https://www.portaire.com>. (n.d.). Retrieved from <https://www.portaire.com/journal/mastering-interior-design-materials-the-ultimate-guide>: <https://www.portaire.com/journal/mastering-interior-design-materials-the-ultimate-guide>.

Huitt, W., Hummel, J. (2003). Piaget's Theory of Cognitive Development . Educational Psychology Interactive: Cognitive Development.

Huseynova, L. A. (2021). The impoatance of color in the human environment . Scientific

Bulletin 4:86-91.

- I Fang Cheng et al. (2018). Anthropometric Database of the Preschool Children from 2 to 6 Years in Taiwan. *Journal of Medical and Biological Engineering*. doi:<https://doi.org/10.1007/s40846-018-0436-4>.
- Inan, H. (2009). *The Third Dimension in Preschools: Preschool Environments and Classroom Design*. Education.
- Izadpanah, S. (2011). Investigation of Identity in Interior Space of Kindergarten: A review on an example of High/Scope Kindergarten . *Institute of Graduate Studies and Research*.
- J. Wesley Burgess, W. Kyle Fordyce. (1989). Effects of preschool environments on nonverbal social behavior: toddlers' interpersonal distances to teachers and classmates change with environmental density, classroom design, and parent-child interactions. *Journal of Child Psychology and Psychiatry and Allied Disciplines*. doi: <https://doi.org/10.1111/j.1469-7610.1989.tb00239.x>.
- Jaglarz, A. (2018). Accessibility, Easy and Comfort of Using Sanitary Devices by Preschool Children: Pre-design Studies. In J. (. Charytonowicz, *Advances in Human Factors, Sustainable Urban Planning and Infrastructure*. AHFE 2017. *Advances in Intelligent Systems and Computing*. Springer.
- Jessica Francis, William S. Barnett. (2019). Relating preschool class size to classroom quality and student achievement. *Early Childhood Research Quarterly*. doi:<https://doi.org/10.1016/J.ECRESQ.2019.05.002>.
- Jhu-Ting Yang et al. (n.d.). Elevating Children's Play Experience: A Design Intervention to Enhance Children's Social Interaction in Park Playgrounds. *Sustainability*, 15(Design for Behavioural Change, Health, Wellbeing, and Sustainability). doi:<https://doi.org/10.3390/su15086971>.
- Joanne E. Riley, M. Roys, S. M. Cayless. (1998). Initial assessment of children's ability to climb stair guarding. *Journal of the Royal Society of Health*.
- JP, S. (2009). Investment in Early Childhood Development Lays the Foundation for a Prosperous and Sustainable Society. *Education, Environmental Science, Sociology*.

- Julie A. Waldron, Ader Garcia, Carolina M. Bedoya, L. Cuervo, Laura Marin, C. Morales, Alcaldía de Medellín. (2022). The Minimum Area Required for Children Aged Between 3 and 5 Years Old in a Kindergarten. AHFE International.
- K. Coolahan et al. (2000). Preschool peer interactions and readiness to learn: Relationships between classroom peer play and learning behaviors and conduct. *Journal of Educational Psychology*.
- Kaya, N. (College student journal). Relationship between color and emotion: A study of college students. 2004.
- Kemal Yildirim; M. L. Hidayetoglu; Aysen Capanoglu. (2011). Effects of Interior Colors on Mood and Preference: Comparisons of Two Living Rooms . *Perceptual and Motors Skills*.
- Keskar, G. (2010). Color psychology and its effect on Human Behavior. *Semantic scholar*.
- Kim T. Ferguson, et al. (2013). The physical environment and children development: an international review. *International Journal of Psychology*, Vol. 48, No. 4, 437–468.
- Kim, S.-H. (2014). A Study on the Finish Material and Color Plan for Elementary School Design. *Korean Institute of Interior Design Journa*.
- KREBS, R. J. (2009). Proximal processes as the primary engines. *International Journal of Sport Psychology*.
- Krstić Hristina, Trentin Annalisa, Jovanović Goran. (2016). Interior-exterior connection in architectural design based on the incorporation of spatial in between layers. Study of four architectural projects. *Spatium*. doi:<https://doi.org/10.2298/SPAT1636084K>.
- Kwak, Jae-Hoon, Han, Hae-Ryon. (2005). A study of the interior finishing materials for improving residential environment. *Proceedings of the Korean Institute of Interior Design Conferenc*.
- L&MDesign. (2019). ArchDaily. Retrieved from ArchDaily: https://www.archdaily.com/924052/montessori-kindergarten-in-xiamen-l-and-m-design?ad_source=search&ad_medium=projects_tab.
- L. Justice et al. (2011). Peer effects in preschool classrooms: is children's language

growth associated with their classmates' skills? Child Development.

L. M. Fawcett, A. Garton. (2005). L. M. Fawcett. British Journal of Educational Psychology. doi:<https://doi.org/10.1348/000709904X23411>.

LancasterOnline. (n.d.). Manheim Central equips 21st-century classrooms. Retrieved from

https://lancasteronline.com/manheimcentral/news/manheim-central-equips-21st-century-classrooms/article_347bb075-5012-55cc-8b28-0ad39fb0def8.html.

Lee, K. (2022). The Interior Experience of Architecture: An Emotional Connection between Space and the Body . Buildings, 12.

Leimgruber, W. (2005). Boundaries and transborder relations, or the hole in the prison wall: On the necessity of superfluous limits and boundaries. GeoJournal.

Long et al. (2021). Research on preschool children's painting application in children's intelligent furniture. 2nd International Conference on Intelligent Design (ICID), (pp. Art, Education).

Lorraine E. Maxwell, Gary W. Evans. (2014). Children and the Physical Environment. In E. B. Rachel Cooper (Editor), Wellbeing: A Complete Reference Guide, Volume II, Wellbeing and the Environment (pp. 273-300). Cary Cooper.

M. Abbas, M. Othman, P. Rahman. (2004). Pre-School Children's Play Behaviour Influenced by Classroom's Spatial Definitions? International Journal of Disability, Development and Education.

M. Blades, C. Spencer. (1994). The Development of Children's Ability to use Spatial Representations. Advances in Child Development and Behavior.

M. Broekhuizen, Irina Mokrova, M. Burchinal, Patricia T. Garrett-Peters . (2016). Classroom Quality at Pre-kindergarten and Kindergarten and Children's Social Skills and Behavior Problems. Early Childhood Research Quarterly.

M. Honauer, P. Moorthy, E. Hornecker. (2019). Interactive Soft Toys for Infants and Toddlers - Design Recommendations for Age-appropriate Play. CHI PLAY '19: Proceedings of the Annual Symposium on Computer-Human Interaction in Play.

M. Y. Abbas, et al.,. (2012). Pre-school Classroom Environment: Significant upon

- Childrens' Play Behaviour? *Procedia - Social and Behavioral Sciences*, Volume 49, page 47-65.
- M.Puhalla, D. (2011). *Design elements: Form & Space*. NewYork: Rockpork.
- Manassakis, E. (2020). Children's participation in the organisation of a kindergarten classroom. *Journal of Early Childhood Research*.
- Maria Vickerius, Anette Sandberg. (2007). The significance of play and the environment around play. *Early Child Development and Care*.
doi:<https://doi.org/10.1080/0300443042000319430>.
- Mariam F. Shaari, Y. Zaiki, S. Sh. Ahmad, I. Ismail. (2021). Modified Open-Plan Preschool Spaces and their Influence on Children's Cognitive Development. *Education, Environmental Science*.
doi:<https://doi.org/10.21834/ajebs.v6i18.382>.
- Mariam Felani Shaari, S. Ahmad, I. Ismail. (2016). Nurturing Environmental Stewards through Preschool Physical Design. *Environmental Science, Education*.
doi:DOI:10.21834/E-BPJ.V1I3.343.
- MARTIN, S. H. (2002). THE CLASSROOM ENVIRONMENT AND ITS EFFECTS ON THE PRACTICE OF TEACHERS. *Journal of Environmental Psychology*.
- MARTIN, S. H. (2002). THE CLASSROOM ENVIRONMENT AND ITS EFFECTS ON THE PRACTICE OF TEACHERS. *Journal of Environmental Psychology*.
doi:<https://doi.org/10.1006/jevp.2001.0239>.
- Mashburn, A. J. (2008). Quality of Social and Physical Environments in Preschools and Children's Development of Academic, Language, and Literacy Skills. *Education*.
- Maude, P. (2006). Observing Children Moving - Developing effective movement observation and analysis techniques to enhance the quality of children's movement. *Physical & Health Education Journal*; Gloucester.
- Maxwell, L. E. (2003). Home and School Density Effects on Elementary School Children: The Role of Spatial Density. *Sage Journals*, Volume 35, Issue 4.
- Maya Matheis & Jasper A. Estabillo. (2018). Assessment of Fine and Gross Motor Skills in Children. In *Autism and Child Psychopathology Series* (pp. pp 467–484). Springer.
- Mazlum, Ö., & Mazlum, F. S. . (2019). A study on conceptual association of colors in

preschool children.

Mehran Fateminia, Talayeh Dehghani Ghotbabadi, Kamran Mohammadi Azad³. (2020).

Perceptions of the taste of colors in children and adults. Wile.

MENDEZ, A. D. (2017). ANALYSIS OF INTERIOR DESIGN REQUIREMENTS FOR KINDERGARTEN CLASSROOMS WITH RESPECT TO LEARNING ENVIRONMENT ELEMENTS.

Michaela Honaue et al.,. (2019). 2019. Interactive Soft Toys for Infants and Toddlers - Design Recommendations for Age-appropriate Play.

Michela Schenetti, Elisa Guerra. (2018). Emotion Map Making. Discovering Teachers' Relationships with Nature. Journal of Research in Early Childhood Education, 31-56.

Ministry of Education and Training (MOET). (2022). Guidelines for preschool education: Document 4216/BGDDT-GDMN. Retrieved from <https://thuvienphapluat.vn/cong-van/Giao-duc/Cong-van-4216-BGDDT-GDMN-2022-huong-dan-nhiem-vu-giao-duc-mam-non-nam-hoc-2022-2023-529173.aspx>.

Mira C. D et al. (2022). Global Diffusion of Montessori Schools: A Report from the 2022 Global Montessori Ceasus. Journal of Montessori Research.

Mittler, G. (2006). Art in Focus. United States of America: Glencoe/McGraw-Hill.

Neaum, S. (2010). Child Development for Early Childhood Studies. Learning Matters Ltd.

Nguyen Hoang Lien. (2005). Principle of Interior Architecture (Nguyên lý thiết kế Kiến trúc Nội thất). In N. H. Lien, Principle of Interior Architecture (Nguyên lý thiết kế Kiến trúc Nội thất) (pp. 77-79). Vietnam: HaNoi Publication.

Nhân Dân. (2022). Tăng tỷ lệ trẻ mầm non được tiếp cận giáo dục. Retrieved from <https://nhandan.vn/tang-ty-le-tre-mam-non-duoc-tiep-can-giao-duc-post719277.html>.

nhandan.vn. (2022). nhandan.vn. Retrieved from <https://nhandan.vn/tang-ty-le-tre-mam-non-duoc-tiep-can-giao-duc-post719277.html>: <https://nhandan.vn/tang-ty-le-tre-mam-non-duoc-tiep-can-giao-duc-post719277.html>.

Nhi Hoang, L. Holopainen & M. Siekkinen. (2018). Children's classroom engagement and

- disaffection in Vietnamese kindergartens. *Educational Psychology*.
- Nicola J. Pitchford, Kathy T. Mullen. (2004). The role of perception, language, and preference in the developmental acquisition of basic color terms. *Experimental Child Psychology* 90.
- Oakley, L. (2004). *Cognitive Development* . Routledge.
- Obaki, S. O. (2017). IMPACT OF CLASSROOM ENVIRONMENT ON CHILDREN'S SOCIAL BEHAVIOR. *International Journal of Education and Practice*.
- OECD. (2019). Educational Research and Innovation. Retrieved from <https://www.oecd-ilibrary.org>.
- Olds, A. R. (1987). Designing Settings for Infants and Toddlers. In C. D. Weinstein, *Spaces for Children*. Springer, Boston, MA. doi:https://doi.org/10.1007/978-1-4684-5227-3_6.
- Organization, I. B. (2019). Learning environments-Creating learning environments. *International Baccalaureate*.
- Paquette, D., & Ryan, J. (2001). Bronfenbrenner's ecological systems theory. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/44165922/bronfenbrenners_ecological-libre.pdf?1459170081&response-content-disposition=inline%3B+filename%3DBronfenbrenners_Ecological_Systems_Theor.pdf&Expires=1725117494&Signature=LLjRStWK-0XSdj9YfnlhVQ5gJ7JCfZ6CjMk.
- Park, J. G. (2013). Correlations Between Color Attributes and Children's Color Preferences. *Wiley Periodicals*.
- Patricia Valdez; A. Mehrabian . (1994). Effects of color on emotions . *Journal of Experimental psychology* , 394-409.
- Pile, J. (1998). *Color in Interior Design*.
- Pornchai Tamthintha, Kusuma Palaprom, & Kritchakhis Nawattanaprasert. (2018). A study on perceptions of preschool children's furniture design: Pictorial stimuli experiment. *International Mechanical and Industrial Engineering Conference 2018 (IMIEC 2018)*, Volume 204, 2018, pp. [insert page numbers if available].

MATEC Web of Conferences.

Products, C. (2009). Pre-K Spaces: Design for a Quality Room

Qing, L. (2023). Discussion on the color design of kindergarten interior space. Highlights in Art and Design.

Qonita Fardlillah, Yoyon Suryono. (2019). Physical Environment Classroom: Principles and Design Elements of Classroom in Early Childhood Education. Proceedings of the International Conference on Special and Inclusive Education (ICSIE 2018).

Read, M. (2010). Contemplating Design: Listening to Children's Preferences about Classroom Design. Education, Art. doi:10.4236/CE.2010.12012.

Read, M. A., & Upington, D. (2009). Young children's color preference in the interior environment. Early childhood education journal, 491-496.

Read, Marilyn A. (2003). Use of Color in Child Care Environments, Application of Color for Wayfinding and Space Definition in Alabama Child Care Environments. Early Childhood Education Journal.

Reyhaneh Ghayouri, Sayedmohammad Ayat. (2020). Color Preference Based on Children's Choices for the Interior Spaces of Kindergartens. International Research Journal of Advanced Engineering and Science.

A. Rigolon, M. Alloway. (2011). Children and their development as the starting point: A new way to think about the design of elementary schools. Educational & Child Psychology. doi:<https://doi.org/10.53841/bpsecp.2011.28.1.64>.

Rizka Rachmawati, Djoko Murdowo, Djoko Murdowo, Imtihan Hanom. (2019). Interior Finishing Study of Play Room for Early Childhood. 6th Bandung Creative Movement International Conference in Creative Industries 2019 (6th BCM 2019).

Rosemary Kilmer; W. Otie Kilmer. (2014). Designing Interiors. Canada: Wiley

S. Močinić, C. Feresin. (2017). THE ROLE OF THE SCHOOL SPACE IN PRESCHOOLERS' LEARNING PROCESSES. Humanities & Social Science Review.

S. S. Dazkir. (2009). Emotional Effect of Curvilinear VS. Rectilinear. Master's Thesis

S.Martin. (2006). Children and their Environments: The classroom environment and children's performance – is there a relationship? Education.

Said, I. (2007). Architecture for Children: Understanding Children Perception towards Built Environment. Faculty of Built Environment, Universiti Teknologi Malaysia.

- Saksri Suebsing, Nithinath Udomsan, Supimol Bunphok. (2023). Competency Development of Early Childhood Teacher in the 21st. International Education Studies.
- Salcı, E. (2019). Designers' Finishing Material Selection Considerations in Interior Spaces. Bilkent Universitesi (Turkey)
- Sancilio, M. F. (1987). Peer interaction as a method of therapeutic intervention with children. Psychology.
- Santrock, J. W. (2000). Children Development . McGraw-Hill.
- Seda Ata, A. Deniz, B. Akman. (2012). The physical environment factors in preschools in terms of environmental psychology: a review. Procedia - Social and Behavioral Sciences 46 (2012) 2034 – 2039.
- Shan Xiaoxian, Wan Meicheng. (2020). Spatial Color Analysis of Kindergarten Interior Design Based on Children's Psychological Activities in Digital Environment. E3S Web of Conferences.
- Shannon R. Audley-Piotrowski et al. (2015). The Role of the Teacher in Children's Peer Relations: Making the Invisible Hand Intentional. Education, Psychology. doi:DOI:10.1037/TPS0000038.
- SHAW, L. G. (1987). Designing Playgrounds for Able and Disabled Children. In T. G. Carol Simon Weinstein, Spaces for children: The built environment and Child development (pp. 187-213). Plenum Press.
- Shivarti, U.V. Kiran. (2012). Design Compatibility of Classroom Furniture in Urban and Rural. Journal Of Humanities And Social Science.
- Støckert, R., & Stoica, G. (2017). Creating a learning space for collaboration, communication, and interaction. Journal Name, Volume(Issue), [page numbers if available]. <https://doi.org/10.12753/2066-026X-17-112>.
- Stonehouse, A. (2011). The 'third teacher' – creating child friendly. Putting Children First,, 12-14.
- Suchman, R . G., & Trabasso, T. (2019). A study on conceptual associations of colors in preschool children. 729-766.
- T. S-Chapman, D. S. Hadden. (2011). Encouraging Peer Interactions in Preschool Classrooms: The Role of the Teacher. Young Exceptional Children.

- T.Moore, G. (1987). The Physical Environment and Cognitive Development in Child-Care Centers. In C. S. G.David, Space for Children (pp. 41-67).
- An.T.T Nguyen; Eakachat J.; Veerawat S. (2023). The relationship between spatial form of interior learning space and children behavior. VIII INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCE “SOLVING ENVIRONMENTAL PROBLEMS IN THE CONSTRUCTION INDUSTRY” ESCI 2022. AIP Conf. Proc. 2560, 020020 (2023).
- Tenenbaum, H., Winstone, N., Avery, R., & Leman, P. J. (2020). How Effective is Peer Interaction in Facilitating learning? A meta-analysis. Journal of Educational Psychology.
- Thuvienphapluat.vn. (2024). Số lượng trẻ tại trường mầm non theo từng nhóm trẻ, tối đa là bao nhiêu? Phòng ngủ và phòng vệ sinh. Retrieved from <https://thuvienphapluat.vn/phap-luat/so-luong-tre-tai-truong-mam-non-theo-tung-nhom-tre-toi-da-la-bao-nhieu-phong-ngu-va-phong-ve-sinh-t-508673-29539.html>.
- Troop-Gordon, W. (2015). The Role of the Classroom Teacher in the Lives of Children Victimized by Peers. Child Development Perspectives.
- tuoitre.vn. (2023). <https://tuoitre.vn>. Retrieved from <https://tuoitre.vn:https://tuoitre.vn/tp-hcm-se-ra-soat-sap-xep-truong-lop-mam-non-quy-mo-nho-20230821130916024.htm>.
- Tuomas Alapieti et al. (2020). The influence of wooden interior materials on indoor environment: a review. European Journal of Wood and Wood Products.
- Tutkun, C. (2023). 21st Century Skills in Early Childhood: What Do Preschool Pre-service Teachers Think? What Skills Do Children Consider Important? 3rd International Conference on Educational Technology and Online Learning – ICETOL 2023 , (pp. 7-14). Cunda, Ayvalık, Balıkesir, Türkiye
- Tutrang Nguyen et al. (2020). The classroom relational environment and children's early development in preschool. Wiley. doi:DOI: 10.1111/sode.12447.
- Vasileios Papavasileiou, et al. (2018). Organization - pedagogical use of the spaces in sustainable kindergarten: views of preschool education graduate students. International E-Journal of Advances in Education,, IV(12).
- Vu, T. T. (2021). Early childhood education in Vietnam, history, and development.

International Journal of Child Care and Education Policy.

Wang Xiaonan, Zhang Ruizhi. (2017). New Trends of Material Design in Indoor Environment. Journal of Landscape Research.

Weinstein, C. S. (1987). Designing Preschool Classroom to Support Development. In T. G. CAROL SIMON WEINSTEIN, Spaces for children. New York: Plenum Press.

Weinstein, C.S., David, T.G. (1987). Designing Preschool Classrooms to Support Development. Springer, Boston, MA: Springer, Boston, MA. doi:https://doi.org/10.1007/978-1-4684-5227-3_8.

Weinthal, L. (2010). Mapping Interior Adjacencies . IDEA JOURNAL 2010.

WHO. (2024). World Health Organization. Retrieved from World Health Organization: <https://www.who.int/tools/child-growth-standards/standards/length-height-for-age>.

William H. Brown, James J. Fox and Michael P. Brady. (1987). EFFECTS OF SPATIAL DENSITY ON 3- AND 4-YEAR-OLD CHILDREN'S SOCIALLY DIRECTED BEHAVIOR DURING FREEPLAY: AN INVESTIGATION OF A SETTING FACTOR. Education and Treatment of Children.

www.ottobredesign.com. (n.d.). Retrieved from www.ottobredesign.com: <https://www.ottobredesign.com/fr/ottobre-lab/grilles-des-tailles/jeunes-enfants-92-122-cm/>.

Xiao-Ping Gao, John H. Xin. (2006). Investigation of human's emotional responses on colors. Color research and Application.

Yaoying Xu et al. (2008). Effects of peer tutoring on young children's social interactions. Education Early Child Development and Care. doi:10.1080/03004430600857485.

Yr Adran Plant et al. (2008). www.wales.gov.uk. Retrieved from www.wales.gov.uk.

Yusuf Koç, Kevser Koç. (2023). Kindergarten Teachers' Experiences in a Spatial Orientation Skills Professional Development Program. Sage Journals.



VITA

NAME	Nguyen Thi Tam An
INSTITUTIONS ATTENDED	<p>Faculty of Interior Architecture, University of Architecture, HCMC</p> <p>Institute International Education, University of Architecture, HCMC</p> <p>Doctor of Philosophy in Design Arts (International Program), Faculty of Decorative Arts, Silpakorn University, Bangkok, Thailand</p>
PUBLICATION	<p>Nguyen Thi Tam, A., Joneurairatana, E., & Sirivesmas, V. (2023). The relationship between spatial form of interior learning space and children behavior. AIP Conference Proceedings, 2560(1), 020020. https://doi.org/10.1063/5.0124736</p> <p>Nguyen Thi Tam, A., Joneurairatana, E., & Sirivesmas, V. (2024). Color design in the physical learning environment influences preschool children's cognitive development. In Ha-Minh, C., Pham, C.H., Vu, H.T.H., & Huynh, D.V.K. (Eds.), Proceedings of the 7th International Conference on Geotechnics, Civil Engineering and Structures, CIGOS 2024, 4-5 April, Ho Chi Minh City, Vietnam. Lecture Notes in Civil Engineering (Vol. 482). Springer, Singapore. https://doi.org/10.1007/978-981-97-1972-3_1146</p> <p>Nguyen Thi Tam, A. ., Joneurairatana, E. ., & Sirivesmas, V. . (2025). Color Design in Preschool Interior Spaces: A Comparative Analysis of Two Preschools in Ho Chi Minh City, Vietnam. International Journal of Building, Urban, Interior and Landscape Technology (BUILT), 23(1), Article 255571. https://doi.org/10.56261/built.v23.255571</p> <p>NguyenThiTam, A., Joneurairatan, E., & Sirivesmas, V. (2024). Improving interior learning spaces in preschool</p>

through 7 spatial layers: A case study of The Creative Kid
Preschool in HCMC, Vietnam. *Sarasatr: Journal of
Architecture and Design*, 7(4). [https://so05.tci-
thaijo.org/index.php/sarasatr/article/view/274742](https://so05.tci-thaijo.org/index.php/sarasatr/article/view/274742)

