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A COMPARATIVE STUDY ON BIOPHILIC PREFERENCES OF SCHOOL LEARNING SETTINGS: A CASE OF ELEMENTARY SCHOOLS IN ASIA

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Abstract

Countless studies have demonstrated evidence of the significance of nature in learning settings on children's performance globally. Children exposed to a learning setting based on nature tend to perform better than those in a typical classroom. Studies have also found that the current generation obtains indirect nature experiences through various e-learning platforms rather than experiencing nature directly in modern society. Recent studies found that an inconducive school design environment that does not fully support students' needs and preferences is one of the main reasons for this. Hence, this paper explores children's choices for biophilic elements in primary school design in three Asian countries: Malaysia, Indonesia, and Thailand. The online survey questionnaire was used as a qualitative method to collect the stipulated data. The results revealed that biophilic elements are highly favourable to the students from all three countries except for the different elements they preferred. In particular, the results found that planting elements within the school area are the biophilic element most preferred by students in Indonesia and Thailand. Meanwhile, students in Malaysia prefer animals (pets and birds). The data and results presented in the present study can be used as a general guideline, particularly in integrating nature as part of the future school design elements in Asian countries. Note that each design preference shows a different result based on each school's preferences in the three countries.

Keywords: School learning setting, Biophilic Elements, Preferences

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INTRODUCTION

Since the global COVID-19 pandemic, environmental disaster issues have been getting increasing attention from people worldwide. According to the latest Intergovernmental Panel on Climate Change (IPCC) report as of August 2021, climate change is currently at an irreversible and critical stage caused by reckless human activities (Kauffman, 2021). The Cable News Network (CNN) reported that countries across the globe have experienced intensified climate change, such as heavy rainfall, extreme global warming, and wildfires, including the coldest city in the world (Kottasová, 2021). Southeast Asian regions, including Malaysia, Thailand, and Indonesia, are also well-known as hotspots of climate-related disasters (Mall et al., 2018). Heavy floods and other extreme climate changes are among the environmental issues that result in a dramatic loss of public life due to unprecedented challenges, particularly in Southeast Asian countries, including Malaysia, Indonesia, and Thailand (Bernama, 2020; Bangkok Post, 2020; Davies, 2021a, 2021b, 2021c).

Moreover, school closures and damage, disruption of social and economic activities deterred new investments in flood-prone areas, as post-disaster psychological effects on children are the effects caused by environmental disasters in Southeast Asian countries (Abdul Rahman, 2014; Roosli et al., 2011; Bangkok Post, 2020) and in 2018, the New Straits Times (NST) reported that over 3,147 students could not attend classes in Pahang, Kelantan, Johor, Sarawak, and Terengganu, due to heavy flood issues. On the other hand, Indonesia has been experiencing environmental disasters since 2013 until now (The Star, 2018; Leung, 2020; Davies, 2021b). In 2020, a massive flash flood caused over 36000 people to be displaced, 66 people were found dead, and 19 schools were damaged due to the incident (Leung, 2020). In Country Report Thailand (2015), it is documented that approximately 95% of damage costs (US$40 million) were incurred due to the flood disaster in 2011. Additionally, studies conducted by Abdul Rahman (2014) show that environmental disasters lead to several damages, including direct and indirect losses. Direct losses include losses due to injury or death and the cost of restoring the damage. Meanwhile, indirect losses include time, travel, and office operating losses.

As a result of the continuous environmental disaster, Asian cities are experiencing increased exposure to climate-related risks every year. Hence, several policies and efforts were introduced to strengthen the city's resilience and overcome the issues. Among these initiatives are launching the Sustainable Development Goals, the New Urban Agenda, the Sendai Framework for Disaster Risk Reduction, and the Paris Agreement, which aims for climate and disaster-resilient within cities (UNDDR, 2015). In a built environment, the uncontrolled environmental impact in most Southeast Asian countries is primarily due to an unresponsive school design environment (Aziz & Said, 2016). Hence, in this study, biophilic design approaches are suggested as having the potential to

overcome the issues of post-disaster schools in Asian countries and reduce the impact of environmental disasters. In 2011, the ASEAN Guidelines on Eco-Schools were formed as part of an effort within ASEAN countries to promote sustainable school concepts and practices throughout ASEAN. The guideline also encourages all ASEAN countries to strive for a sustainable school environment, including reducing environmental degradation and its impact on human well-being.

LITERATURE REVIEW

Children's Learning Approaches in Malaysia, Indonesia, and Thailand

Numerous research studies have acknowledged that environmental disasters in Asian countries have led to post-disaster psychological effects on children. Urban Heat Islands (UHI), heavy flash floods, landslides, and other ecological distress have drastically affected students' achievements and well-being (Nasir et al., 2012; Najafi et al., 2018). However, Mohamed et al. (2017) emphasised that children's health related to flood disasters has paid little attention these days. Hence, it can be suggested that natural elements are essential to enhance children's psychological and physiological well-being due to past traumatised events. This statement is supported by numerous studies that address the significant benefits of biophilic design implementation in urban spaces to people's restorative experience, decreasing mental distress, and increasing health and well-being (Berman et al., 2012; Walimbe & Chitgopkar, 2018).

However, research has indicated that most children's learning approaches in these three Asian countries are geared towards the indoors rather than the outdoors. In Indonesia, the traditional indoor learning classroom is still preferable to outdoor learning (Assa et al., 2021). Kullberg (2010) conducted studies over 12 years in southern Thailand schools and found that the most common teaching method used is recital or recital in indoor classrooms. In Malaysia, the design of outdoor learning has been found to not fully support a conducive learning environment from preschool up to the university level, including the needs and preferences of its users. Hence, these circumstances lead to low engagement and underutilised outdoor spaces among users (Aziz & Said, 2016). Underutilised outdoor spaces disconnect nature among schoolchildren in Asian countries. These factors are due to the unresponsive design of the outdoor learning environment and lack of exposure to the natural environment (Szczepanski, 2009; Kamaruzzaman et al., 2011; Mohidin et al., 2015; Assa et al., 2021).

Biophilic school design potential in an Asian school setting

Limited exposure to nature creates low attachment and awareness of children's ecosystem services and environmental values (Jeladze et al., 2017). Numerous studies have highlighted that connection to nature could positively influence

users' ecological concerns and responses to nature (Cheng & Monroe, 2010; Duerden & Witt, 2010; Collado et al., 2013; Zhang et al., 2014). Therefore, based on the discussion on the learning styles and practices in all three Asian countries, biophilic approaches are considered an essential design element to fill the gap and connect the existing learning culture and children's attachment to nature. The current attention to biophilic design, which integrates nature and natural elements into the built environment, has helped further connect us with nature. Moreover, a biophilic design helps increase environmental awareness among the young generation for a sustainable future. Biophilic design ideas create a strong attachment in children to the character through direct nature experience. Hence, more understanding of ecosystem services is obtained.

Biophilic design concept

Biophilic design studies have focused on various fields, such as workplaces, healthcare, and learning institutions. Recently, studies have examined the biophilic benefits of design for extreme climates (Parsaee et al., 2019), climate change (Africa et al., 2019), and, most recently, its restorative effect related to COVID-19 (Gillis, 2020). Biophilic design derived its concept from biophilia, an inherent human inclination to associate with nature. This concept was initially introduced by Wilson (1986), who suggested biophilia as an innate and positive human tendency and affiliation with the natural environment, allowing them to experience the benefits that facilitate human beings' development, adaptation, and survival. Even in the modern world, biophilia is part of an essential aspect of people's physical and mental health and well-being (Wilson, 1986; Kellert & Wilson, 1993; Kellert,1997, 2012). The disconnection of the human and natural environment can delay a sustainable environment. The study of Simaika and Samways (2010) suggests biophilia as a process of inherent love towards nature that can be nurtured, developed, and experienced by anyone.

Biophilia aims to continue the culture-nature relationships of an individual's connection with nature (Kellert, 2018, 2016; Kellert et al., 2011). In another study by Kellet & Calabrese (2015), they believed that a biophilic design in the modern built environment is intended to offer suitable habitats for humans as biological organisms and advance people's health and well-being. Park and Lee (2019) defined biophilic design as an essential element that integrates and connects people and nature in the building and architectural environment where we live to induce positive changes towards nature. On the contrary, being disconnected from nature leads to ignorance of the natural environment and decreased emotional well-being (MacKerron & Mourato, 2013; White et al., 2013; Capaldi et al., 2014; Rai et al., 2020).

There are several theories related to biophilic design and the built environment. Based on the present study's key issues and concerns, the

Restorative Environmental Design (RED) theory is most suitable for this study context. The biophilic concept is part of the element in the RED approach. RED intends to recover and replenish human emotional resources and support people through stressful mental activities or environments with potential distractions (Kaplan,1995).

Biophilic design approaches

The book Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life outlines six main biophilic design elements and attributes that can be used as design guidelines (Table 1.0).

Table 1: Biophilic Design Elements and Their Corresponding Attributes

Biophilic design element	Attributes
Environmental features	Colour, Water, Air, Sunlight (Natural light), Plants, Animals, Natural materials, Views and vistas, Façade greening, Geology and landscape, Habitats, and ecosystems
Natural shapes and forms	Botanical motifs, Tree and columnar supports, Animal (mainly vertebrate) motifs, Shells and spirals, Egg, oval, and tubular forms, Arches, vaults, domes, Shapes resisting straight lines and right angles, Simulation of natural features, Biomorph, Geomorphology, Biomimicry
Natural patterns and processes	Sensory variability, Information richness, Age, change, and the patina of time, Growth and efflorescence, Central focal point, Patterned wholes, Bounded spaces, Transitional spaces, Linked series and chains, Integration of parts to wholes, Complementary contrasts, Dynamic balance and tension, Fractals, hierarchically organized ratios, and scales
Light and space	Natural light, Filtered and diffused light, Light and shadow, reflected light, Light pools, Warm light, Light as shape and form, Spaciousness, Spatial variability, Space as shape and form, Spatial harmony, Inside-outside spaces
Place-based relationships	Geographic connection to place, Historic connection to place, Ecological connection to place, Cultural connection to place, Indigenous materials, Landscape orientation, Landscape features that define building form, Landscape ecology, Integration of culture and ecology, Spirit of place, Avoiding place lessness
Evolved human-nature relationships	Prospect and refuge, Order and complexity, Curiosity and enticement, Change and metamorphosis, Security and protection, Mastery and control, Affection and attachment, Attraction and beauty, Exploration and discovery, Information and cognition, Fear and awe, Reverence and spirituality

Source: Kellert, S., R, Heerwagen, J., & Mador, M. (2011)

Recent studies by Browning, Ryan, and Clancy (2014) extended the biophilic design principle related to human response and the building environment. Nature in the space, Natural Analogue, and Nature of the area are three primary categories that reflect the other 14 patterns of biophilic design principles related to the connection between humans and the built environment (Table 1.1).

Table 2: Biophilic design patterns in improving health and well-being for the built environment.

Biophilic categories	Biophilic design patterns	Attributes
Nature in the Space	Visual Connection with Nature	View elements of nature, living systems, and natural processes.
	Nonvisual connection with nature	Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems, or natural processes
	Nonrhythmic sensory stimuli.	Stochastic and ephemeral connections with nature may be analysed statistically but may not be predicted precisely.
	Thermal and airflow variability.	Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.
	Presence of water	A condition that enhances the experience of a place through seeing, hearing, or touching water.
	Connection with natural systems.	Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.
	Dynamic and diffuse light.	Leverages varying intensities of light and shadow that change over time to create conditions that occur in nature.
Natural Analogues	Biomorphic Forms and Patterns	Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.
	Material connection with nature.	Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place
	Complexity and order	Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature
Nature of the Space	Prospect	An unimpeded view over a distance, for surveillance and planning
	Refuge	A place for withdrawal from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.

Biophilic categories	Biophilic design patterns	Attributes
	Mystery	The promise of more information is achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment.
	Risk/Peril	An identifiable threat coupled with a reliable safeguard.

Source: Browning, Ryan, Clancy (2014)

METHODOLOGY

This study applied mixed methods, quantitative and qualitative. Only quantitative data from the survey questionnaire is presented in this paper. The survey questionnaire was formed and adapted from Kellert, Heerwagen, and Mador's (2011) studies on biophilic design, theory, and practices related to the building environment. This survey questionnaire's biophilic design elements and attributes were designed before the study scope. The survey was conducted online among five selected Thailand, Indonesia, and Malaysia schools. Sixty-six schoolchildren from *Sekolah Riyadlul Wardiyah* in Lombok and the School of Universe in Bogor were from Indonesia, and another sixty schoolchildren were from *Baan Don Tan* and *Baan Pha Gor Dam*, Chiang Rai, Thailand.

Meanwhile, 77 schoolchildren were from SK Kanchong Darat, Banting, Selangor, Malaysia. All male and female schoolchildren in this survey were between 9 and 12 years old. The school was selected because it had won the GPS Award for the Most Creative Landscape Categories.

Student's Preferences for Biophilic design elements for the learning setting

The survey design was divided into (6) sections. The first section asked about the children's feelings about the school design. The second section asked about the preferable school spaces. The third section asked their opinion about the school environment, particularly on play spaces, social spaces, and outdoor spaces within their school. Next, the fourth section asked about the classroom environment and the elements they wanted to add to the school design improvement. The last section asked about the student's preferences for having biophilic aspects as part of their school design. The children were asked to rate their preferences for those elements based on a four-point Likert scale of (1- very unlikely, 2- unlikely, 3-, and 4- very likely). Based on the earlier literature reviews, 15 biophilic elements were selected to suit the Asian primary school design context (Figure 1.0).

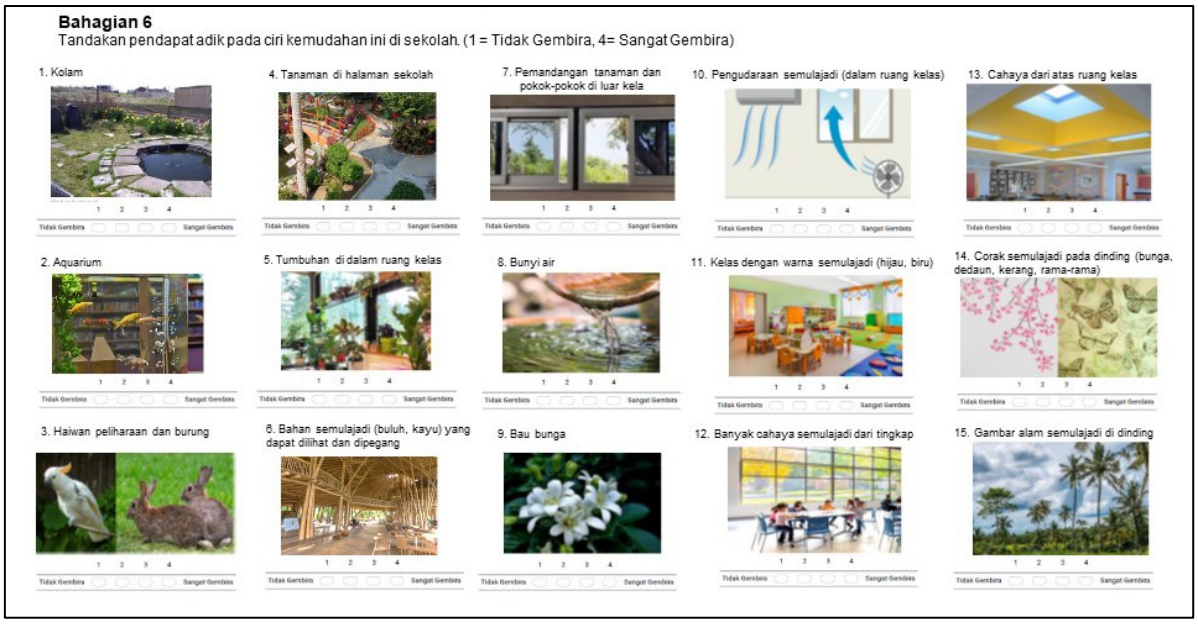

Figure 1: 15 biophilic design elements listed in the survey questionnaire. *Source: (Authors, 2021)*

FINDINGS AND RESULTS

The data were analysed using descriptive analysis in the Statistical Package of Social Science (SPSS) to identify the most preferred elements among children in three Asian countries (Thailand, Indonesia, and Malaysia). Table 1.3 below presents the results for each country.

Table 3: Results for each country on students' preferences for biophilic elements

Biophilic Theme	Feature	Overall rating					
		Thailand	R	Indonesia	R	Malaysia	R
Non-Visual connection	Natural materials (bamboo, wood) to see and touch	3.38	**8**	3.37	**9**	3.29	**12**
	Animals (pets and birds)	3.52	**4**	3.60	**2**	3.71	**1**
	Smell of flowers	3.23	**10**	3.29	**11**	3.52	**5**
	Plants inside the classrooms	3.53	**3**	3.41	**7**	3.33	**11**
Presence of water	Sound of water	3.52	**4**	3.39	**8**	3.48	**6**
Visual Connection	A pond	3.20	**11**	3.59	**3**	3.53	**4**
	An aquarium	3.47	**5**	3.41	**7**	3.57	**3**

Biophilic Theme	Feature	Overall rating					
		Thailand	**R**	**Indonesia**	**R**	**Malaysia**	**R**
	Plants in the school grounds	3.73	**1**	3.69	**1**	3.57	**3**
	View of the outside to see plants and trees	3.58	**2**	3.59	**3**	3.34	**10**
Light and space	Natural airflow (in classrooms)	3.42	**7**	3.56	**4**	3.62	**2**
	Lots of natural light from the windows	3.17	**12**	3.59	**3**	3.43	**8**
	Skylight in classrooms	3.34	**9**	3.44	**6**	3.38	**9**
Natural patterns	Classrooms with natural colours (green, blue)	3.47	**5**	3.54	**5**	3.44	**7**
	Patterns of natural plants or creatures on walls (flowers, leaves, shells, butterflies)	3.47	**5**	3.33	**10**	3.38	**9**
	Images of nature on the walls	3.14	**13**	3.26	**12**	3.38	**9**

*R= Rank

Non-visual connection

In this study, five items were measured under non-visual connection. The first item is natural materials (bamboo, wood). Table 1.3 indicates that school children from Malaysia scored this item with 3.29, 3.37, and Thailand 3.38. From the results, this item is the least preferred biophilia pattern among Malaysian school students compared to the other two countries. Browning, Ryan, and Clancy (2014) state that this biophilic design falls under non-visual connection. Non-visual connection involves other contacts with human senses except visual (Table 1.1). In this finding, the importance of touch involved touching natural materials (bamboo) within the school area. Most Malaysian students consider this biophilic design pattern the least preferred due to less direct experience with nature, particularly planting elements. Other studies on children's connectedness to the heart these days tested in 20 schools in Malaysia stated that children obtain indirect nature experiences through visuals such as movies, videos, and images more than direct experiences of nature (Mustapa, 2018). The direct experience involved connecting with nature through *haptic* (sense of touch).

Malaysian students preferred to have animals (pets and birds) as part of the biophilic elements in their school (3.71), as compared to Indonesia (3.60) and Thailand (3.52). Even though the first and second items involved similar senses

(*haptic*), the results indicate a massive gap in preference between these two items among Malaysian children. Hence, this is likely due to the negative feeling or response toward bamboo (*biophobia).* Unlike biophilia, biophobia refers to ‘‘the fear of living things and aversion, and alienation from nature (Simaika & Samways, 2010). For this paper, *biophobia* can be referred to as children’s affection towards certain types of natural elements (like or dislike). Additionally, the development of biophobic feelings may vary considering gender (Änggård, 2011), residential or school areas (Hinds & Sparks, 2008; Zhang et al., 2014; Mohamad Muslim et al., 2017), and cultural differences (Milfont, 2012).

On the other hand, out of the 15 items tested, Malaysian schoolchildren rated animals (pets and birds) as the most preferred elements that they wanted to have in their school (3.71), as compared to Indonesian (3.60) and Thailand (3.52). This is because children in Malaysia may have a high attachment to domestic animals, particularly birds, cats, rabbits, and chickens. Indeed, this statement is supported by Mustapa et al. (2020). The studies also evidence similar findings that most school children in Penang and Kedah had developed high attachments toward domestic animals. Moreover, having pets significantly impacted children’s attitudes toward animals’ presence (Prokop & Tunnicliffe, 2010) and their connection to nature-related experiences among Malaysian children (Muslim et al., 2019). According to Yamane et al. (2004), pet therapy, where companionship, petting, and feeling the fur of domesticated animals, is evidenced to have profound calming effects and develop environmental stewardship among children.

The third item under this category is the smell of flowers, where Malaysia scored 3.52, while 3.29 is the score given by Indonesian and 3.23 by Thailand. This survey item for this category involved olfactory stimuli (smell). Most Malaysian students tended to floral smells more than students from the other two countries. This is due to several reasons. During the observation conducted earlier, various types of flowers were planted at schools in Malaysia. Hence, the children were exposed to flowering plants within their school compound, and they positively accepted ornamental and scented plants. Meanwhile, in Thailand and Indonesia, the school design was observed to be similar. Studies also support the findings by Tomazic (2011) and Ballouard et al. (2012), which revealed that children’s favourable attitudes or interests in plants and animals are enhanced by observing and interacting with these elements.

On the other hand, plants inside the classrooms were rated at 3.33 among Malaysian schoolchildren, 3.41 among Indonesians, and 3.53 among Thai schoolchildren. The findings from Table 2.1 indicate that even though items 3 and 4 fall under the same categories, Malaysian students prefer olfactory (smell) stimuli more than haptic (touching) senses when planting elements. In the natural environment, different reasons bring different psychological effects to humans. Studies show that plants that produce pleasant smells help to calm or energise

people. Exposure to friendly scented plants positively impacts the healing process and human immune function (Kim et al., 2007; Li et al., 2012). Current studies also show that specific fragrance plants help calm nerves, improve health, and lower the risk of various diseases (Kim Grove, 2012). A survey by Mustapa et al. (2020) also demonstrated that most schoolchildren in Malaysia prefer ornamental and beautiful flowering plants.

Hence, while there are various biophilia approaches, both direct and indirect contact with nature should be introduced to increase environmental awareness and nature sensitivity among children for future benefits. Indeed, Lekies et al. (2015) also suggest that direct contact with nature can be the most effective way to grow environmental stewards and inject an emotional connection to nature conservation attitudes and behaviour. Moreover, it is worth emphasising that indirect nature experience is a fundamental learning approach that promotes biophilic design principles. Kellert and Calabrese (2015) highlighted that the biophilic design encourages an emotional attachment to settings and places. The biophilic principle promotes positive interactions between people and nature, encouraging an expanded sense of relationship and responsibility for human and natural communities.

The fact that Malaysian school students show a low tendency for direct contact and connection with planting elements is also due to inadequate exposure to outdoor gardening or planting elements compared to animals. This statement is supported by other studies conducted on the learning environment in Malaysia, which stated that nature-related subjects are taught through a visual and indirect relationship with nature instead of experiencing nature itself, for instance, through images and video recording (Spalie et al., 2011).

Presence of Water

The sound of water is part of the items measured in this study. The findings from Table 1.3 indicate that Thai students score the highest (3.52) as compared to Malaysian students (3.48) and Indonesian (3.39). The sound of water can be translated into different types of water elements. In biophilic design related to human experience, Biederman and Vessel (2006) and Alvarsson, Wiens, and Nilsson (2010) had evidence that the presence of water helps to improve concentration and memory restoration in terms of cognitive performance. Their studies also found that water elements help to reduce stress, increase calmness and tranquillity, and lower heart rate and blood pressure.

Meanwhile, other studies on moods and emotions found that sounds and the presence of water stimulate positive emotional responses in a biophilic design context (Barton & Pretty, 2010; White et al., 2010; Windhager et al., 2011; Jahncke et al., 2011). Moreover, in biophilic design studies, the presence of water elements also helps to improve concentration and memory restoration through natural and complex changes in visual stimuli. In addition, they enhance

perception and psychological and physiological reactions when several senses are stimulated (Alvarsson et al., 2010; Pheasant et al.,2010). Hence, water elements could be suggested as part of school design's indoor and outdoor elements. Water elements such as ponds or aquariums could enhance the children's connectedness with nature and sensitivity towards the water ecosystem. The presence of water elements could also act as part of the learning tools for specific subjects such as science and art.

Visual connection

In terms of the presence of a pond, Malaysian students scored (3.53), followed by Indonesian (3.59) and Thailand (3.20). Meanwhile, aquarium elements scored (3.57) among Malaysian school children, 3.41 among Indonesian, and 3.47 among Thailand participants. Most Thai (3.73) and Indonesian students (3.69) rated plants on school grounds as the most preferred elements, while Malaysia scored 3.57. Regarding views outside to see plants and trees, Malaysia scored 3.34 compared to Thailand (3.58) and Indonesia (3.59). Based on the results, Malaysian students tended to prefer having ponds and aquariums compared to Thailand and Indonesia. The findings of this study, also supported by other studies conducted by Salleh, Abdul Latip, and Abdul (2018) on outdoor learning in Malaysia, suggested that children prefer to learn via direct experience using their motor skills and senses of smell, hearing, sight, and touch. The studies indicated that water elements and mini kitchen gardens could be introduced as part of the design to expose children to the basic concept of living things within nature and their ecosystem. Direct experience in this finding refers to direct contact with natural elements, namely animals. Hence, it indicates that Malaysian school children are keener towards features that offer interaction with pets and fish than interacting with planting elements. Regarding planting elements, children from Malaysia prefer a visual connection in the school design rather than a non-visual connection.

Based on the supporting data from open-ended questions in this study, most of the students from Malaysia wanted to have the mini farm so that they could spend some time taking care of and getting in touch with their favourite animals, namely, rabbits, turtles, and birds. Meanwhile, some Indonesian schoolchildren also wanted animals in their school environment. According to Kellert, Heerwagen, and Mador (2011), a person who falls under this category is explorative, attracted to nature's beauty, and curious. Interestingly, Otto and Pensini (2017) found that environmental stewardship could be developed in traditional classroom settings; however, direct experience with nature had developed an emotional connection and a higher sensitivity toward the heart. The result indicates a 69% variance. Other studies found that direct nature experience by school children developed positive connections to nature (Cheng & Monroe, 2010; Duerden & Witt, 2010; Zhang et al., 2014). Therefore, it can be suggested

that children in Malaysia need more exposure to direct contact with nature, particularly with planting elements.

Malaysia's learning style and practices lack direct contact with nature, particularly in planting elements. Most of the learning styles in Malaysian primary schools are traditional or indoor learning; any nature-related subject is taught through visual and indirect relationships with nature instead of experiencing nature, for instance, through images and video recordings (Spalie et al., 2011). Referring to Table 1.3, it can be suggested that Malaysia school children show a lack of preferences for direct contact with planting elements, such as planting in the classroom and natural material (to touch and see), as compared to other factors, due to a lack of exposure on outdoor learning environment. The children prefer planting on school grounds rather than the presence of planting aspects in the classroom. Various studies related to the learning environment also provide evidence that direct and indirect experiences have different impacts on children's cognitive, educational performance, physical and social well-being (Selhub & Logan, 2014; Schneller et al., 2017; Mustapa, 2018; Walimbe & Chitgopkar, 2018).

Light and space

Under this category, Malaysian students rated natural airflow (in classrooms) as the second preferred element (3.62). Meanwhile, Thailand students rated natural airflow as the seventh most preferred (3.42) and ranked 4th by Indonesian students (3.56). Lots of natural light from the window was ranked 8th by Malaysian students (3.43), 3rd by Indonesian students (3.59), and 12th by Thai students (3.17). Skylights in classrooms were rated ninth by Malaysian (3.38), 6th by Indonesian (3.44), and 9th by Thai students (3.34). Based on the results from Table 1.3, it can be indicated that most Malaysian school students are more concerned about the outdoor classroom setting than the indoor classroom itself. These findings suggest that children in Malaysia show a high tendency toward the outdoor elements rather than the classroom design setting itself. In terms of natural airflow, the classroom's exposure to natural airflow is one of the essential measures for climate adaptation. Malaysia is a country that experiences heavy rainfall and flooding issues. Hence, moderate transformation to natural airflow and natural lighting can be suggested. On the other hand, extreme penetration or exposure to direct sunlight is not recommended (Moghaddami, 2019).

School designers need to gain the ability to find the balance between distributing unified and diffused lighting throughout the day to prevent too much glare, particularly when learning is taking place. Evidence has shown that humans prefer moderate levels of sensory variability, including light, sound, and temperature variation. An environment devoid of sensory stimulation and variability can lead to boredom and passivity. The study further indicates that changing thermal classroom conditions improved student performance. In

contrast, changes in ventilation velocity evoke positive comfort with no negative impact on cognitive function. According to Attention Restoration Theory, "soft fascination" elements such as light breezes or other natural movements can improve human concentration (Kaplan,1995).

Natural patterns

Three items were tested under natural patterns. Classrooms with natural colours (green, blue) scored 3.44 for Malaysian school children, followed by 3.54 for Indonesia and Thailand with 3.47. Patterns of wild plants or creatures on walls (flowers, leaves, shells, butterflies) scored 3.38 for Malaysians, 3.33 for Indonesian school children, and 3.47 for Thai school children. Meanwhile, the last item tested was images of nature on the walls, with 3.38 by Malaysian, 3.14 by Thailand, and 3.26 by Indonesian school students. Table 1.3 shows that children from Thailand and Indonesia prefer closer connections to natural elements than natural patterns. Surprisingly, Malaysian students prefer a natural direct contact with nature (non-visual relationship), particularly planting elements. However, the Malaysian students had shown a high tendency for direct contact (non-visual connection) with animals and pets, natural lighting, and water elements.

This study believes that the interior classroom influences children's moods in the learning setting. Even though the score given is not as high as their tendency towards other biophilic design elements, it does not indicate that these biophilic elements should be left behind. Studies by Van et al. (2017) on the effects of classrooms with green wall designs on children's performance and perception stated that green walls bring positive moods and perceptions among the students, where their performance on specific subjects tested also improved. The students were happy with the new classroom environment and requested that the green wall design be kept in the future. Instead of having indoor plants, green wall approaches could be suggested as part of the school design to expose children to the natural environment slowly. Recent research by McCullough, Martin, and Sajady (2018) on green wall implementation in the classroom has shown that the presence of green walls has inspired students with real-world thinking related to science, technology, engineering, art, and mathematics fields within the indoor learning environment.

Apart from its benefits on both children's and teachers' moods and psychological and physiological well-being, the results from various studies also confirmed an improvement in both indoor and outdoor temperature reduction as well as natural wind control tools using green wall design approaches (Safikhani et al., 2014; Perini, & Rosasco, 2016; Sudhakar et al., 2019; Tan et al., 2020).

CONCLUSION

Based on the findings discussed above, biophilic design patterns and elements are positively accepted in all three countries in the present study: Malaysia, Thailand, and Indonesia. In particular, the findings from each study vary differently in terms of biophilic preferences due to different cultures, learning settings, and backgrounds. Hence, the results of this study can help designers and educators provide a better learning environment for future generations. Learning is not just merely focusing on lesson planning and academic achievement; concern should also be given to spatial planning. A conducive learning environment, particularly the connection between indoor and outdoor design settings, and thermal comfort are essential aspects that should not be overlooked, considering their benefits on children's cognitive levels, brain functions, self-development, and psychological and physiological development. Hence, biophilic school design is a possible solution, especially in countries that experience continuous environmental disasters.

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