

"BIOPHILIC DESIGN INTEGRATION IN LANDSCAPES: ENHANCING HEALTH AND WELLBEING ACROSS AGE GROUPS"

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Abstract

This paper explores the integration of biophilic design as a fundamental component within landscapes, aiming to enhance the health and well-being of individuals. Biophilic design, encapsulating the connection between humans and nature, emerges as a potent tool not only for augmenting aesthetic appeal but also for significantly advancing overall wellness (Tan et al., 2018). To comprehensively elucidate the profound impacts of biophilic elements across diverse age groups, this study examines their integration into various landscape contexts.

By applying biophilic design principles, landscapes can be transformed into dynamic environments evoking sensations of tranquility and vitality (Ryan and Browning, 2020). This innovative approach capitalizes on the symbiotic relationship between humans and the natural world, providing avenues for sensory stimulation and stress alleviation. Indoor plants, for instance, have been demonstrated to mitigate feelings of anger and induce calmness (Franco et al., 2017), while outdoor green spaces have shown efficacy in reducing blood pressure, fostering mental health, and enhancing visualization (Bennett and Jones, 2018).

Of particular focus is the implementation of biophilic design principles within educational settings, with the aim of fostering a deeper connection with nature and enhancing the well-being of children. This emphasis aligns with emerging research emphasizing the significance of nature-based experiences in promoting cognitive development and emotional resilience among young learners.

Keywords: Biophilic Design, Landscape Design, Indoor Air Quality, Stress Reduction, Indoor Plants, Natural Elements

Introduction

The term "biophilia," originally introduced by Erich Fromm in 1964, connotes an affinity for "love" and "living things," implying a profound connection with life itself. Coined by Edward O. Wilson in 1984, the term combines "bio" and "philia," signifying a deep-seated attraction to the natural environment. Wilson's publication of "Biophilia" in 1984 popularized the concept, highlighting humanity's intimate relationship with the natural world.

Central to the biophilic hypothesis is the notion that humans have evolved as integral components of nature, necessitating a symbiotic relationship with the environment for productivity and health (Beatley, 2011). This innate emotional affiliation with living organisms, as articulated by Kellert and Wilson (1993), underscores the foundational aspect of human nature.

Biophilic design emerges as a sustainable strategy for rekindling human engagement with the natural environment, as advocated by Kellert et al. (2008) and Beatley (2010). According to Kellert

and Calabrese (2015), successful implementation of biophilic design hinges upon meeting fundamental conditions:

- 1. Continuous and recurrent engagement with nature.
- 2. Emphasis on human adaptations to the natural environment that historically enhanced health and wellbeing.
- 3. Promotion of emotional bonds with specific environments.
- 4. Encouragement of beneficial interactions between humans and their environment, fostering a sense of relationship and responsibility.
- 5. Promotion of connected, integrated architectural solutions.

A crucial aspect of biophilic design is its potential to restore nature while benefiting both individuals and the environment (Gillis and Gatersleben, 2015). Understanding the primary dimensions and principles of biophilic design is pivotal for evaluating its impact on the mental and physical health of individuals.

The first dimension, termed the organic or naturalistic dimension by Kellert, encompasses direct and indirect experiences with natural and manmade environmental forms and shapes. Direct experiences entail interaction with self-sustaining natural elements like animals, plants, and natural light, while indirect experiences involve interaction with elements essential for human survival, such as water bodies and potted plants.

The place-based or vernacular dimension of biophilic design, as described by Heerwagen, Kellert, and Mador (2013), underscores the significance of environmental characteristics, natural forms, patterns, and place-based relationships in shaping human-nature interactions.

Studies on human behavior and performance emphasize the profound impact of one's surroundings, whether natural or artificial, on physical and mental wellness (Bratman et al., 2012). Exposure to natural environments is associated with improved learning abilities and cognitive function, as evidenced by research conducted by Grinde & Grinde-Patil (2009), thereby advocating for the incorporation of biophilic elements in educational settings.

Case Studies

Limited systematic case studies incorporating biophilic design in educational institutions are evident in the literature. However, existing examples predominantly serve as descriptive illustrations rather than comparative analyses due to the specificity of chosen scenarios. These cases reflect various models of school design and approach methodologies, encompassing:

- Complete integration of natural elements into school design.
- Incorporation of selected natural features within school architecture.
- Utilization of biophilic elements in school buildings.

The selected case studies, situated in tropical and temperate climates, offer insights into the integration of biophilic design dimensions and elements within educational settings.

1. OZU X, Istanbul, Turkey

One such institution, OZU X in Istanbul, Turkey, exemplifies biophilic design principles through its comprehensive incorporation of nature into both its interior and exterior environments. OZU X

integrates natural elements such as plants, natural light, and landscape features throughout its campus (Elmashharavi, 2019). The architectural design maximizes exposure to natural light, enhancing student concentration and productivity. Cylindrical projected glass walls facilitate the influx of sunlight into interior spaces, promoting a conducive learning environment. Additionally, the transparent design enables students to maintain a visual connection with the surrounding natural landscape, further enriching their educational experience.

The design of OZU X also incorporates natural patterns and processes, fostering a visually stimulating and engaging environment. Through the use of diverse textures, daylight, and spatial configurations, the building promotes a sense of harmony with nature. Furthermore, the integration of curved and straight lines in both the construction and furniture design caters to the diverse needs of students, enhancing their overall comfort and well-being.

In terms of human-nature relationships, OZU X emphasizes the promotion of well-being through the integration of biophilic design elements. By incorporating features such as plants and natural light, the institution seeks to foster a stronger connection between students and nature (Kellert, 2012), ultimately enhancing their learning experience. Moreover, the architectural design, including the use of a ramp connecting the building to a nearby natural hill, reinforces a sense of continuity and connection with the surrounding environment.

2. The Green School, Bali, Indonesia

Another notable case study is The Green School, located in Bali, Indonesia, which prioritizes sustainability and environmental stewardship in education. Situated amidst a lush jungle of native plants and trees, the campus utilizes renewable energy sources such as solar panels and hydropowered generators. Architectural structures, constructed primarily from locally sourced bamboo, demonstrate innovative and experimental approaches to sustainable design.

The Green School aims to instill in students a deep appreciation for the natural world, fostering curiosity and passion for environmental conservation. Through its emphasis on sustainability and green leadership, the institution serves as a model for integrating biophilic principles into educational settings, inspiring future generations to become stewards of the earth.

Table 1. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at The Green School)

S.No.	Design Pattern	Presence (Yes/No)	Application
	Nature in Space (Di	irect Exper	iences)
1	Visual Connection	Yes	Vast openings to nature
2	Non –Visual Connection with nature	Yes	Openings allow sound and smell of nature inside
3	Non-Rhythmic Sensory Stimuli	Yes	Open facades allow seeing natural movement within nature.

			The openness of the building allows the air to create
			movement within the space.
4	Thermal and airflow variability	Yes	Air circulation creates cooling
			effect for users and changes in
			humidity levels
5	Presence of Water	Yes	The open façade connects the
			occupants to water through
			rainfall (seen and heard from
			inside).
6	Dynamic and Diffuse Light	Yes	Open façade and roof form
			provides natural light throughout
			the day.
7	Connection with Natural Systems	Yes	Open structures connects
			occupants to the everchanging
			outside environment
	Natural Analogues (1	
1	Biomorphic forms and Patterns	Yes	Curves and natural shapes
			(ranging from the furniture,
			incorporating the natural
			features and strength of bamboo)
2	Material Connection with Nature	Yes	Natural materials are used
			throughout the school
3	Complexity and Order	Yes	Sustainable features (Solar
			panels, Mini hydro vortex and
			water filtration) are visible to
			users.

3. Barn Klong Bon School and Art Spaces, Thailand

Vin Varavarn Architects are currently engaged in the development of the Barn Klong Bon School and Art Spaces project situated in Thailand. A notable feature of this project is the reconfiguration of the second-floor classroom's floor plans, undertaken by the design team to establish a spatial continuity between the upper floor and the ground level, which accommodates the art classroom. In ensuring the internal spaces remain protected from adverse weather conditions, the design incorporates translucent corrugated panels with steel frames for windows and doors. This choice not only offers weather resistance but also facilitates ample natural light penetration, contributing to a well-lit and inviting interior atmosphere. Complementing this, the walls of the second floor are adorned with bamboo wood, fostering a warm and welcoming ambiance while seamlessly integrating the building with its natural surroundings.

To delineate spaces effectively and establish a tangible connection with the outdoors through non-rhythmic sensory stimulation, the design incorporates openable opaque façades and drapes. This strategic use of architectural elements aims to create a dynamic interplay between interior and exterior environments, enhancing the occupants' engagement with nature.

Furthermore, the architecture prioritizes the use of organic materials, transparent facades, and indoor plants to reinforce the relationship between occupants and nature. By seamlessly blending natural elements with the built environment. As shown in Table 2 the design fosters a harmonious coexistence between human occupants and their surrounding ecosystem, ultimately contributing to a conducive learning and creative environment.

Table 2. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at Barn Klong Bon School and Art Spaces)

S.No.	Design Pattern	Presence	Application		
		(Yes/No)			
	Nature in Space (Direct Experiences)				
1	Visual Connection	Yes	Indoor Plants		
2	Non –Visual Connection with nature	Yes	Open façade allows light, air & smell inside		
3	Non-Rhythmic Sensory Stimuli	Yes	The open facade of the building allows the air to create movement within the space while plants and curtains dividing the internal spaces		
4	Thermal and airflow variability	Yes	Air circulation creates cooling effect for users and changes in humidity levels		
5	Presence of Water	No	Not evident		
6	Dynamic and Diffuse Light	Yes	Large openable façade and opaque glass panels diffuses the natural light		
7	Connection with Natural Systems	Yes	Openable façade allows the users to experience the outside weather.		
	Natural Analogues (I	ndirect Exp	periences)		
1	Biomorphic forms and Patterns	Yes	Images of animals and trees on the walls		
2	Material Connection with Nature	Yes	Natural and native (bamboo) materials are used throughout the school		

3	Complexity and Order	Yes	Exposed	structural	materials
			indoors		

4. Eureka Centre in Anglo Colombiano School, Bogota, Colombia

The Eureka Centre within the Anglo Colombiano School features distinctive architectural elements designed to evoke a sense of harmony with the natural world. Markedly, the structure boasts two half-moon-shaped entrances, symmetrically positioned and separated by a longitudinal axis, imparting a sense of balance and symmetry to the overall design.

At the heart of the building lies a central courtyard, meticulously crafted to emulate the organic form of a leaf, symbolizing growth and vitality. This central space serves as the focal point of the structure, fostering a sense of community and connection among its occupants. Notably, the courtyard's design facilitates transparency throughout the building, affording visibility of the classes and activities unfolding within its confines.

The circulation within the Eureka Centre follows a helical pattern, intricately woven to navigate the various floor plans and connect the different spaces seamlessly. This helical circulation not only enhances the spatial flow but also reinforces the central courtyard as the nexus of the structure. Moreover, the classrooms surrounding the courtyard are interconnected through this circulation pattern, further promoting interaction and collaboration among students and faculty.

Organic elements such as clay and plants are thoughtfully integrated throughout the structure, imbuing it with a sense of biophilia and a connection to the natural environment. By incorporating these natural elements, the Eureka Centre establishes a harmonious relationship with its surroundings, fostering a serene and conducive learning environment conducive to intellectual growth and creativity.

Table 3. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at Eureka Centre in Anglo Columbian School)

S.No.	Design Pattern	Presence	Application
		(Yes/No)	
	Nature in Space (D	irect Exper	iences)
1	Visual Connection	Yes	Plants in the central
			atrium/courtyard space
2	Non –Visual Connection with nature	No	Not Evident
3	Non-Rhythmic Sensory Stimuli	No	Not Evident
4	Thermal and airflow variability	Yes	Air circulation is created by opening windows towards the courtyard
5	Presence of Water	No	Not evident
6	Dynamic and Diffuse Light	Yes	Varying intensity of lights and shadows creates nature like conditions.

7	Connection with Natural Systems	No	Not Evident
	Natural Analogues (In	ndirect Exp	periences)
1	Biomorphic forms and Patterns	Yes	Symbolic references to nature
			(patterns, textures and numerical
			arrangements).
			Fluidic walkways and seating
2	Material Connection with Nature	Yes	Minimal processed materials
			reflect local ecology and
			geology.
			Use of earthy tones and bricks
3	Complexity and Order	Yes	Ventilation and power systems
			are visible to the users

5. Hazelwood School, Glasgow

Hazelwood School, situated in Glasgow, caters to children and teenagers with complex learning needs and sensory impairments, underscoring its commitment to providing an inclusive and supportive educational environment. The architectural design of the school is meticulously tailored to address the diverse sensory needs of its students while fostering a secure and engaging atmosphere for both students and staff.

A prominent feature of the school's design is the deliberate incorporation of elements to maximize natural light, acknowledging its profound impact on the learning environment. In addition to enhancing visibility, ample natural light is known to positively influence mood and cognitive function. To this end, high-level clerestory windows are strategically positioned to facilitate an equitable distribution of natural light throughout the classrooms.

Furthermore, the design ethos of Hazelwood School emphasizes sensory stimulation and unrestricted movement as integral components of the learning experience. Planted teaching gardens and weaving walkways are integrated into the school grounds, providing sensory-rich environments that encourage exploration and engagement. Additionally, cork-clad walls contribute to the tactile experience within the school, promoting a sense of comfort and connection to the natural world.

In recognition of the diverse needs of its student population, Hazelwood School prioritizes the provision of specialized amenities aimed at supporting various disabilities and impairments. Notably, the inclusion of a hydrotherapy pool underscores the school's commitment to holistic well-being, offering therapeutic benefits and promoting physical activity among students.

Overall, Hazelwood School exemplifies a holistic approach to inclusive design, where architectural features and amenities are thoughtfully curated to accommodate the diverse needs of its students while fostering an environment conducive to learning, growth, and well-being.

Table 4. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at Hazelwood School)

S.No.	Design Pattern	Presence	Application
		(Yes/No)	
	Nature in Space (D	irect Exper	iences)
1	Visual Connection	Yes	Mature trees around site are
			visible and accessible to the
			users.
2	Non –Visual Connection with nature	Yes	Touching natural materials
3	Non-Rhythmic Sensory Stimuli	Yes	Not Evident
4	Thermal and airflow variability	Yes	Natural Ventilation - Air
			circulation is created by opening
			windows towards the courtyard
5	Presence of Water	Yes	Indoor pool
6	Dynamic and Diffuse Light	Yes	High level glazing
			Louvres to filter sun
			Light and shadows replicate
			nature
7	Connection with Natural Systems	Yes	Not Evident
	Natural Analogues (I	ndirect Exp	eriences)
1	Biomorphic forms and Patterns	Yes	Not Evident
2	Material Connection with Nature	Yes	Materials and elements from
			nature such as cork and wood
3	Complexity and Order	Yes	Wooden structural elements

1. Paul Chevallier School, Lyon, France

Tectoniques architects spearheaded the creation of the Paul Chevalier School, an establishment comprising both a wooden nursery and elementary school complex situated in Lyon, France. The architectural concept underlying this project prioritizes the seamless integration of the built environment with its natural surroundings, underscoring the intrinsic connection between architecture and the environment.

Central to the design ethos of the Paul Chevalier School is the incorporation of features that foster a symbiotic relationship between the architectural structure and its natural milieu. This includes the integration of a vegetable garden, expansive walkways for children to explore, and sloping rooftops adorned with vegetation. Notably, vegetation is thoughtfully incorporated into both the upper and lower floors of the building, achieved through the strategic use of wood and roofing materials conducive to plant growth.

The architectural layout of the nursery school and elementary school follows a V-shaped floor design, with the latter elegantly winding around a small courtyard. This configuration not only enhances spatial flow but also fosters a sense of unity and cohesion within the school complex. Furthermore, the predominant use of timber for both interior and exterior cladding contributes to

the establishment's organic aesthetic, augmented by select panels painted in contrasting yellow hues to accentuate architectural features.

In terms of functionality, natural light assumes a paramount role in the architectural design, exemplified by large corridors outfitted with ceiling-reaching windows. These expansive windows not only illuminate interior spaces but also afford captivating views of the surrounding natural landscape, enriching the teaching and learning experience within the classrooms. The Paul Chevalier School epitomizes a harmonious blend of architectural innovation and environmental consciousness, where thoughtful design elements converge to create a nurturing educational environment that celebrates the intrinsic beauty of nature.

Table 5. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at Paul Chevallier School)

Design Pattern	Presence	Application
	(Yes/No)	
Nature in Space (Di	rect Exper	iences)
Visual Connection	Yes	Vegetable garden
		Accessible rooftop with plants
Non –Visual Connection with nature	Yes	Use of natural materials and
		textures
Non-Rhythmic Sensory Stimuli	Yes	Not Evident
Thermal and airflow variability	Yes	Natural Ventilation
Presence of Water	Yes	Not Evident
Dynamic and Diffuse Light	Yes	Natural light in corridors
		Floor to ceiling windows
		Façade with holes and wood
		frame
Connection with Natural Systems	Yes	Nature is frames by large
		windows
Natural Analogues (Ir	direct Exp	eriences)
Biomorphic forms and Patterns	Yes	Panels with circular holes allows
		light to enter the classrooms
Material Connection with Nature	Yes	Use of wood internally and
		externally
Complexity and Order	Yes	Visible wooden structures
	Nature in Space (Di Visual Connection Non –Visual Connection with nature Non-Rhythmic Sensory Stimuli Thermal and airflow variability Presence of Water Dynamic and Diffuse Light Connection with Natural Systems Natural Analogues (In Biomorphic forms and Patterns Material Connection with Nature	Nature in Space (Direct Exper Visual Connection Yes Non – Visual Connection with nature Yes Non-Rhythmic Sensory Stimuli Yes Thermal and airflow variability Yes Presence of Water Yes Dynamic and Diffuse Light Yes Connection with Natural Systems Yes Natural Analogues (Indirect Exp Biomorphic forms and Patterns Yes Material Connection with Nature Yes

2. Vo Trong Nghia's Farming Kingdom

Vo Trong Nghia's Farming Kindergarten, located in Vietnam, stands as a testament to architectural innovation and sustainability, crafted by the esteemed firm. This two-story educational institution is distinguished by its distinctive knot-shaped roof, which not only serves as an additional green space but also accommodates a flourishing vegetable garden. The roof's verdant covering,

comprised of grass and plants, not only provides insulation but also fosters sustainability, aligning with the school's eco-conscious ethos.

In pursuit of maximizing natural lighting and promoting cross ventilation, the architectural design incorporates sheltered courtyard playgrounds and strategically positioned windows on both the exterior and courtyard-facing sides. These features not only enhance the overall ambience of the learning environment but also contribute to energy efficiency and environmental comfort.

Central to the design philosophy is the integration of nature into the very fabric of the structure. Concrete louvres adorning the exterior walls serve as a canvas for climbing plants, further enhancing the school's greenery and promoting biodiversity. Embracing a commitment to sustainability, the kindergarten eschews traditional air conditioning in favor of natural ventilation, thereby reducing energy consumption. Additionally, the implementation of eco-friendly practices such as harnessing solar energy for water heating and employing water reuse systems for toilet flushing and irrigation underscores the school's dedication to environmental stewardship. Vo Trong Nghia's Farming Kindergarten epitomizes a holistic approach to sustainable architecture, where ecological considerations are seamlessly integrated into the design process to create a nurturing educational environment that not only educates but also inspires future generations to embrace environmental responsibility.

Table 6. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at Vo Trong Nghia's Farming Kingdom)

S.No.	Design Pattern	Presence	Application		
		(Yes/No)			
	Nature in Space (Di	irect Exper	iences)		
1	Visual Connection	Yes	Three sheltered courtyard with		
			visible tree planting		
2	Non –Visual Connection with nature	Yes	Not Evident		
3	Non-Rhythmic Sensory Stimuli	Yes	Not Evident		
4	Thermal and airflow variability	Yes	Designed for cross natural		
			Ventilation		
5	Presence of Water	Yes	Not Evident		
6	Dynamic and Diffuse Light	Yes	Natural light through windows		
			to the courtyard facing the outer		
			wall.		
			Louvres filter the direct sunlight.		
7	Connection with Natural Systems	Yes	Green roof as an edible garden.		
			Experiencing growth cycle of		
			plants.		
	Natural Analogues (Indirect Experiences)				

1	Biomorphic forms and Patterns	Yes	Curved building with green roof (natural hill shape with access from ground level)
2	Material Connection with Nature	Yes	Bricks and tiles are used within the buildings
3	Complexity and Order	Yes	Not Evident

3. The Garden School, Hackney, England

Situated in Hackney, England, The Garden School caters to children with exceptional needs, including those with autism spectrum disorder. The architectural design of this institution is carefully curated to cultivate a profound connection with nature and promote overall wellness among its students.

A distinctive feature of The Garden School's architecture is its array of seating alternatives, exemplified by built-in hexagonal seating crafted from natural wood and strategically positioned window seats offering panoramic views of the playground. These seating arrangements not only provide comfort but also facilitate engagement with the outdoor environment, fostering a sense of tranquility and connection with nature.

Furthermore, tactile and visual elements inspired by the natural world are integrated throughout the school's interior design, evident in the incorporation of wallpaper and carpet adorned with woodland imagery. These design elements evoke a sense of immersion in nature, enhancing the sensory experience and promoting a calming atmosphere conducive to learning (Hung and Chang, 2024).

An innovative multi-sensory component further enriches the educational environment at The Garden School (Diep, 2019), allowing students to interact with and regulate artificial lighting. Color-changing LED lighting discs embedded in the ceiling emulate natural tones, creating dynamic lighting scenarios that mimic the changing hues of daylight. This integration of biophilic design principles not only enhances the aesthetic appeal of the space but also supports students in managing sensory stimuli and promoting a sense of well-being (Peters and D'Penna, 2020). The Garden School exemplifies how biophilic design concepts can be effectively employed to create a stimulating and inclusive learning environment for children with specific educational challenges. By seamlessly integrating elements of nature into the architectural and sensory design, The Garden School fosters a nurturing and welcoming setting that prioritizes the holistic development of its students.

Table 7. Presence and use of patterns in case studies located in tropical climate related to Nature in the Space (Direct & Indirect Experience at The Garden Kingdom)

S.No.	Design Pattern	Presence	Application
		(Yes/No)	
	Nature in Space (Di	irect Exper	iences)
1	Visual Connection	Yes	Window seats allow occupants a view to nature outside
2	Non –Visual Connection with nature	Yes	Nature sounds played within space
3	Non-Rhythmic Sensory Stimuli	Yes	Not Evident
4	Thermal and airflow variability	Yes	Natural Ventilation
5	Presence of Water	Yes	Not Evident
6	Dynamic and Diffuse Light	Yes	Natural lighting inside controlled with blinds
7	Connection with Natural Systems	Yes	Visible nature from seats
	Natural Analogues (In	ndirect Exp	eriences)
1	Biomorphic forms and Patterns	Yes	Honeycomb like seating Wallpaper (Woodlands)
2	Material Connection with Nature	Yes	Materials to evoke nature Natural colors
3	Complexity and Order	Yes	Not Evident

Conclusion

Biophilic architecture underscores the importance of fostering connections between individuals and the built environment, recognizing that architectural surroundings exert both direct and indirect influences on human psychology. It is imperative for architects and designers to prioritize the creation of healthy and aesthetically pleasing building ecosystems that cater to the well-being of occupants (Botchwey et al., 2022).

Moreover, the impact of architectural environments on students' emotional health is particularly pronounced, given the substantial amount of time spent within educational institutions for learning and academic pursuits. Mental health considerations among students are often overlooked in pedagogical approaches, underscoring the critical importance of designing educational spaces imbued with biophilic principles to cultivate a positive learning atmosphere.

The integration of biophilic design in learning environments, exemplified by projects such as OZU X at Ozyegin University, yields favorable outcomes for students' psychological and social well-being. Incorporating biophilic elements such as vegetation and natural lighting enhances students' productivity, concentration, and overall sense of well-being. The OZU X building serves as a

compelling illustration of how biophilic design principles can be effectively integrated into both interior and exterior spaces, thereby promoting a conducive learning environment.

The overarching objective of integrating biophilic design into educational spaces is to provide students with an environment conducive to innovation and creativity. The paper delineates ten biophilic design patterns categorized under two main themes: natural analogues and nature in the space. Case studies from diverse geographical locations illuminate the manifestations of biophilia in elementary school settings and offer guidance on the application of biophilic design patterns.

To ascertain the extent to which well-being is augmented by biophilic design patterns, it is proposed that primary school students participate in a co-design process. The findings of these case studies underscore the significance of both visual and non-visual connections with natural materials and features in school architecture, highlighting the pivotal role of biophilic design in enhancing the overall educational experience.

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