

CHAPTER 1 INTRODUCTION

1.1. Background

In 2024, Taiwan had an estimated 988,828 preschool-aged children (0-5 years old), according to data from the National Development Council Population Estimate Inquiry System. The growth and development of these young children were considered crucial. Experts like (Borghi & Sachdev, 2024), highlighted several key factors that profoundly influenced a child's growth and development: a supportive environment, nutritional intake, access to education and stimulation, emotional attention, and opportunities for physical activity. A nurturing and supportive environment was believed to be essential for optimizing children's growth and development.

During their development, children engaged in a variety of activities. Play, particularly that involving physical activities, helped foster their motor development. Social interaction with peers or family members was crucial for supporting emotional development, while educational activities aided in their academic development (Borghi & Sachdev, 2024).

Kindergartens served as essential early educational environments that supported children's overall development during these formative years. Furthermore, kindergartens also played a key role in teaching social skills, preparing children for the transition to formal elementary school education (Angelaki et al., 2022).

The diverse activities offered in kindergartens aimed to cultivate children's cognitive, social, emotional, and physical growth. Cognitive development was nurtured through engaging activities that encouraged problem-solving, memory, and reasoning. Social development flourished in group settings, with collaborative games and role-playing enhancing communication, teamwork, and empathy. These experiences were instrumental in helping children reach important social milestones, such as understanding turn-taking and developing concern for their peers.

Emotional development in early childhood was supported through activities like expressive art, discussions about feelings, and reading emotion-themed stories. These approaches helped children identify and regulate their emotions. Physical development was promoted through activities such as climbing, running, and fine motor tasks like drawing or

cutting, which built both gross and fine motor skills. These physical activities not only enhanced strength and coordination but also supported cognitive development by increasing blood flow and stimulating neural activity (Harvard University Center on the Developing Child, 2017).

Kindergartens offered a blend of outdoor and indoor activities. Many outdoor activities focused on physical games like running, playing ball, and jumping, which served to enhance children's motor skills, physical fitness, and even practice cooperation and communication. Additionally, playing in the provided playground, going for walks, or cycling around the school environment helped children learn about their surroundings.

Meanwhile, indoor activities at kindergarten included various creative pursuits. Drawing, coloring, music, or handicrafts helped children express themselves and fostered their creativity. Additionally, learning activities such as reading, writing, completing assignments, and counting were also carried out to support children's academic development (Talley & Cook, 2012).

These various activities required adequate and supportive lighting to improve children's comfort. Children generally had a higher sensitivity to light compared to adults (Westwood et al., 2023). Proper lighting in the classroom could improve children's attention and memory. Furthermore, lighting was also found to make children more sensitive in perceiving form and space, which was directly related to their cognitive abilities (Doulos & Tsangrassoulis, 2022).

Both natural and artificial lighting were necessary. Regarding natural lighting, Taiwan, being a country with four seasons, experienced varying intensities of natural light throughout the year. Data from the Central Weather Administration of the Ministry of Transportation and Communications in Taiwan showed that in 2024, the longest sunshine hours occurred in July (during summer), with an average of 8 hours and 59 minutes of daylight (Figure 1). Conversely, the shortest sunshine hours were recorded in November (during winter), averaging 1 hour and 15 minutes of daylight (Figure 2).

交通部中央氣象署
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每月氣象

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2024年7月 氣象資料

	溫度 (°C)			雨量	風速 (公尺/秒)/ 風向(360°)/日期			相對濕度(%)		測站 氣壓	降水日數 ≥0.1毫米	日照 時數
測站	平均	最高/日期	最低/日期	(毫米)	最大十分鐘風		最大瞬間風	平均	最小/日期	(百帕)	(天)	(小時)
Yushan	9.1	23.1/22	2.6/08	2.6/08	925.5	27.4/230.0/25	39.3/220.0/25	59	37/08	644.9	16	188.3
Tainan	29.9	36.0/14	24.3/26	24.3/26	648.5	15.1/200.0/25	24.7/220.0/25	76	50/12	1004.3	15	233.4
Kaohsiung	29.3	36.5/03	23.0/09	23.0/09	945.5	10.4/250.0/25	20.7/240.0/25	83	46/03	1005.7	13	235.1
Hengchun	29.6	35.0/22	25.3/07	25.3/07	398.5	11.0/280.0/24	24.9/270.0/24	80	51/22	1004.9	19	242.9
Yilan	29.6	36.5/20	24.3/09	24.3/09	324.5	16.4/30.0/24	28.5/30.0/24	79	50/17	1006.0	8	257.7
Hualien	29.0	35.0/22	24.7/08	24.7/08	593.5	24.5/360.0/24	43.8/340.0/24	82	55/22	1005.0	10	275.0

Figure 1 The Longest Sunshine Hours in Yilan
(<https://www.cwa.gov.tw/V8/C/C/Statistics/monthlydata.html>)

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每月氣象

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2024年11月 氣象資料

	溫度 (°C)			雨量	風速 (公尺/秒)/ 風向(360°)/日期			相對濕度(%)		測站 氣壓	降水日數 ≥0.1毫米	日照 時數
測站	平均	最高/日期	最低/日期	(毫米)	最大十分鐘風		最大瞬間風	平均	最小/日期	(百帕)	(天)	(小時)
Yushan	4.8	17.4/11	-5.1/29	-5.1/29	144.5	25.0/130.0/15	32.6/130.0/15	65	40/29	645.5	9	172.2
Tainan	23.7	31.2/02	15.7/30	15.7/30	126.5	9.2/220.0/01	16.6/250.0/01	76	36/29	1011.9	4	179.5
Yongkang	23.6	31.1/02	15.1/30	15.1/30	101.5	9.3/230.0/01	16.6/230.0/01	78	37/29	1013.6	4	166.8
Kaohsiung	23.7	30.8/02	13.1/30	13.1/30	174.0	5.8/250.0/01	12.2/280.0/01	88	43/29	1013.1	5	173.3
Hengchun	25.3	30.3/09	19.8/28	19.8/28	83.0	15.7/40.0/18	31.0/40.0/18	73	48/05	1011.5	6	181.0
Yilan	21.3	29.7/15	12.0/29	12.0/29	414.0	11.7/150.0/01	23.0/140.0/01	88	41/29	1017.2	twenty one	22.7
Hualien	23.2	30.0/13	16.6/30	16.6/30	80.5	20.4/180.0/01	29.0/180.0/01	79	48/29	1015.0	14	60.0

Figure 2 The Shortest Sunshine Hours in Yilan
(<https://www.cwa.gov.tw/V8/C/C/Statistics/monthlydata.html>)

Taiwan experienced a humid subtropical climate, characterized by frequent rainfall. The Weather Channel Taiwan website provided detailed information about the sky condition

for each season (Figure 3). The spring season (March to May) was marked by regular rain and predominantly cloudy skies. During the summer months (June to September), the weather was generally sunny with occasional thundershowers. While the skies were mostly cloudy from June to August, September brought clearer skies. In the fall (October to November), the weather tended to be mostly cloudy with intermittent rain. Similarly, the winter season shared these traits, featuring a mix of sunny or cloudy days with occasional rain. In terms of sky conditions, December and February were predominantly cloudy, while January typically had clearer skies (Tech et al., n.d.).

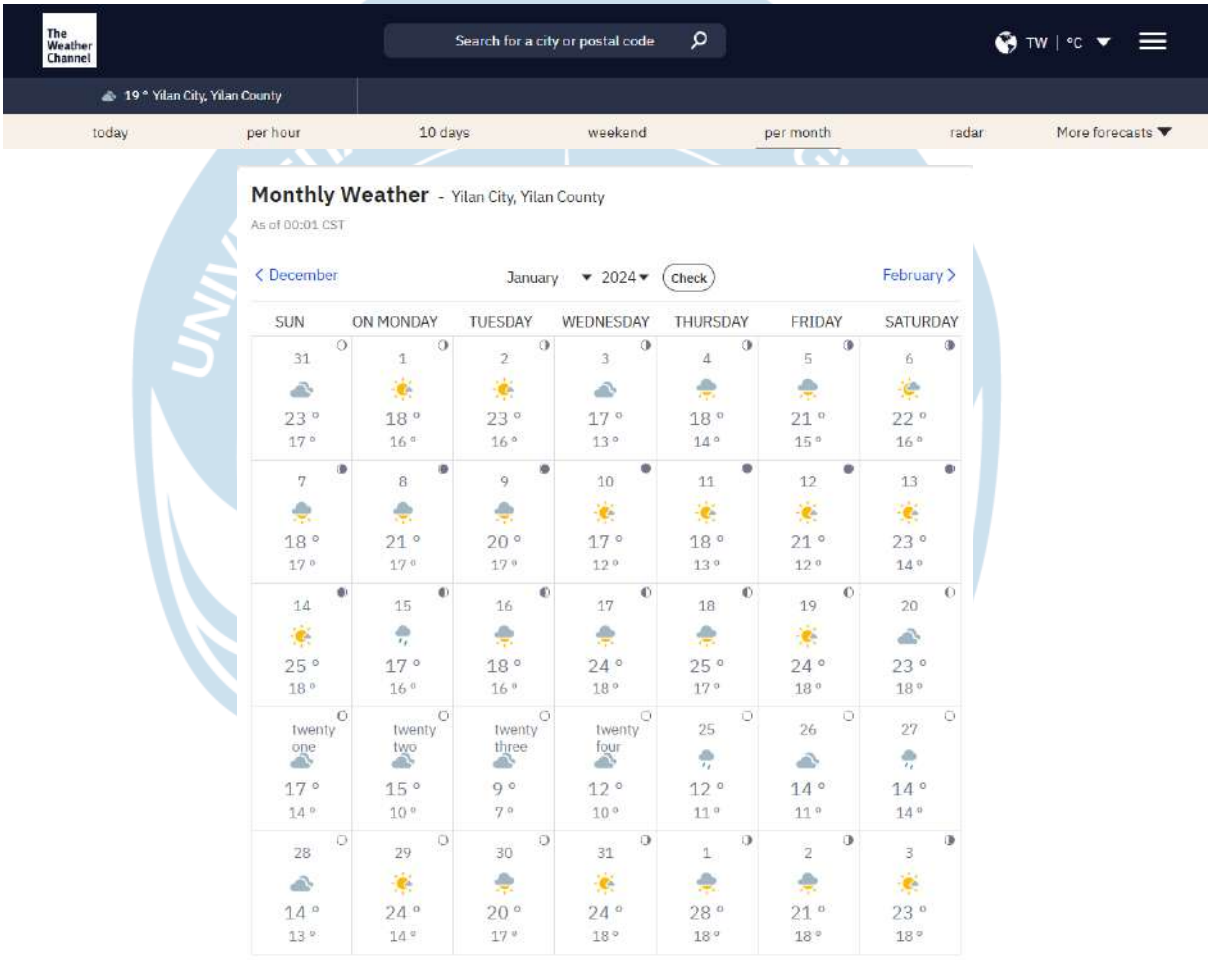


Figure 3 The Weather Channel
(<https://weather.com-November> 2024)

Each season brought varying lighting needs, particularly concerning artificial lighting. If natural light was insufficient to meet a classroom's requirements, supplemental artificial lighting became essential. Adequate lighting played a crucial role in supporting children's learning activities. Therefore, this research aimed to explore the lighting preferences of

kindergarten children and examine the relationship between these preferences and seasonal lighting conditions.

1.2. Research Question

Based on the background, the research question for this research was:

“What is the relationship between the level of children preference for natural and artificial lighting with children activities in Yilan Kindergartens?”

1.3. Research Limitations

The limitations for this research were:

1. The children included in the study were those attending kindergartens in Yilan. Limiting the study to kindergartens within Yilan was a pragmatic choice driven by several factors: it ensured geographical feasibility and efficient resource management for the researcher by concentrating data collection efforts. This focus also guaranteed climatic and environmental consistency among participants, as all kindergartens would have been subject to Yilan's specific weather patterns and natural lighting conditions. Furthermore, it promoted homogeneity in the educational context, as children within this region were likely exposed to similar curricula and kindergarten environments, thereby helping to control for potential confounding variables.
2. Data on children's activities were gathered through direct observation by the researcher. Young children, typically aged 4-5 years old, were generally unable to effectively articulate their activities or participate in surveys or interviews. Therefore, direct observation was deemed the most suitable and reliable method for collecting data on their spontaneous behaviors, play, and engagement in various activities within a kindergarten setting.
3. Natural lighting measurements were based on sky conditions, while artificial lighting was measured using an illumination meter.

1.4. Research Objectives

The research aimed to achieve the following:

- Asses the level of children's preference for natural and artificial lighting in kindergartens in Yilan, Taiwan.
- Analyze the relationship between lighting preferences (natural and artificial) and different types of children's activities, such as learning, play, and rest.
- Identify the optimal lighting conditions that enhanced children's engagement and performance in various kindergarten activities.

1.5. Research Benefits

The benefits of the study:

- This research provided valuable insights into creating optimal lighting conditions in kindergartens, fostering better concentration and engagement during learning activities.
- This research enhanced child well-being by contributing to an understanding of children's lighting preferences.

1.6. Research Methods

The research, entitled " Exploring the Relationship Between Lighting Preferences and Children's Activities in the Kindergartens in Yilan, Taiwan," utilized a mixed-methods approach, combining both qualitative and quantitative methods through observation and measurement.

1.7. Prior Research Scheme and Originality

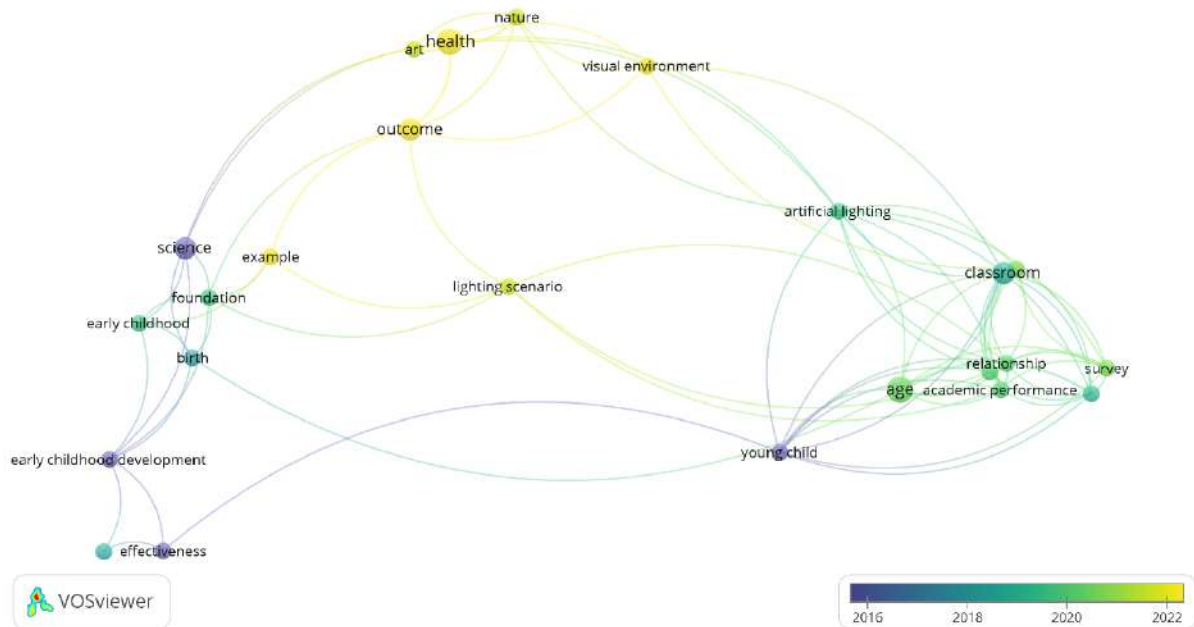


Figure 4 Previous Research Scheme

This scheme highlighted previous research focusing on the keywords "child development," "kindergarten lighting," and "lighting for children," encompassing publications from at least the past decade (Figure 4). It revealed that much of the existing research emphasized child development, health, and the visual environment. While there were studies on artificial lighting and its impact on young children, there remained a noticeable gap in research exploring the preferences for both natural and artificial lighting in relation to children's activities in kindergarten settings.

1.8. Scope of Research

The following were the focus and locus of the research carried out:

1.8.1 Research Focus

This research focused on the relationship between natural and artificial lighting preferences and children's activities in the kindergartens. This research also investigated how different types of light (natural and artificial) affected children's activities in kindergartens.

Understanding these preferences was key for designing better learning spaces. The study sought to identify if children gravitated toward particular lighting conditions, offering valuable insights for designers and educators. Ultimately, this research helped create more stimulating environments that aligned with children's developmental needs by recognizing light's powerful role in shaping behavior and engagement.

1.8.2 Research Locus

The research was conducted in Yilan, Taiwan. The selection included different types of kindergartens, such as public, non-profit, those affiliated with a public elementary school, and private institutions. This diversity was crucial because the "type" of kindergarten often correlated with its funding, facilities, design, and, potentially, its approach to utilizing natural versus artificial lighting, thereby providing a broader perspective on lighting conditions and preferences.

Despite varying types, the core activities offered in all selected kindergartens (learning, play, rest, creative arts, physical activities, etc.) were generally consistent for preschool-aged children. This ensured that the study could observe children engaged in the same range of developmental activities across different settings, making comparisons of lighting preferences relevant to the activities performed. The following were the locations of the kindergartens studied:

a) Kindergarten A (新 OO 幼兒園)

Location: Wujie Township, Yilan



Figure 5 新 OO 幼兒園

(<https://maps.app.goo.gl/Vq8kv3UH1RXdhL5Z9>)

b) Kindergarten B (育 OOO 利幼兒園)

Location: Yilan City, Yilan



Figure 6 育 OOO 利幼兒園
(<https://maps.app.goo.gl/FRfWFHShu3hec9UCA>)

c) Kindergarten C (壯 OOO 小學)

Location: Zhuangwei Township, Yilan County, 263



Figure 7 壯 OOO 小學
(<https://maps.app.goo.gl/ejHLRkpnQ3f1Qd917>)

d) Kindergarten D (中 O 幼兒園)

Location: Zhuangwei Township, Yilan County, 263



Figure 8 中 O 幼兒園

(<https://maps.app.goo.gl/vDjaJ8zikhK4QfoL8>)

1.9. Research Standards

This research aligned with the United Nations Sustainable Development Goals (SDGs), specifically SDG 3: “Good Health and Well-Being”. SDG 3 had a target to ensure overall health conditions across various ages (Seelajaroen & Jitmaneeroj, 2025). By investigating the relationship between natural and artificial lighting preferences and children's activities in Yilan kindergartens, the study aimed to identify lighting conditions that best supported children's cognitive development, attention, and physical comfort. Adequate and appropriate lighting could reduce eye strain, improve concentration, positively influence mood, and foster a more engaging environment for learning, play, and rest. Ultimately, ensuring children had access to supportive and healthy indoor spaces, where lighting was optimized for their unique sensitivities and developmental needs, was fundamental to promoting their overall physical and mental well-being from a very young age, thereby contributing to healthier and more thriving future generations.

1.10. Research Ethics

The research in all kindergartens was conducted with the permission of the principals, on the condition that the children's identities were kept secret by blurring their faces. Photography and light measurements were also carried out with the permission of the principal in each kindergarten.

1.11. Research Process

This research is structured into different chapters (Figure 9):

1. **Introduction:** this chapter explained the research background, research problem, objectives, and benefits of the study. It also detailed the methodology used, the originality of the research, scope of the research, and the research standards. Additionally, the research process and the licensing process in each kindergarten were described within this chapter.
2. **Literature Review:** This chapter introduced the theories related to the topic of this research, including children development, the effects of kindergarten on children, and natural and artificial lighting in kindergarten settings. This chapter also explained details about each of the kindergartens that were the objects of this study.
3. **Research Methodology:** this chapter explained the schematic diagram of the research, and detailed the methods used to collect and analyze the data.
4. **Results and Discussions:** the first part of this chapter presented photos of activities and the results of light measurements taken in each classroom across the four kindergartens. Following that, the results of lighting simulations and behavior mapping were presented for each kindergarten. The chapter concluded with a simulation analysis comparing the same activity across all the kindergartens.
5. **Conclusions:** the conclusions discussed about the relationship between children lighting preferences with their activities in the kindergartens in Yilan. This chapter also included suggestions for the future research.

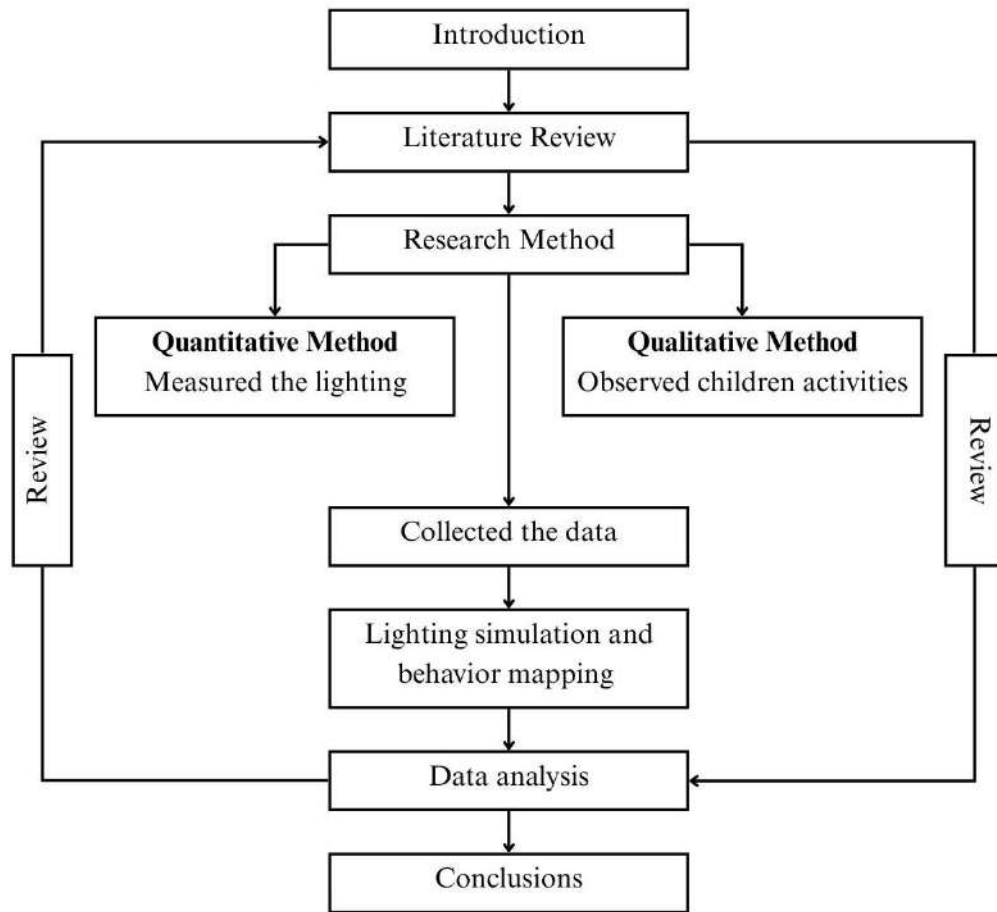


Figure 9 Research Flow