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OJ-TP

http://publisher.uthm.edu.my/ojs/index.php/ojtp
e-ISSN : 2289-7410

Online Journal for TVET Practitioners

Learning with Nature in Malaysia: Methods of Incorporating Nature in Kindergarten Outdoor Physical Environments

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DOI: https://doi.org/10.30880/ojtp.2023.08.03.001
Received 28 February 2023; Accepted 21 September 2023; Available online 23 November 2023

Abstract: Learning with nature is increasingly popular in Malaysia. However, there are challenges when designing kindergarten outdoor physical environments to assist learning with nature in Malaysia. Previous studies have looked into the types of necessary nature interaction and spaces needed for learning with nature. However, there is a gap in understanding the factors influencing the methods to include nature in the kindergarten outdoor areas. This research aims to investigate the methods of incorporating nature in the outdoor physical environment of kindergartens to facilitate learning with nature. This research is a multiple case study using maximum variation sampling. The main findings suggest that each school's design is unique as their curriculum's and philosophy are different, and the way children interact with nature depends on it. Gibson's Theory of Affordances, which is when the environment and surroundings allow for the interaction we intended, can help design kindergarten outdoor areas to cater to the curriculum. Integrating nature and man-made materials in the design can create a conducive environment for learning with nature. External factors namely the size of available outdoor areas, terrain conditions, and others will influence how nature is incorporated in the design.

Keywords: Nature-based learning, nature-based kindergarten, outdoor physical environment, affordances, preschool play area, cognitive development, children

1. Introduction

Urbanisation has limited people's exposure and interaction with nature (Mohamad Muslim et al., 2017; Rahmatullah et al., 2021). Compared to those who grew up in rural areas, a significantly lower number of children who grew up in urban areas had experiences in nature-related activities (Noor Hafizah et al., 2019). In terms of children learning and development, learning through play via exposure to nature and its elements have greater impact on their cognitive development than classroom activities and social learning alone (UNICEF, 2018). Saleh et al. (2018) explains that nature provides both formal and informal learning to children, in which learning without direct participation by their educators is equally important as learning in a formal environment. Hence, a school's environment should allow them to participate in diverse natural surroundings. A school's physical environment should encourage learning as children will be more motivated to be innovative and creative if the environment encourages experimental play (Safaripoor, 2016; Shaari et al., 2021).

When a child's connection to nature is lacking, they will face difficulties with their senses and attention during learning and are more susceptible to chronic physical and mental illnesses (Shaari et al., 2021; Woodward & Zari, 2018). Moreover, exposure to heavy pollutants and environmental stressors, particularly from urban and industrialized areas, can significantly affect mental and physical development (Di Cesare et al., 2019) and predispose humans to various non-communicable diseases in later stages of life such as Diabetes, obesity, and cancer, which are currently

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among the major health burdens worldwide (Zaiki et al., 2022; Zaiki & Wong, 2021). Therefore, as children spend most of their daytime learning in kindergartens, their safe and quality interaction with nature should be maximized.

Cordiano et al. (2019) reports the interest of researchers and educators to increase the time children spend outdoors during school hours instead of being inside and inactive. A method that is gaining traction to allow this is by using nature to learn. The initiative can increase the connection between children and nature. In response, children can gain advantages in their educational development. Advocates of using nature for learning mention that there are various advantages for a child in his academics, social and behavioural development through nature-based learning (Luen et al., 2020; Shaari et al., 2020a).

However, it has been reported that in Malaysia, the formal educational system gives more emphasis on indoor learning more than outdoor learning, which has limited the amount of time children spend to play outside and interact with nature (Shaari et al., 2021; Sia et al., 2023; Zin et al., 2019).

Lee et al. (2021) also noted that most Malaysian preschool operators frequently overlook the value of outdoor play areas for young children. Without appropriate physical environments to incorporate learning activities, Malaysian educators frequently struggle to improve the performance and quality of children's learning (Shaari et al., 2021). In fact, play-based learning not only raises student achievement but also motivates teachers. Moreover, through play-based learning, teachers also have more opportunities to learn more about each child's strengths, knowledge, skills, and needs by watching them play (Amissah-Essel et al., 2020). However, it is challenging to design for an effective outdoor learning space, particularly for urban areas in Malaysia. Therefore, more efforts are needed to incorporate nature in outdoor kindergarten learning areas to encourage better learning among children in Malaysia.

1.1 Problem Statement

As children nowadays become increasingly inactive due to higher use of technology, excessive amounts of screen time, and decreasing nature interaction, recent studies strongly suggest that nature-based kindergartens can play a crucial role to maximize children's cognitive development as well as overall learning, especially in urban areas. In Malaysia, a nature-based kindergarten would still need to incorporate all six learning strands listed in the Malaysia's National Preschool Standard-Based Curriculum (KPSK). But learning with nature emphasises the Personal Competence and the Physical Development and Aesthetics strands. However, designing kindergartens suitable for learning with nature activities remains challenging and poor design of a kindergarten's outdoor physical environment will result in less conducive spaces for learning with nature which can have detrimental effects on children learning and development. Despite its importance, there are currently limited guidelines for kindergarten outdoor physical environment designs and how they can accommodate children learning. Further, various challenges like weather, especially for a tropical country like Malaysia, require climate-specific design considerations. Thus, evaluation of outdoor physical environments of existing nature-based kindergartens in Malaysia is much needed to analyse methods of incorporating nature elements in kindergarten designs that are suitable for hot-humid climates. Such analyses will allow better design considerations for kindergarten outdoor physical environments that accommodate nature-based learning.

1.2 Research Questions

The research questions addressed in this study are:

1. What are the important children-nature interactions for kindergarten nature-based learning?
2. What are the factors that influence the incorporation of nature-based learning into the design of kindergarten outdoor physical environment?
3. How were nature elements incorporated into the design of pre-existing nature-based kindergartens in Malaysia?

1.3 Aim and Objectives

1. To identify the important children-nature interactions for kindergarten nature-based learning.
2. To determine the factors that influence the incorporation of nature-based learning into the design of kindergarten outdoor physical environment.
3. To investigate how nature elements were incorporated into the design of pre-existing nature-based kindergartens in Malaysia.

2. Literature Review

2.1 Nature-Based Learning

In 1952, Ella Flautau established the first forest school in Denmark (Stasiuk, 2014), while in Sweden, outdoor learning has been practiced for over a century (Mikaels, 2019). Since then, many countries have adopted similar learning styles in preschool, all bearing different names. Jordan and Chawla (2019) stated that nature-based learning

can take place in a natural setting or built environments that are incorporated with elements of nature. Some schools may have a wide green space, some with gardens, while others may utilize nearby outdoor areas. Schools either build permanent structures or are equipped with play structures that are portable. Despite the varying design choice, they serve to provide children with opportunities to interact with nature (Jordan & Chawla, 2019).

Many scholars have defined and discussed nature-based learning. Despite the differences in conducting the programs, one similarity between them is the use of nature as the core of their curriculum and the emphasis they put on learning outdoors. Nature-based learning was defined by Izadpanah et al. (2019) as a concept that incorporates knowledge of the natural environment and emotions, dispositions, and skills. A nature school in Indonesia conducts its learning activities outdoors and its classes are related to the direct nature they are in (Fauzi & Novikasari, 2019). According to Larimore (2016), nature-based learning is one of the branches of early childhood environmental education (ECEE). Nature-based ECEE program's core is to have daily interactions with nature using pedagogy as a way of teaching.

For this study, nature-based learning will be defined as a kindergarten using nature-based learning as their curriculum, one of the branches of ECEE. This means, their curriculum and daily learning activities mainly involve children's interactions with nature. In this research, nature-based kindergarten and nature-based learning will be used interchangeably.

2.2 The Physical Environment of Nature-Based Learning

The objective of nature-based kindergarten according to Bailie (2012) is to address the developmental needs of young children as well as their biophilic tendency to focus on the natural world. For a child to be able to have a sense of place and be environmentally ethical with their ecological identity, they need to be in direct contact with nature. To achieve this, a child needs to feel safe and secure before engaging with nature. Nature-based kindergartens can offer children an environment to develop their confidence and overcome their fears. This is further supported by a recent comparative study of schools in Kuala Lumpur, Malaysia by Azlan et al. (2021). This is in line with the KPSK's learning strands' objective. Awareness on safety and security is part of the Physical Development and Aesthetics Strand, while socio-emotional skills like building confidence and challenging ones fear is part of developing a child's Personal Competence.

The fastest growth and development of a child's brain and nervous system occurs between birth and age five, according to research (Othman et al., 2023; Rahmatullah et al., 2021). Thus, apart from a balanced diet, which is crucial for a child's growth and development, accommodative learning environments particularly for the development of their cognitive skills during the preschool years, are equally important (Lee et al., 2021; Sia et al., 2023). In other words, early childhood education is essential to their future success during these formative years because early brain development affects a child's ability and performance in school and in later stages of life. Kindergartens, preschools, and day-care centres are highly advocated as a means of preparing young children for their formal education before they start school (Muhamad Ridza et al., 2021). This is due to the fact that preschool settings aid in building a strong foundation for both social and intellectual skills in young children.

Children learn best through play especially with interactions with nature, and based on UNICEF (2018) recommendations, when kids are playing outdoors in natural elements, they typically behave more maturely and above their age. Thus, it follows that learning through play is one of the most effective ways to teach young children early education so that they are equipped with adequate learning and living knowledge and skills. By providing adequate outdoor learning and play areas that have ample access to nature elements, we can increase the likelihood that children's sense of competence would improve (UNICEF, 2018).

In a study by Saleh et al. (2016), the ideal physical environment necessary must support nature-based learning which includes gardens with plants and animals, spaces for unstructured play, integrated outdoor environment classrooms, rest area, water and sand play area, playground area, and recycling area. These areas offer greater opportunities for children to learn through visual, auditory, tactile, and kinesthetics stimuli compared to a typical indoor classroom. This is important for children learning and cognitive development as learning through practical application helps a child understand better than theoretical learning. For example, learning about recycling through a dedicated area will give a clearer explanation than learning about it through books. These types of activities are pivotal for children to develop their physical, intellectual, social, and emotional wellbeing while being in touch with nature. Furthermore, in a recent prospective cohort study of children's cognitive development in various preschool learning environments in Klang Valley, Malaysia, it was found that outdoor play areas that incorporate nature elements such as plants, children-appropriate green spaces, and diffused natural daylight are associated with better cognitive development and subsequent performance among children living in urban areas (Shaari et al., 2020a; 2021).

Cordiano et al. (2019) suggested designing strategies that were categorised into 3 sections namely educational benefits, communal and physical benefits, and emotional benefits. They noted that as each school has different curriculums, these strategies may be implemented differently in different schools. For example, schools may implement different methods for learning about animals. Schools can include small animals in their compound and kept in a petting area for children to interact with the animal. Alternatively, schools can schedule time for children to explore wild animals like birds and insects around their school compound.

Nature-based learning consists of direct interaction with nature. As per Cvetanovic et al. (2019), methods of implementing direct connections to nature in a kindergartens' physical environment include visual and non-visual connections, air and thermal variability, presence of water, light and sunlight, and plants. In relation, indirect connection is equally important. It can be presented through organic, non-living, and indirect evocations of nature. Portrayal of nature through shapes and patterns can be adopted in arts, furniture, or others (Cvetanovic et al., 2019). Tiles designed to imitate wood, wallpapers with leaves imprint or sculptures of animals that can be found in the current market can be included in a school's design when actual nature is absent and can't be included.

2.3 Limitations of Designing Nature-Based Kindergartens

According to Saleh et al. (2016), concerns of safety can be a limitation when providing or designing facilities in a nature- based kindergarten. Threats to safety include pollution like haze, accidents, and injuries inflicted by design choices, availability of constant teacher supervision, insect bites and stings, as well as secured barriers. In Malaysia, climate conditions can be a significant limitation (Alwetaishi & Gadi, 2018). Fully adopting design considerations of schools in other countries may not be appropriate due to the different climates and weather. The hot and humid climate of Malaysia makes it difficult to include design considerations like an entirely open outdoor play area and maximisation of natural light (Lee et al., 2021; Sia et al., 2023). By simply transposing and adopting Western design concepts for both children indoor and outdoor learning spaces in Malaysia, stakeholders run the risk of inappropriately designing kindergartens that do not adequately serve the learning, developmental, health as well as socio-demographic needs of Malaysian children. In particular, such designs can put children at risk of harm due to hot weather, dangerous animals, and harsh daylight which will render the outdoor spaces unusable (Shaari et al., 2020b; 2021).

Other limitations are maintenance and sustainability (Dennis et al., 2014). The negative impacts that they listed are labour demands, maintenance challenges (water play, etc.), material failure (tree roots' destroying pavements), constant care of natural and man-made structures, plant maintenance (weeding, etc.), and regular replenishing of materials (sand, etc.).

2.4 Gibson's Theory of Affordances

Gibson's Theory of Affordances in architecture is described as a building being more than just an object (Betsky, 2015; Gibson, 2015). It is an environment that could provide us with opportunities, that open and shut, that respond and provide us hints, and that do not differentiate between inside and outside, form and space, structure and enclosure. According to Gibson, depending on a child's ability and experience, the child will analyse the possibilities of their surroundings and interact with it in a sensible manner to them (Gibson, 2015).

Employing the theory in the kindergartens' design for nature-based learning by using the right material, the proper design of shelter, and the appropriate safety measures taken into the design consideration of the outdoor environment will give children a sense of security when exploring nature to learn. Fjørtoft's (2004) study identified that the dynamic landscape of the natural environment of a forest offers a wide range of play opportunities. Where different landscape elements provide a particular form of play for the children. The children give names to places they play at, and it reflects to the affordances the nature provide. For example, "The Cone War" for games of throwing pinecones and "The Cliff" for the steep rock where the children climb, slide, and jump off from. She also found that the surface areas that children were climbing, and sliding were rougher than areas for construction play. These show that children interact with their environment according to its affordances. Incorporating the elaborateness of nature in the school's outdoor space will provide an opportunity for the children to explore and learn through interacting with nature (Kim et al., 2020).

In this study, the natural environment of a forest area proved to be a suitable playground for children. Landscape ecology analysis confirmed a high diversity of topography and vegetation in the area. The complexity of the landscape afforded a variety of play activities. Particular forms of play were linked to special landscape elements.

3. Methodology

This study is a qualitative multiple case study. It can be presented individually, proceeded with cross-case analysis to infer generalisability (Merriam, 2018). It will study a quintain, which is defined by Stake as a collection of cases with common characteristics (Stake, 2015). Three (3) different schools, all located in Klang Valley, Malaysia were chosen as individual cases to be studied as a quintain. The common characteristic of the schools is that they are all practicing nature-based learning. Each case was selected as it has multiple variables between it that will give a deeper understanding of a quality outdoor physical environment.

In this research, several variables are identified. The dependent variable in this research is the method of including nature in the kindergartens' outdoor environment. In relation, the independent variable is the factor affecting design decisions. Due to this research being designed as a multiple case study, each kindergarten faces different factors from other kindergartens. The variation of factors will give a rich answer and input to future designers.

The controlled variable in this research will be the element that contributes to the selection criteria. In this research purposeful sampling is used to pick the kindergartens. Assuming that the chosen kindergartens will give the most

discovery, understanding, and insight to be learned from. Independent kindergartens that market themselves using nature-based learning with an emphasis on outdoor learning are chosen to be studied. Despite all marketing themselves for practicing nature-based learning, they all adopt different curriculums, which are forest school, nature-based Montessori and the Steiner/Waldorf Education. Hence, this research will use maximum variation sampling to acquire as much perception as possible. The rationale for choosing independently-run kindergartens over franchised is due to the lack of such environments available in the market.

The research employs the relational analysis process. The data collection is commenced by deciding on questions, followed by framing the analysis. This is to outline the overall units of analysis. Once outlined, the data was collected through prior study online, which includes analysis photographs, extracting information from websites, and conducting a literature review. It was proceeded with on-site observation, and followed by interviews with teachers, owners or the management of the kindergartens. The kindergartens selected were contacted through email to obtain permissions prior to conducting the study. All the collected data were coded and categorized into its units of analysis to explore their relationship. The relationships are then coded, analysed, and mapped which can be presented to establish the relationships weaknesses or strengths.

Only case studies were conducted due to the limited number of nature-based kindergartens in Malaysia, and since the study was conducted during Covid times, the data was not able to be collected during learning sessions.

4. Findings and Discussion

Content analysis for the quintain is done using 3 case studies. Each case study provides itself with individual findings and later grouped to form merged findings. These findings are then used to write assertions, which is when the individual findings from multiple case studies are grouped together to portray the understanding of the quintain.

In order to maintain confidentiality and provide privacy to the kindergartens, they are labelled “Kindergarten A”, “Kindergarten B”, and “Kindergarten C”. Individual presentations of the case are necessary to provide the reader with the uniqueness of each case.

4.1 Profile of Kindergartens

Before presenting the findings, a brief background introduction is needed to acquaint the readers with the essential context of the kindergartens. It includes the kindergartens’ history, location, an overview of the outdoor physical environment, and other information deemed necessary. It is also important to understand that despite using different teaching curriculum, all the chosen schools have adapted and integrated their teaching curriculum with nature-based learning. This means that each school allocates a minimum of 2 hours daily to interact with nature as part of their learning process. Kindergarten A uses Forest School as their teaching curriculum, a child-centred learning process that encourages play, exploration and risk taking by having a hands-on experience in natural setting. Their outdoor setting is designed to encourage nature exploration. Kindergarten B uses Nature-based Montessori as their teaching curriculum. Montessori approach leans towards reality-based education. Hence the school focuses on giving their children opportunity to choose the daily life skills they want to “work” on like picking produce from the garden or maintaining the gardens as part of their learning. The outdoor area is designed with the food garden as a focus without leaving out the fun process of interacting with other nature elements. Kindergarten C uses the Steiner/Waldorf Education. Similar to Kindergarten B, they focus on practical life skills, however they are taught to make full use of what nature provides. They learn how to build fires for heat and shelters for rain. They included man-made interventions only when needed.

Table 1 - The kindergartens’ profile

Categories	Kindergarten A	Kindergarten B	Kindergarten C
Year established	2019	2019	2019
Location	Taman Bukit Desa, Kuala Lumpur	Bukit Damansara, Kuala Lumpur	Bukit Penchala, Kuala Lumpur
Aim	To connect children with nature, discover the circle of life, understand the ecosystem, and learn to coexist with nature	To provide kids with a firm basis for continuous learning	To teach children to think rationally, have compassion, and have confidence in their ability to overcome challenges in our world and in the future.

Teaching Curriculum/ Pedagogy/ Approach	• Forest School • Permaculture education • Sustainability	• Nature-based Montessori	• Steiner/Waldorf Education
Curriculum Philosophy	Forest schools are frequently referred to as classrooms without walls. They learn through involvement and observing. They will then review and talk about what they have learned. Lessons are frequently themed, and no two days are alike.	The hands-on Montessori method emphasises developmental learning. Children are taught beyond academics and through self-correction. The Montessori approach emphasises real-world life skills.	Although comparable to Montessori, Steiner's approach has more teacher involvement. Typically, their lessons are organised around daily schedules. They promote imagination, so simple toys and surroundings are preferred.
School setting	Residential Area, corner-lot terraced house, triangle shaped flat outdoor area	Residential Area, three-storey detached house, rectangular flat outdoor area	Hilly Forest, groups of regional buildings, hilly and lushes' forest
Outdoor Area	560 sqm, triangle shape, flat terrain	580 sqm, rectangular shape, flat terrain	~ 3.74 acres, organic boundary, hilly terrain

A B

Fig. 1 - Outdoor area of Kindergarten A (a) Concrete waterfall and river with animal enclosure; (b) Sand pit area with hideout house and slide designed to mimic rocks *(Source: Author).*

A B

Fig. 2 - Outdoor area of Kindergarten B (a) Various raised plant beds built by timber or bricks; (b) Pond area made from repurposed PE tanks as tadpoles' and frogs' shelter *(Source: Author).*

A B

Fig. 3 - Outdoor area of Kindergarten C (a) Tiered plant beds to adapt to its hilly terrain; (b) Water catchment area with water supplied from nearby natural spring *(Source: Author)*.

Table 2 - Design and facilities of the outdoor area of the kindergartens

Categories	Literature	Kindergarten A	Kindergarten B	Kindergarten C
Sense of Place	Bailie (2012)	✓	✓	✓
Safety	Bailie (2012) Saleh et al. (2018)	• Enclosed outdoor area • Partially fenced water area	• Enclosed in outdoor area	• Gated Entrance • Naturally protected boundary
Landscape Trees	Cvetanovic et al. (2019) Saleh et al. (2018) Woodward & Zari (2018)	• Decorative and matured trees	• Matured and fruit trees	• Virgin forest trees
Vegetable Garden	Cordiano et al. (2019) Cvetanovic et al. (2019) Saleh et al. (2018) Woodward & Zari (2018)	• Small area of concrete plant beds	• Variety large plant beds from timber and bricks	• Tiered veggie beds
Animal	Cvetanovic et al. (2019) Saleh et al. (2018) Woodward & Zari (2018)	• Animal enclosure • Fish and tortoise in pond	• Free range chicken • Tadpoles and frogs in pond	• Wild animals • Free range chicken

Unstructured Play	Cordiano et al. (2019) Cvetanovic et al. (2019) Saleh et al. (2018)	• Hideout house • Adventure play structure • Wall climbing	• Timber play structure • Wall climbing	• Timber play structure • Tyre swing • Rope swing
Outdoor Classroom	Cordiano et al. (2019) Saleh et al. (2018)	✓	✓	• Undesignated area
Water	Cordiano et al. (2019) Cvetanovic et al. (2019) Saleh et al. (2018) Woodward & Zari (2018)	• Small pond, river and waterfall	• Repurposed PE tanks	• Tiered water catchment pool
Texture	Cvetanovic et al. (2019) Saleh et al. (2018) Woodward & Zari (2018)	• Sand pit • Gravel and timber walkway • Plant bed soil • Concrete rock-imitation slide	• Plant bed soil • Timber walkway	• Forest ground • Sand in water catchment pool • Plant bed soil
Sustainable area	Saleh et al. (2018)	**X**	• Compost bays	**X**
Group activity	Cordiano et al. (2019)	• Under tensile canopy • Sand pit	• Undesignated area	• Gathering circle
Weather Consideration	Shaari et al. (2020b)	• Shaded pergola • Tensile canopy	• Shed	• Through building task

4.2 Research Questions and Assertions

The data collected are explained as assertions. Some of which are direct interpretations of the data. The assertions will be divided based on the answers it provides to the research questions.

Research Question 1: What are the important children-nature interactions for kindergarten nature-based learning?

Assertion 1.1: *Past studies and research have listed numerous necessary children-nature interaction for effective nature-based learning that kindergartens can implement.*

According to existing studies, nature-based learning puts an emphasis for children to physically interact with flora and fauna. It also puts an importance for children to learn through visual, auditory, tactile and kinesthetics. For this purpose, elements like water and sand, smooth and rough surfaces, as well as platforms and heights, needs to be included in their learning area for children to explore. Additionally, they shall not only interact with nature for educational and physical benefits, but it should also include communal and emotional benefits. Group activities with nature should be incorporated when learning with nature. Furthermore, apart from direct connections to nature like water, light, and air, indirect interaction with nature should also be considered. For example, using furniture made from wood or sculptures of animals as decorations.

Research Question 2: What are the factors that influence the incorporation of nature-based learning into the design of kindergarten outdoor physical environment?

Assertion 2.1: *The kindergartens' curriculum and its philosophy have the biggest influence on the type of nature interaction and activities incorporated in their outdoor physical environment.*

Although all school implements and adapted nature-based learning, their different teaching curriculum and philosophy influence the type of nature interaction the children have. Kindergarten A's design encourages nature exploration, a more direct approach on learning about nature. While Kindergarten B and Kindergarten C focus on practical life skills by utilising nature, where learning about nature comes hand in hand with working on life skills. This is especially evident when comparing Kindergarten, A and Kindergarten B outdoor environment. Kindergarten A has a proportionately designed their outdoor environment to include various nature interaction. Kindergarten B has a comparatively large edible garden in comparison to the other nature elements that is included in their design.

However, even when each of the school have different goals, they still try to incorporate as many nature interactions as possible. The difference between how nature is implemented in their outdoor physical environment depends on how nature is implemented in their learning curriculum and which nature interaction in emphasized more.

Assertion 2.2: *The immediate context influences how nature is incorporated in the design of the outdoor physical environment of kindergartens to assist earning with nature.*

As mentioned earlier, Kindergarten A and Kindergarten B both adapted existing houses. They did not have much existing nature. This is why they needed to bring in nature and design it with man-made material to fully maximise the potential of their outdoor physical environment to be used for learning with nature. Kindergarten C was built in a forest with a variety of native flora and faunas. Unlike the other kindergartens, they did not need to bring in a lot of nature, just elements that are absent from the site.

Assertion 2.3: *The size, shape and terrain condition of the kindergarten available outdoor area influences the method or design nature is incorporated to assist learning with nature.*

School A has the smallest available outdoor area, and it has an odd narrow triangle shape. This has influenced a couple of things, which is prominently seen with the water element. If you compare the water interaction facilities in Kindergarten A and Kindergarten C, you can see that Kindergarten A can only provide a small pond and a narrow stream. Kindergarten C on the other hand, has a very big water catchment pool and is tiered. Both still managed to introduce water into their site, but the manner that they have done is due to the size and site of their outdoor area. Another example is the vegetable gardens. Kindergarten A has a small veggie bed, Kindergarten B has multiple large veggie beds and Kindergarten C built its vegetable garden as a tiered terrace. Kindergarten A with its small outdoor area and needing to include variations of nature to fulfil its curriculum needs, can only provide a small veggie bed. Comparing Kindergarten B and Kindergarten C, Kindergarten B has a flat ground allowing them to build large veggie beds, but Kindergarten C has a hilly terrain, hence they built their vegetable garden on a tiered terrace.

Assertion 2.4: *Budget is a factor in design. A bigger budget allows for complete design from the start, but limited budget allows progressive improvement to the learning area.*

Kindergarten A had the budget to design their outdoor learning area to what is deemed complete for nature exploration right from the beginning. Kindergarten B however had limited budget when they started. But they improved and added more facilities over the years.

Research Question 3: How were nature elements incorporated into the design of pre-existing nature-based kindergartens in Malaysia?

Assertions 3.1: *The kindergartens introduce spaces for nature interaction activity and designs them using natural material and man-made material.*

Kindergarten A and B had to adapt an existing building designed for residential use with limited nature available on site. Kindergarten A despite having the smallest outdoor are, managed to incorporate the most natural elements on site by combining both natural material and man-made materials for children to explore. Kindergarten B had a very straightforward approach using easily available materials to design for nature-based learning. They built veggie beds from bricks and planks and used PE tanks for ponds. Kindergarten C had the most abundant available nature. They made full use of the available nature and incorporated man-made materials only when needed.

4.3 Gibson's Theory of Affordances

Affordances of the environment bring opportunities, which allows or prohibit and gives us clues about the activities that can be conducted. As we go through the findings and discuss them, it shows that each kindergarten and its curriculums have their own aims and objectives. So, the design of their outdoor physical environment is catered to make it possible for the kindergartens to conduct learning activities and interaction with nature according to their curriculum needs. Even though they are all nature-based, they have different end goals, which results in the different designs of their outdoor physical environment to support learning with nature.

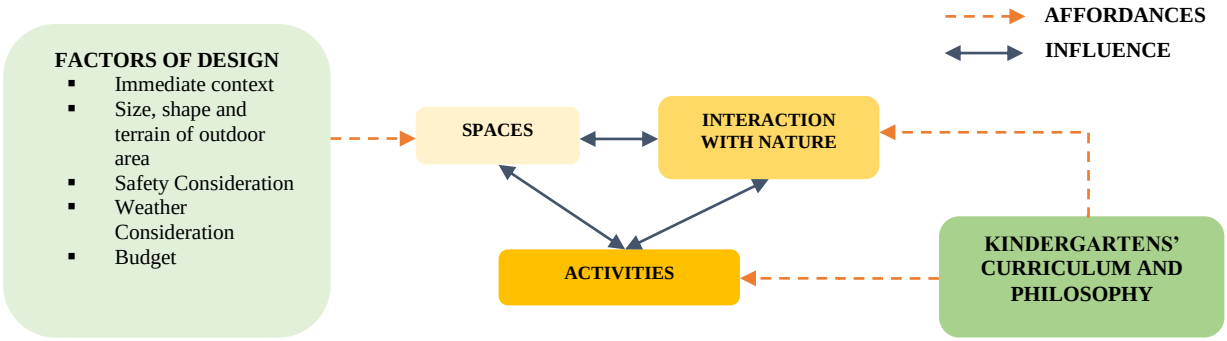

Fig. 4 - Conceptual model of correlation between variables in designing the outdoor physical environment of kindergartens for learning with nature.

The conceptual model (Fig. 4) explains the relationship of the variables involved in the design of the outdoor physical environment of kindergartens to assist learning with nature. Discussions on findings through assertions made based on the categories that emerge against the research questions. They explain how nature-based kindergartens are designing their outdoor physical environment to support their curricular needs to learn with nature. Nature-based kindergartens are a new thing in Malaysia and is gaining interest from parents. Learning from the design of existing nature-based kindergartens can benefit future designers to address the site's potentials and limitations.

5. Conclusion

The aim and objectives were achieved after identifying the necessary nature interaction to assist learning and reviewing the factors that influenced the method of incorporating nature in outdoor areas of existing nature-based kindergartens in Malaysia. The designs tied back to Gibson's Theory of Affordances as the design of the outdoor environments influenced the type of activities conducted in the provided space.

Foreseeing the rising trend of learning with nature, this research intended to provide designers with methods and guidelines to efficiently design for learning with nature. This study suggests that educators or more specifically kindergarten operators need to communicate to the designers on their curriculum and philosophy, as well as other factors concerning learning with nature. When designing, designers then need to incorporate the needs and concerns, as well as exploring alternatives especially when considering space constraints and safety considerations. It is also suggested for policy makers to revise policies for nature kindergartens to better integrate nature elements for a more effective learning. A well designed outdoor physical environment for an effecting learning with nature might need a bigger budget compared to a conventional kindergarten. This study would suggest to policy makers to provide incentives or grants for kindergartens who are taking initiatives.

This study investigated case studies in Kuala Lumpur, Malaysia. It can be extended to other localities to uncover different factors. However, due to limited number of nature-based kindergartens in Malaysia, only a case study was done. Further studies should be done when more similar kindergartens are available for better generalisability.

Acknowledgement

The authors would like to thank Universiti Teknologi MARA (UiTM) for facility support in this research.

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