MALAYSIA ARCHITECTURAL JOURNAL

Malaysia Architectural Journal

Journal homepage:
https://majournal.my/index.php/maj
e-ISSN : 2716-6139

Nature-based Experiences in Urban Preschool Environment: A Systematic Contextual Mapping Study

Farhana Mohammed Isa[1*] and David Grierson[1]

[1] University of Strathclyde, Department of Architecture, James Weir Building, 75 Montrose Street, Glasgow G1 1XJ, United Kingdom

ARTICLE INFO

Article history:
Received: 30 April 2024
Received in revised form
Accepted: 15 October 2024
Available online: 23 June 2025

Keywords:
Nature-based experience; preschool; contextual mapping; architecture-nature; child-nature-architecture

ABSTRACT

Children's connection with and exposure to the natural environment is a vital part of their growth and development process, having been shown to support their learning opportunities and improve their overall health and well-being, particularly during the first five years of life. Increasingly environmental issues such as climate change, the scarcity of green spaces due to urbanisation, post-pandemic health and safety concerns, and the emergence of technology-driven indoor classroom learning present complex challenges that restrict urban preschooler's participation in nature-based learning play and result in a lack of access to nature. Although recent progress has been made within teaching pedagogy around outdoor learning and nature-based play, discussions on the role of architecture in supporting improvement and diverse interactions with nature and in utilising green spaces in preschool environments still need to be included. Derived from a systematic literature review, this paper offers a framework for contextual mapping that can be used to evaluate architecture-nature provision in preschools across two continents. In this study, child-nature-architecture assessment tools are highlighted to demonstrate the potential of architecture to contribute positively to preschool children's experiences of nature, enhance their learning opportunities, and improve their overall health and well-being. The work aims to provide insights into nature-based experiences in preschool environments and to identify the similarities and differences of nature-based experience concepts and approaches within preschool environments across two continents to find useful common ground. The systematic contextual mapping study should enable stakeholders, including architects and educationalists, alongside governing bodies, to better consider the provision of access to nature in preschool architecture through design interventions in existing facilities, to inform proposals for the design of new preschools, and to improve investment decision-making for future education facilities.

* *Corresponding author.*
E-mail address: farhana-binti-mohammed-isa@strath.ac.uk

1. Introduction

Exposing children to nature is a world agenda that aims to create a more sustainable and successful living. Learning through nature and experiences of playing outdoors are often remembered for a lifetime (Howe *et al*., 2020). Integrating learning and nature-based experiences, whether through unstructured or structured play, adds complexity and relevance to the curriculum in challenging ways indoors (Parker *et al*., 2022; Stadler-Altmann, 2021). This approach of bringing nature closer to children can be translated into greater health and well-being concerning the physical and cognitive development of psychological, social, and emotional academic children (Beauchamp *et al*., 2022; Chawla, 2015). Many scholars and evidence have shown that connecting children with nature contributes to their positive development (Abd Rahim *et al*., 2020; Cumming & Nash, 2015; Hadzigeorgiou *et al*., 2011; Herrington, 1998; Kuo *et al*., 2019; Michek *et al*., 2015; Waite, 2020; Waite *et al*., 2022). The connection between closeness to greenspaces and levels of physical activity is the most explored to investigate the benefit of local nature for young ones (Jimenez *et al*., 2021). When Taylor *et al.* (2002) investigated the effects of vegetation around Chicago public housing, they found that the greener the view from apartment windows, the better teen girls performed on tests of concentration, control of impulsivity, and delay of gratification. In other studies by Kuo and Taylor (2004) on parents' assessments of their children's behaviour who have attention deficit disorder, activities that reduced attention deficit disorder symptoms were disproportionately likely to take place in green settings. The greener the environment in terms of tree cover and grass, the less severe the symptoms. Referring to a fantastic book by Louv (2008), when children do not play outside and instead spend much of their leisure time staring at a screen, it may result in a decreased attention span, decreased ability to solve problems, overweight and obesity, and other difficulties with their emotional and physical health, which leads to nature deficit disorder symptoms in children which are rising and concern among the urban dwellers and big cities.

It is how the journey through education of any child in this world must include opportunities for planned and quality nature-based experiences in the architecture of preschools. However, the status of nature in pedagogical practices and outdoor learning varies within different cultures, historical, geographical, and contextual of the country's theory (Atencio *et al.*, 2015; Beery *et al*., 2024; Iwan & Poon, 2018; Mohammad *et al*., 2023). This study intends to widen the notion between two continents, Asia and Europe, cross-cultural and intervention from future empirical findings, and uncover the circumstances of culture creation in nature-based experiences both inside and between diverse contexts. Connecting children with nature in urban preschools creates a better space for the overall built environment (Chawla, 2020; 2015). This study also helps to beautify and craft a greener place, which not only children can benefit from this gesture, but also the community and surrounding urban habitats in the now and future.

2.0 Related Work

1.1 Types of Education Intervention in Outdoor Settings

In the context of European countries, education intervention in nature-based or outdoor settings has been classified into four (4) concepts and approaches depending on the intentions used. Firstly, the **Forest School or Nature School**, *vandrebørnehave,* which was first created in Denmark in 1952, Ella Flautau and her neighbours' children began to have get-togethers every day in a nearby forest, informal activities that try to employ outdoors or nature experience as an active agent for the effects of hundred per cent (100%) via the outdoors (Atler, 2024; Bentsen *et al*., 2009; Häfner, 2002; Mackinder, 2023; Nugent, 2017). In 1993, Germany registered the first forest preschool. Nowadays, Germany operates over 1500 forest kindergartens for 30,000 preschool children, and Sweden registered over 180 forest kindergartens in 2008 (Wilkinson, 2013). Norway nature preschools are defined as preschools that

have nature, forest, outdoor, farms, maritime, local communities' boats, galleries, theatres, or another prefix that was correlated with nature and physical outdoor activity (e.g. Lierskogen nature preschool) were categorised as nature preschool (Lysklett & Berger, 2017) without prefix name. In Australia, the definition of forest school, or the **bush school**, where the school set in the natural bushland research context (Cumming and Nash, 2015). The conception is rapidly spreading, and we can now see forest kindergartens or institutions founded on a very similar concept in the United States, Scotland, England, Canada, Australia, Japan, Switzerland, Austria, Finland, Norway, Latvia, and Russia (Boileau & O'Donoghue, 2024; Frances *et al*., 2024; Kiviranta *et al.*, 2024; Knight, 2013; Michek *et al.*, 2015).

Secondly, the **Outdoor Adventure School**, which is a physical activity or sport meant to be practised outdoors in a natural environment, was inspired by Tenzing Norgay and Sir Edmund Hillary, the first humans to reach Mount Everest in 1953 (Ramsay, 2002; Schnaufer, 2021). Since then, more than 4,000 people have accomplished this feat with little to no experience climbing with the help of qualified guides.

Thirdly, the Scandinavian concept of **Outdoor School or *'Udeskole'*** derived from out-of-school-teaching stems from Norway (Barfod & Mygind, 2022; Jordet, 2008) which activities or learning purposely or not purposely aim to be used in the outdoors or nature environments for a certain duration of time. In a Norwegian context, like a Swedish outdoor school context by Dahlgren and Szczepanski (2015) and a Danish outdoor school context by Mygind (2007) described the outdoor school as an edited environment such as botanical gardens, zoos and cultural historical museums, which prepared for educational activities or unedited environments such as the cities trail, forest, and waterscapes.

Lastly, **Environmental Education** aims to raise awareness about outdoor, environmental, or nature-related issues or themes for the outdoor environment. The mixture of classroom and outdoor education had a good influence on the children's social relationships, teaching experience, and self-perceived physical activity level (Barfod & Mygind, 2022; Beauchamp *et al*., 2022; Mygind *et al*., 2019).

1.2 Nature-based Setting in Preschool

Early Learning and Childcare Center (ELC) out-to-play setting in Scotland is referred to as a baseline to categorise the formal natural setting where play and learning take place (The Scottish Government, 2017). Scotland has been establishing a national outdoor play program since 2008 that encourages children's development and well-being (Howe *et al*., 2020). In Scotland, Early Learning Centers (ELCs) offer diverse outdoor learning opportunities for kids through various outdoor activities. These consist of (i) Fully outdoor, where children spend most of their time in a park or forest with lots of natural features; (ii) Indoor/Outdoor, where children can go back and forth between indoor and outdoor areas of their ELC setting; (iii) Dispersed or Satellite, where the ELC has a nature space (like a park or forest) but it's not on the school's actual property; and (iv) Indoor-traditional, which is frequently connected to a primary school and involves children spending most of their time indoors but gets to explore the outdoors during structured programs or recess (The Scottish Government, 2020).

A study done by To & Grierson (2024) on architectural decisions promotes children's connections to nature through design approaches and preferences of children's multi-sensorial experiences, classroom arrangement, spatial organisation of the schools, and material choice can encourage and support children to explore the natural world on school grounds. The well-designed outdoor areas and connection with indoors can support a variety of space usage and ease the use of teachers and children (Alliance, 2019). In summary, the connection between the educational intervention in an outdoor setting and the preschool nature-based setting is exhibited in Figure 1.

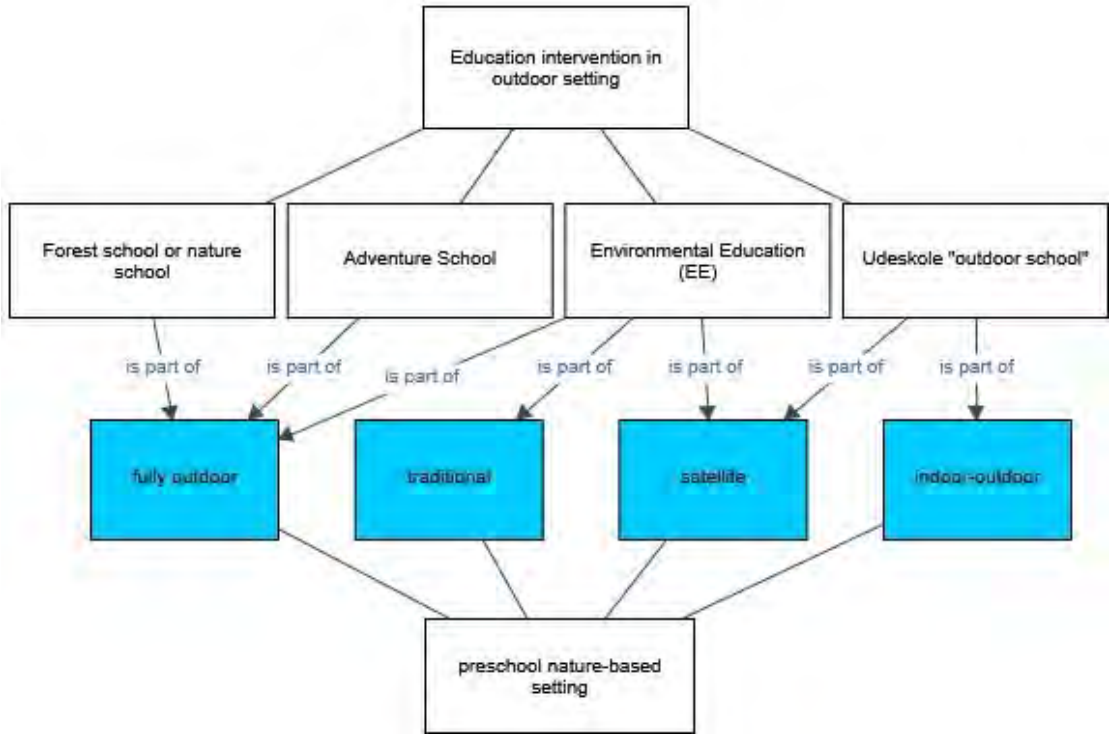


Figure. 1: Mind mapping of the connection between education intervention in outdoor settings and the preschool nature-based setting
(Source: To & Grierson, 2024; Howe et al., 2020; The Scottish Government, 2020; Alliance, 2019; The Scottish Government, 2017)

The study of the relationship between the setting context and the pedagogical relationship of nature-based experiences was done by Beauchamp *et al.* (2022) in primary schools and preschools in Quebec, Canada, mentioned that a variety of pedagogical objectives in outdoor learning was integrated by teachers such as flexible planning and well-established routines with a variety of academic subject, for example, French, Mathematics and teaching tasks such as building a nature shelter in variety of settings either in city parks or in the woodlands. Children enjoyed different kinds of settings and activities with parental support and constrained natural settings and storage to integrate the fully outdoor learning environment on school grounds. The pedagogical relationship between the 'content', which is the built and unbuilt environment, is a didactic relationship between resource and subject learner (Beauchamp *et al*., 2022; Guerriero, 2017).

Nature-based education should be started as early as preschool age to absorb nature according to humans' psychological and physical environment. Previous studies have shown that nature-based learning in children and schools has various types and opportunities depending on the intention and aim (Mann *et al*., 2022; Matterson, 1989; Otto & Pensini, 2017). However, due to limited resources and policies that only focus on cold climate regions, this study intends to discover the connection between the geographical setting context and pedagogical relationship of nature-based experience in two different continents whilst having opposite climatic conditions and social and cultural backgrounds. This study focused on preschool architecture, as the first seven years of a child's life is a period of great opportunity and significant risk (Cohen & Wingerd, 1993; Matterson, 1989). Even so, the age range of children entering preschools differs according to country. Both theoretical and practical concepts of nature education programs are lacking and fragmented. It is pressing to connect the theoretical framework of education and the strategy design of natural preschool settings (Education Scotland, 2009; Kuo *et al*., 2019; OECD, 2021). This study also aims to bridge the gap between education and the built environment to progress the nature-based experience in urban preschools.

2.0 Research Questions and Goal

2.1 Formulation of Research Questions

The formulation of research questions for this study was created on PICo, which is a tool to assist researchers in developing and creating appropriate research questions using three main concepts of Population or Problem, Interest, and Context (Thabane *et al*., 2019). This study incorporated three main aspects in the review, namely Preschool children (Population), Nature-based experiences (Interest), and Asia and Europe (context), which then directed to articulate its main research question, *"What are the nature-based experiences among urban preschool children in Asia and Europe?"*. See Table 1, PICo method.

Table 1
PICo method for formulating the research question

Population OR problem	**Interest**	**Context**
Preschool children, urban	Nature-based experiences, Architecture of preschool	Asia and Europe

In detail, based on teaching pedagogy, architecture-built environment, urban preschools, and the PICo method, we address the following research questions to explore what previous research studies (RQ1), how the research was conducted (RQ2) and the findings (i.e., result and outcomes) of previous research (RQ3 and RQ4) as follows:

- **RQ1: What is the concept of nature-based experiences among preschool children who have been studied in the two continents?** Rationale: This question aims to identify the appropriate research interest relevant to a certain locality. To cope with this question, three sub-questions were formed:
    - RQ1-1: How has the number and frequency of publications evolved over the years?
    - RQ1-2: What are the main aspects that the research focuses on, either education, teaching pedagogy, health, or built environment?
    - RQ1-3: What is the relationship between the setting context and pedagogical relationship of nature-based experience learning provision that has been explored in the Asia continent?
- **RQ2: How can the role of architecture assess and support the improvement of natural interaction in preschool environments? What has been studied or proposed in two continents?** Rationale: This question explores the applicable methods and approaches toward preschool architecture and its users in evaluating nature-based experiences in previous works. This RQ emphasises the outcome of previous studies, such as contributions in terms of new methodology, an overview of the best solution, and best practices approaches towards localisation that can vary depending on urban context and design.
- **RQ3: What are the gaps, limitations, and challenges identified in previous studies?** Rationale: Based on challenges mentioned in previous studies, it can guide the development of better theoretical frameworks, avoid previous issues, and focus on specific issues with less evidence gathered.

Therefore, we conduct a systematic mapping study with the following goal:

Goal: Explicate a summary of previous research on nature-based experiences in preschool environments across two continents.

3.0 Methodology

3.1 The review protocol

This section accounts for the methodological approach applied in the review and working process. From January 2024 to March 2024, a systematic contextual literature search was conducted. Web of Sciences and Scopus were selected as the two main databases as both are the leading databases and possess advanced searching functions and a comprehensive index of more than 5000 publishers. In addition, both databases have quality control on articles and focus on multidisciplinary research, including architecture, planning, and built environment (Gusenbauer & Haddaway, 2020; Martin-Martin et al., 2018; Pranckutė, 2021). Google Scholar is the third database chosen. The advantages of using Google Scholar are that it can conduct an umbrella search for journals/articles from various databases and materials and sources of information that are significant to the research topic (Falagas *et al*., 2008).

3.2 Key term evaluation

For this systematic contextual mapping study, this study applied the key terms as evaluation tools in search engines, and it divided the terms into four categories: basic keywords, words that have the same meaning, related words, and variations as per Table 2.

Table 2
Key term used for evaluation tools in searching engine

Basic keyword	Words have the same meaning	Related words	Variation
• Nature (nature-based)	Natural, Outdoor, Landscape, environment, restorative	playground, informal setting	Forest, woods, wildlife
• Experience	learning, education, study, play, schooling, surroundings	practical, participatory, involvement, adventure, spatial	Assessment, services, design, valuation, understanding
• Urban	City, city centre, town	Metropolis, Metropolitan	Settlement
• Preschool	kindergarten, playgroup, pre-K, playschool, Nursery school, ante-pre-school	early learning centre, day nursery, childcare, Day-care centre	Pre-primary school, crèche
• Architecture	The built environment, Physical environment	Building. Planning, Ecology	Construction, architectonics

3.2 Search String

Using these searching tools, this study employed two processes, which are manual searching of handpicking and advanced searching using search strings as follows:

3.2.1 Process 1: Manual searching (handpicking):

- Health and well-being and access to the outdoors in preschools
- Outdoor classroom provisions for sustainability in preschool
- Biophilic architecture in preschool
- Child-nature connections in the context of preschool environments.
- Outdoor learning environment in preschool
- Nature-based design in early years centre
- Assessment of preschool physical and outdoor environment

3.2.2 Process 2: Advance searching (search string):

TITLE-ABS-KEY (("research gap" OR "knowledge gap" OR "scientific gap") AND (own research keywords))
(("outdoor learning environment*" OR "learning with nature" OR "nature school" OR "forest school*" OR "experience* of/with nature*" OR "learn through nature" OR "outdoor play*" OR "environment* education" OR "biophilic architecture" OR "biophilic design" OR "biophilic parameter")) AND (("preschool*" OR "kindergarten*" OR "early learning*" OR "playschool*" OR "nursery school*" OR "child care*" OR "day nursery" OR "daycare "))

The process of systematic literature reviews must start with general keywords and narrow it to more specific keywords (Boell & Cecez-Kecmanovic, 2015). This study starts with the general search for *'nature-based experience in architecture and the built environment'* and narrows to '*education', 'school design', and 'preschool architecture'* and focuses specifically *'in the context of Asia and Europe'*. These methods are called deductive thematic analysis (Braun & Clarke, 2022), as shown in Figure 2.

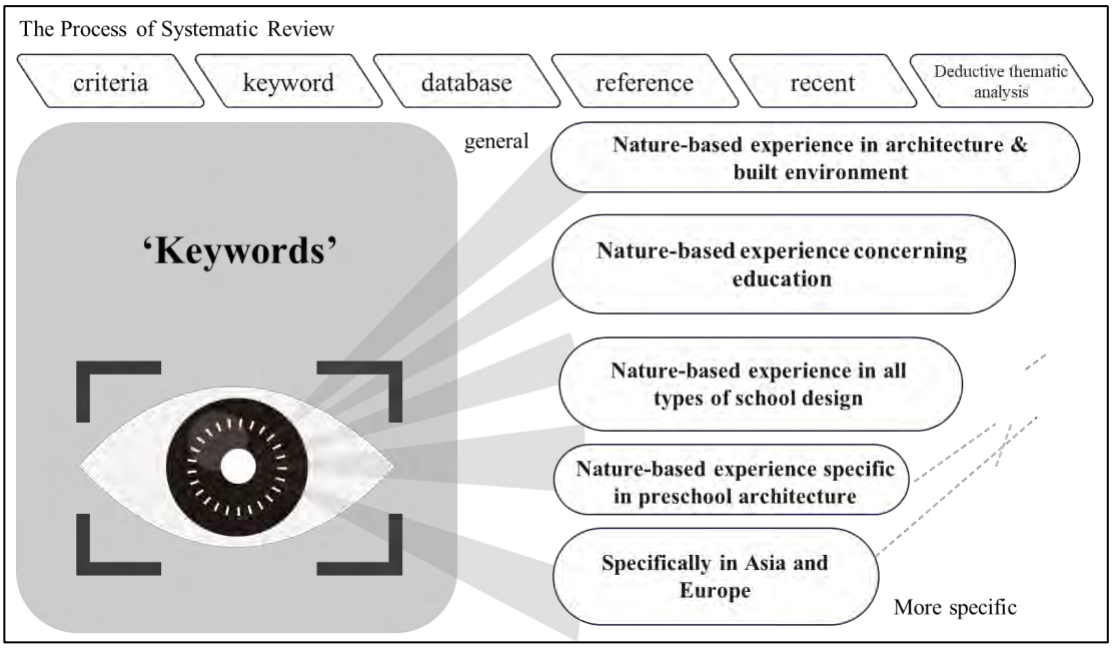


Figure 2. Deductive Thematic Analysis of the nature-based experience in urban preschool

By exploring the appropriate methods to gather children's involvement and contribution and children's perspective, this study explores the children's right to participate in the design decision process that may be relevant to their lives and what is best for children (OECD, 2021). The motivation of this study in terms of the architectural scope of work is to explain further the interaction between architecture and nature in terms of human orientation or design, which is unpredictable, more participatory, and dynamic. The relationships between the principles of biophilic design, the concept of being human-oriented, and well-being, with consideration for education and learning environments, are initial findings for this subject. Hence, this systematic literature review of nature-based experience and outdoor learning in the architecture of preschools across two continents was presented to explore the opportunities and what has been known.

3.2.3 Process 3: Thematic Analysis

As part of qualitative analysis, the thematic analysis method was applied to the selected literature reviews to identify the common themes, ideas, and patterns of interpretation of nature-based experiences in preschools. The systematic contextual mapping study data were analysed using NVIVO.14 (NVivo - Lumivero, 2024) to analyse the codes and research questions and develop the

coding framework. Theme and sub-themes were created, and the frequency of themes in the works of literature were reviewed. All the literature reviews were coded in variables, mind mapping of the codes was generated, and all the codes using NVIVO.14. After analysing the codes and networking, the project network mapping diagrams were generated using a preferred layout. The layout portrays a significant position in ensuring all the information fits in and is illustrated as easy to read and well-structured.

4.0 Data Analysis

4.1 Background of the selected articles

This section is to answer the RQ1-1 and RQ1-2.

- **RQ1: What is the concept of nature-based experiences among preschool children on the two continents?** Rationale: This question aims to identify the appropriate research interest relevant to a certain locality. To cope with this question, three sub-questions were formed:
    - RQ1-1: How has the number and frequency of publications evolved over the years?
    - RQ1-2: What are the main aspects that the research focuses on, either education, teaching pedagogy, health, or built environment?
    - RQ1-3: What is the relationship between the setting context and the pedagogical relationship of nature-based experience?

RQ1-1: How has the number and frequency of publications evolved over the years?

For this study of nature-based experiences in preschool, only 4% of the papers were published in the Architecture, Planning, and Built Environment journals or Web of Conferences, while accumulated of 86% of the papers are from social science, medicine, and education areas, which shows the big gap in architecture and built environment field. The growing number of publications since 2010 depicts more than double the number of articles that have been published, and the researcher limited the selection of articles from 2010 to 2024, as shown in Figure 3. This justification by Castells (2010) for the growing number of publications identifies the narrative of the boom of technological advancement and the deterioration of natural exposure to children.

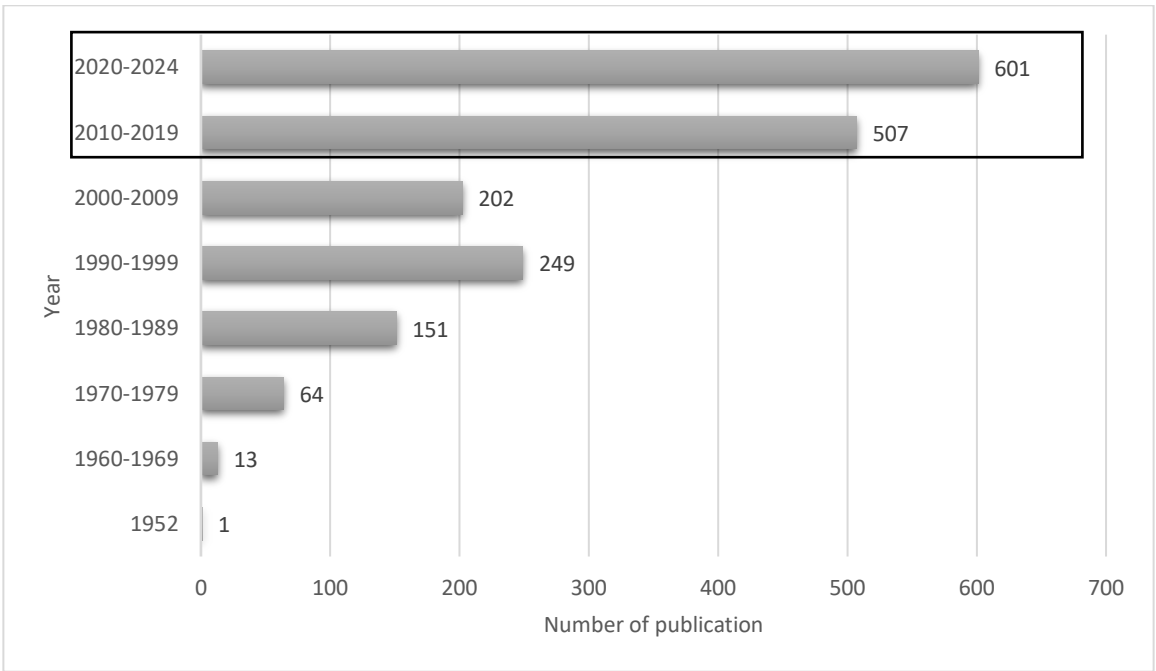


Figure 3. The number and frequency of publications evolved over the years

RQ1-2: What are the main aspects that the research focuses on, either education, teaching pedagogy, health, or built environment?

The research has presented recent results in finding related terms and variations for the main keywords for nature-based experiences, urban, and preschool architecture. It aims to provide more options for selected databases to search for more related articles for the review. The search process utilising three databases has resulted in 1,108 articles. This study screened all 1,108 selected articles using the sorting function in the database website automatically. Next, the inclusion and exclusion criteria were predetermined as it is almost impossible to review all the existing published articles, as in Table 3.

Full-text articles were excluded due to the heavy focus on teaching pedagogy and education rather than architecture, planning, and built environment, focus on outdoor play and playground design rather than indoor-outdoor or outdoor environments, physical interaction or nature-based experiences, focus on interior design and furniture layout rather than overall spatial organisation of preschool design, focus on urban planning rather than local context of preschools, its methodology section is not clearly defined, not clearly stated their target group which only mention school or education facilities in general and not focus on preschools children, published in conference proceedings or a chapter book. Studies written in languages other than English were omitted from the searches. Most of the related articles of nature-based experience are from the USA, Australia and Canada, as the emergence and growth of outdoor learning and nature-based education are from there. Articles from USA, Australia and Canada were omitted from this study because it is not part of the research scope. Further screening from selected areas of articles to omit n=63 of duplicated records and full-text articles were assessed articles from other than Asia and European continents only. Selected articles where compared by country for up to 15 countries in Figure 4.

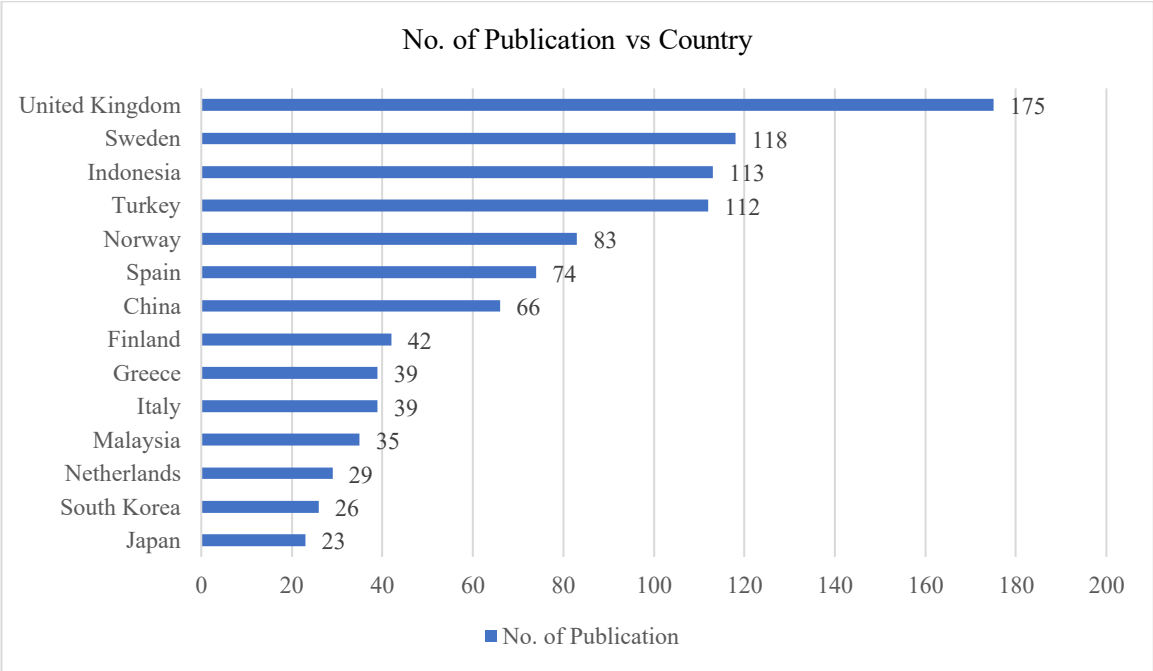


Figure 4. Comparison of articles selected by 15 countries from the highest.
(Source: Scopus database, Web of Science and Google Scholar)

From 1,108 records, only 4% (42 articles) of research contributions are from Architecture, Landscape, Planning, and Built Environment field; the rest are mostly from Social Science at 31% (343 articles), Educational Research and Psychology at 28% (310), Medicine, Nursing and Dentistry at 24% (271), Environmental Science at 9% (98 articles) and Agricultural and Biological Science at

4% (44 articles) as shown in Figure 5. The article selected for this study is from the area of research in Educational Research and Psychology (35%), Architecture, Planning, and Built Environment (30%), followed by Social Science (24%), Environmental Science (7.5%), and Agricultural and Biological Science (2.5%). Out of 53 articles discovered in the Architecture, planning, and built environment, only 12 were selected due to the focus of the eligibility criteria. This review finds out that most of the architectural and built environment studies related to this study were published in Social and Behavioural Science journals, as shown in Figure 6.

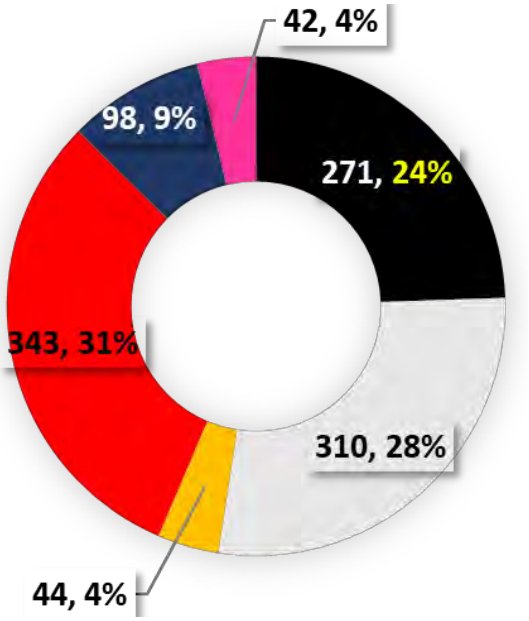


Figure 5. Area of Research in this study

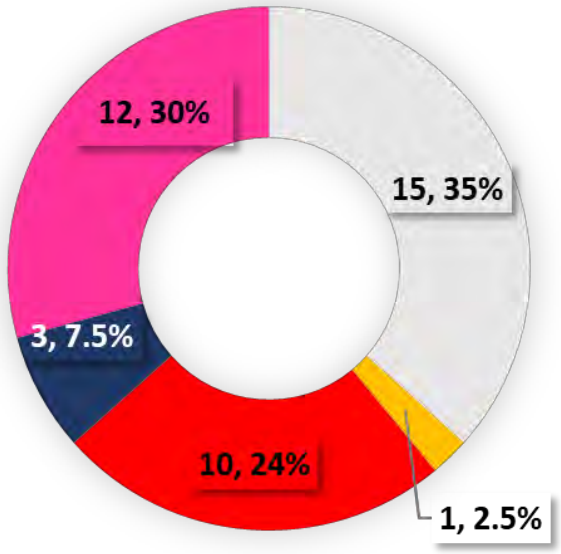


Figure 6. Area of research for selected article

This review took into consideration articles and journals published from the year 2010 until March 2024. After the screening process using inclusion and exclusion criteria, as shown in Table 3, only 42 articles were included for the qualitative synthesis after full-text articles were assessed. Figure 7 represents the systematic review process adopted by Abu Samah *et al.* (2021).

Table 3
The inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Timeline	2010-2024	<2010
Document Type	Article journal	systematic review articles, review articles, meta-analyses articles, meta-synthesis articles, videos, book series, books, chapters in books, conference proceeding
Language	English	Non-English
Continent	Asia and Europe countries	Non-Asia and Non-Europe countries

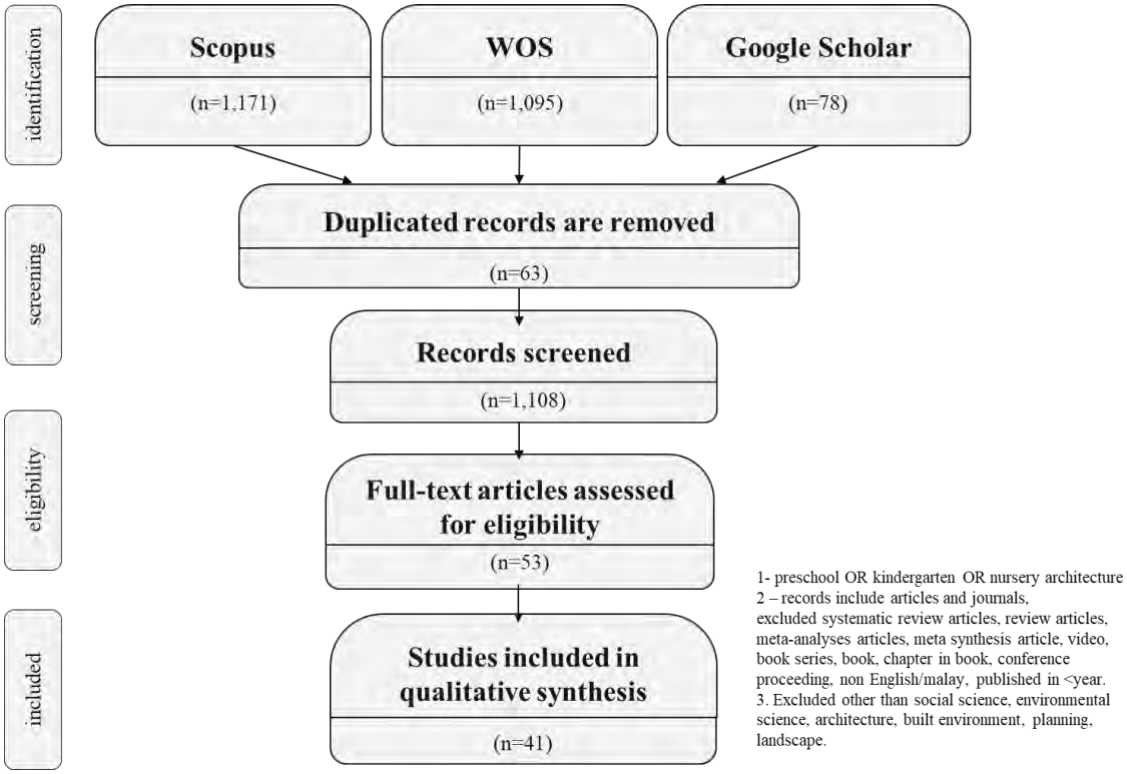
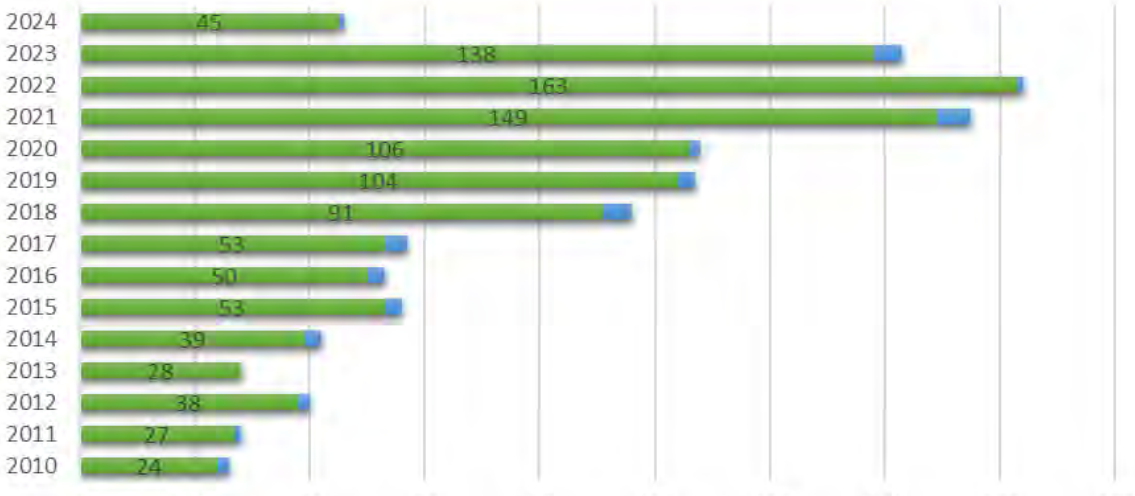


Figure 7. The systematic review processes

Most articles selected according to the years are from 2021 (6 articles), followed by 2023 and 2018 (5 articles), 2017 (4 articles), 2014-2016 (3 articles per year), 2010 and 2012 (2 articles per each year) and 2011, 2022 and 2024 (1 article per each year). The summary of selected articles in comparison with the articles screened is presented in Figure 8. A summary of the overall selected articles according to regions and years for this qualitative synthesis is shown in Figure 9.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Article screened	24	27	38	28	39	53	50	53	91	104	106	149	163	138	45
Selected Article	2	1	2	0	3	3	3	4	5	3	2	6	1	5	1

Figure 8. The number of articles screened compared to articles selected according to the year published

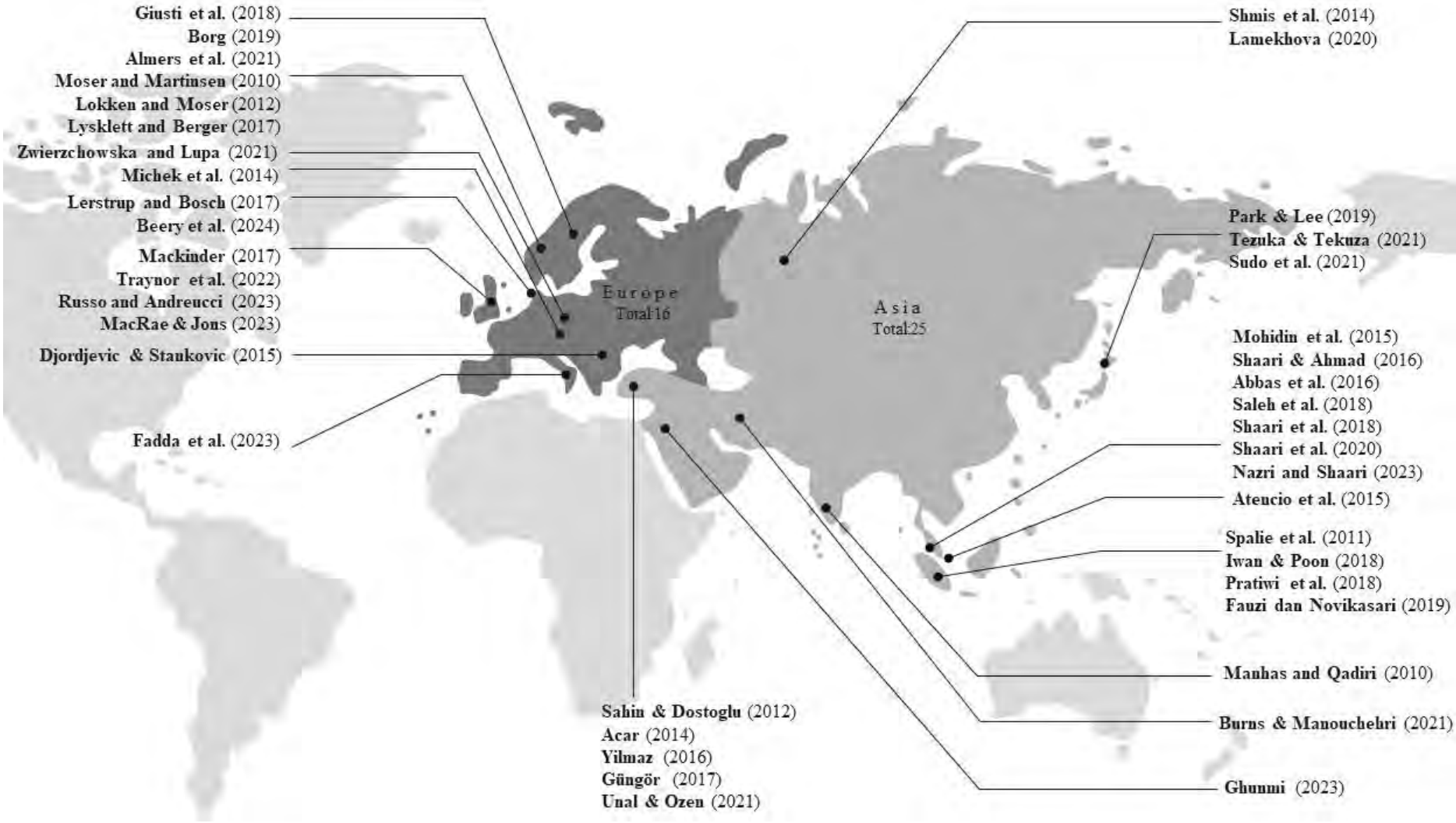


Figure 9. Systematic contextual mapping of the literature selected based on countries

RQ1-3: What is the relationship between the setting context and the pedagogical relationship of nature-based experience learning provision?

Starting from the school grounds and beyond, there are four "zones" of nature-based experience and outdoor learning provision, according to Beames *et al.* (2012) and Higgins & Nicol (2002) (Figure 10). Beyond the school grounds resides the area, which one may investigate on foot or by public transit. Usually requiring some group transportation, day excursions—also known as "field trips"—often take place somewhat further out. Residential outdoor centres, cultural trips and adventures spanning overnight away from home comprise the fourth 'zone' and provide logistical difficulties. This paper investigated the correlation between these four zones of learning provision idea and various setting contexts and areas as the foundation of comparison and similarities.

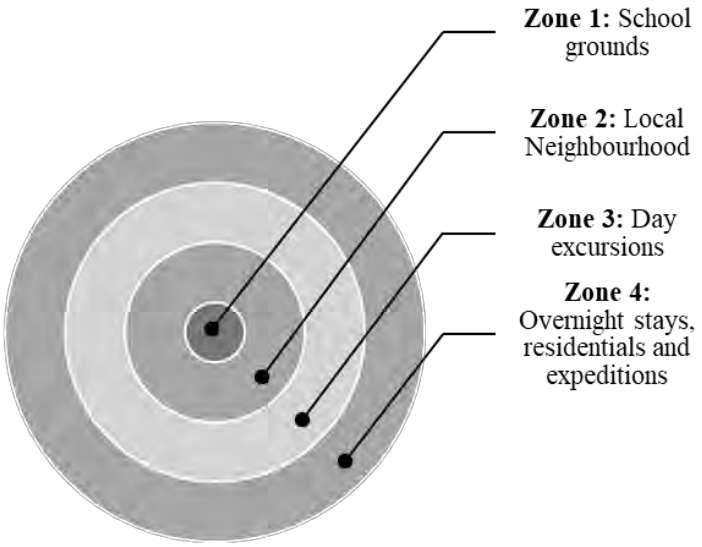


Figure 10. The 'four zones' of nature-based experiences and outdoor learning provision
(Adopted from Beames et al., 2012; Higgins & Nicol, 2002)

In European countries, it has been noted in Beauchamp *et al*. (2022) and Waite (2020) that four concepts and approaches to nature-based experiences in preschool architecture. Recent studies by Waite (2022) in comparison of international views by several authors (Kenyon, 2019; Waite, 2020; White, 2011) on school-based outdoor learning reveal new values and attributes to it, as Canadians values of camping, Denmark prefers visits to cultural places, whereas the Scottish locality emphasises more bike-ability, John Muir Award, leading voice for the UK's wild place and nature kindergarten. This research question focuses on exploring nature-based preschool concepts across Asian countries. A vision for an outdoor environment **in Singapore** schools suggested by Atencio *et al.* (2015) must come to account for unique histories, local-based provision, and sociocultural context within Asia. Prioritisation of residency experiences, overseas trips, and immersion within adventure centres are the approaches in Asian countries. Formerly, outdoor learning investment in non-academic roles included improving students' physical condition, doing adventure activities, and providing military and leadership training outdoors.

In Indonesia, a private nature school, also known as "Sekolah Alam," holds its lessons near the natural environment and conducts its learning activities outside as a case study conducted by Fauzi and Novikasari (2020) and Spalie *et al.* (2011). The children do organic vegetable gardening, care for the natural environment, and organise municipal waste management (Prawiti & Geraldi, 2019). The teaching of education for sustainable development is introduced in daily action conceptually by creating a sense of wonder at the natural world and affective appreciation towards our planet (Beames *et al.,* 2012). The different interpretations of nature between Asia, European, and UK countries, where

school-based outdoor learning is mostly held in rivers, beaches, and mountains in Indonesian (Dwiningrum *et al.*, 2022).

A forest kindergarten concept **in Japan** was established as early as 1950; although it is called "Oyama-no Yochien", which means "kindergarten on the hill", this kindergarten site is in the forest, which connects to the mountain area surrounding the urban area of Kyoto city (Sudo *et al.,* 2021). The basic skills of gardening are adopted in Japanese kindergarten, which often demands direct experience.

In Malaysia, the national preschool curriculum includes outdoor learning or activities under free play sessions or physical activities, which contribute to 12.5% of school hours daily (Ministry of Education, 2012). A field trip which happens 1-2 times a year, for example, going for a zoo trip, animal farm, or science centre, is mostly subjected to teacher or school preferences and not specified in the curriculum. The forest school concept has been an experimental method for indigenous or Orang Asli in Malaysia due to the rate of dropout among children in school and the formal education system in Malaysia found unable to apply the knowledge due to different settings of the environment (Sawalludin *et al.,* 2020).

In the Philippines, incorporating a community-based science curriculum, which includes rice farming, a community garden, fishing, visiting streams and rivers, and animal farming, could be a model for responsive education for Indigenous people and multicultural countries. The Philippines embedded an understanding of the physical and natural environment in their preschool curriculum (Aquino *et al.,* 2017). Here, students gain knowledge about the community and surroundings of their school. Engaging with the land firsthand brings its tale to life. By comprehending the socio-cultural, geophysical, and ecological phenomena of the landscape—how our culture, the land we live on, and the other living things with whom we share the land have all been uniquely shaped—this method of learning through local landscape and community expanded the creativity and speaking (Beames *et al.,* 2012).

In South Korea, the new national curriculum called Nuri for preschools which covers both daycare and kindergarten centres range 3 to 6 years old emphasizes the importance of outdoor play (Jung & Han, 2018). According to recent outdoor play done by Byun *et al*. (2013); Lee (2019) and Nah *et al.* (2017) stated that most institutions for young children implement outdoor activities three times a week for an average of 30 minutes. shows that outdoor play or activities are implemented approximately thrice a week, for about 30 minutes on average. The most frequently documented activities in preschoolers using a structured equipment or engaging with physical play, followed by exploring and observing the natural surroundings. Furthermore, most Asian countries implemented outdoor learning and physical activities only in moderate weather conditions, not too hot or rainy which are considered as 'good' weather conditions.

The **Turkish** Ministry of National Education created and introduced a new national early childhood education curriculum in 2013. The curriculum stressed the need for instructors to implement activities both within and outside the classroom. The presence of a playground, a garden, and their organisation, is critical for providing instruction in a healthy and appropriate setting in early childhood education facilities (Yilmaz, 2016)**.**

The Nature Schools movement in **Iran** began in 2014 and grew gradually for half a decade, reaching nearly 100 schools. Nature Schools, modelled after comparable educational projects in Europe and North America, provided outdoor educational opportunities for preschool and primary school students in both metropolitan and regional Iran (Burns & Manouchehri, 2021). In summary, Table 4 shows the relationship between outdoor learning concepts and four zones of learning provision in Asian preschool countries from the systematic mapping review. Only three zones were highlighted in recent studies, excluding the fourth zone of overnight stays, residentials and expeditions for preschools' outdoor learning provision.

Table 4
Relationship between outdoor learning concepts and pedagogy in Asian countries in the preschool curriculum.

	Japan	South Korea	Philippines	Malaysia	Singapore	Indonesia	India	Iran	Turkiye
ZONE 1: SCHOOL GROUNDS									
Early Years Outdoor Activities or free Play session		✓		✓			✓		✓
Movements, Physical Exercise				✓	✓				
Embedded On-Site Curricular Outdoor Learning			✓		✓				✓
School Gardening	✓	✓		✓		✓			
Natural Environment Play	✓								
Environment Education			✓			✓			
ZONE 1: SCHOOL GROUNDS - ZONE 2: LOCAL NEIGHBOURHOOD									
Forest School, Nature School	✓							✓	
ZONE 2: LOCAL NEIGHBOURHOOD									
Community-based			✓						
ZONE 3: DAY EXCURSIONS									
Field Studies				✓	✓				

Source: Aquino et al. (2017); Atencio et al. (2015); Beauchamp et al. (2022); Burns & Manouchehri (2021); Byun et al. (2013); Fauzi & Novikasari (2020); Kenyon & Pearce (2019); Lee (2019); Ministry of Education (2021); Nah et al. (2017); Pawilen (2023); Sawalludin et al. (2020); Spalie et al. (2011); Sudo et al., 2021;Waite (2022);White (2011); Yilmaz (2017).

RQ2: How can the role of architecture assess and support the improvement of natural interaction in preschool environments that have been proposed on two continents?

The next research question for this study is to gather how the nature-based experiences and outdoor learning environment in preschools correlated with its architecture and design. Six sub-themes have been identified under the main theme of design management as follows: i) the physical environment, ii) place-based or socio-cultural influence, iv) ecological design approach, v) communication, vi) spatial organisation and vii) green technology or energy efficiency of the preschool building.

4.2.1 Physical environment

According to Sahin and Dostoglu (2012), successful design of the physical environment of children's education facilities requires knowledge of children's needs and ideas. The 'participation in

design' and opportunities to participate should be provided by the designer to understand user experiences. Shmis et al. (2014), on the other hand, emphasize the importance of building open learning settings with versatile and accessible technology, as well as merging research findings from pedagogy, child psychology, and architecture.

4.2.1.1 Size of nature and traditional preschool and distance to nature

According to Lysklett and Berger (2017), nature preschool size is significantly smaller than other preschools. The reference area of nature is defined by distance as the nearest reference area is 0.225km, and the farthest reference area to nature is 3.64km. The traditional preschool classroom size in Scotland is between 2.3 – 3.7 m² per person depending on the age of the child (The Scottish Government, 2017), whereas in Malaysia, the size of a classroom per person is between 2.5-3.5 m² depending on the typology of a building (PLANMalaysia, 2017). The exposure to nature in nature preschool is 32.7%-43% of time spent daily compared to other daily schools at 4.9-9.8% time spent daily or every second day (Zwierzchowska & Lupa, 2021). In Scotland, urbanised settings can be places of value for outdoor learning where local urban environments are appreciated, with different values of outdoor nature-based models (To and Grierson, 2019; Thorburn & Allison, 2010; Traynor *et al.*, 2022; Beames & Atencio, 2008). A study by To and Grierson (2024) defined nature child-nature-distance in multi-sensorial natural environments in classrooms, playgrounds, and school sites. Summary of the distance of preschools to nature as in Figure 11.

Source	Distance (km) to the nearest nature	Definition of nature
Lysklett & Berger (2017);	0.225 – 3.24km	Places that are outside of the school boundaries
Zwierzchowska & Lupa (2021)	a) 0.806 - 1.134km	Park
	b) 0.663-1.04km	Forest

Figure 11. Distance (km) from preschool to the nearest nature

The overview of the methodological framework for providing nature to children, concentrating on the case study of a preschool in Poland, considers that possibilities for preschoolers to come into touch with nature result from; 1) the availability of the preschool's own outdoor spaces that can be used by children (Podawca, 2018), 2) the availability of neighboring green spaces that can be visited by children (Rice & Torquati, 2013); and 3) the frequency and duration of outdoor activities in green spaces resulting from preschools' practices (Lysklett & Berger, 2017).

4.2.1.2 Size of Outdoor School Area

The study of recommendations for outdoor areas for Nordic-Baltic countries in comparison with the United Kingdom has been done by Rutkauskaite *et al.* (2021). A renowned school's large and varied outdoor facilities encourage pupils to participate in regulated and self-organised physical activities (Mikalsen & Lagestad, 2022). None of the Nordic countries has a national guideline for school outdoor areas, but past research has shown that a larger area per child increases activity. However, Thorén *et al.* (2019) found that outdoor spaces under 20 m² per child negatively impact students' health. Finland suggests a minimum schoolyard size of 500 m² (excluding sports fields) and 5 m² per child (Boverket, 2015; Rakennustieto, 2019). To estimate playground size in Lithuania, multiply the expected number of learners by 4 m2 and add 1200 m². Schoolyards are for sports grounds and facilities (Mikalsen & Lagestad, 2022; Thorén et al., 2019). To accommodate 400-450 students in Iceland, schools need to have 25,000-28,000 m² of area, including buildings and parking. The minimum schoolyard size is 2000 m², with 4-5 m² per student for outdoor space (Rutkauskaite et al., 2021; Hilmarsson et al., 2007). Schools with less than 99 students in Norway need a minimum of 3000 m². According to Mikalsen et

al. (2022) and Thorén et al. (2019), schools with 100-499 students should give 30 m2 per child, while those with above 500 students should supply 15 m² per child. Moser and Martinsen (2010) noted that each child had an average of 47.1 m² of outdoor space. These ideas are not always followed by towns and playground space restrictions, which often depend on geography. Table 5 summarises outdoor school area sizes in Nordic–European nations and Figure 12 compares them.

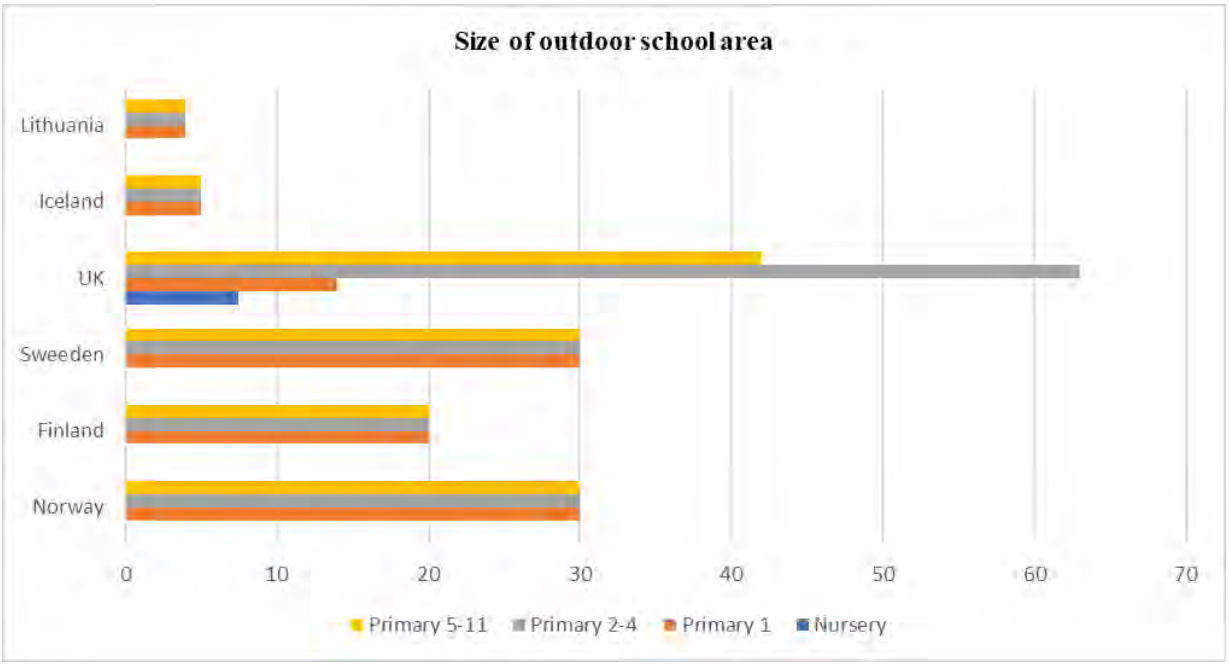


Figure 12. Comparison of the size of outdoor school areas in different countries
Source: Mikalsen et al., 2022; Thorén et al., 2019; Moser & Martinsen, 2010;Rutkauskaite et al, 2021

Table 5
Descriptions of the size of outdoor school areas in different countries

Country	Size	Source
Norway	30m² per pupil in primary school Each child has an average of 47.1m² of outdoor area.	Mikalsen *et al*., 2022; Thorén *et al*., 2019; Moser and Martinsen, 2010.
Finland	10–20 m² per pupil	Thorén *et al*., 2019
Sweeden	30 m² per pupil	Thorén *et al*., 2019
UK	7.5 m² per pupil for nursery 14 m² per pupil for Reception & Primary 1 63 m² per pupil for primary 2-4 42 m² per pupil for primary 5-11	Department of Education, UK, 2014
Iceland	4-5 m² per pupil	Rutkauskaite *et al*, 2021; Hilmarsson *et al*. 2007
Lithuania	4m² per pupil + 1200 m²	Mikalsen & Lagestad, 2022; Thorén *et al*., 2019

4.2.2 Place-Based or Socio-Cultural Influence

Finding the connection between architecture and teaching pedagogy in contemporary kindergarten design is valuable, but it is also beneficial to address the specific kindergarten concerning its location, climate, and culture (Shmis *et al.,* 2014). According to Mohidin *et al.* (2015), in the Malaysian context, single dwelling-based kindergarten design is more effective in providing better outdoor education for preschool children because it provides spacious outdoor and indoor play areas. Educators have good control of indoor and outdoor, and safety and security are well-established in the neighborhood vicinity

as passive surveillance in urban areas. Recourse to the locally based urban environment may be appreciated in Singapore's context in terms of nearby and readily accessible spaces with which the students are familiar, such as their local communities and neighbourhoods, parks and gardens.The potential of school-based approaches represents the opportunity for growth and development of outdoor learning (Atencio *et al.,* 2015). A study done by Iwan & Poon (2018) mentioned that cultural differences in countries affect the preschool design. In Indonesia, a Balinese Hindu preschool in the jungle used a sustainable and holistic approach and a unique bamboo structure. In Hong Kong, an authoritarian, academically focused preschool in traditional Chinese culture with Confucian influences used the typical high-rise cityscape design. Furthermore, in Berkeley, USA, a child-centred approach in an academically focused community used the green building design with low-rise cityscapes.

4.2.3 Ecological Design Approach

Almers *et al*. (2021) emphasise that access to the natural environment should be diversified from the inside of the schoolyard with ecosystem features. The review of the built environment for preschool education within the context of the ecological and environmental approach would be incomplete if the kindergarten building mass were disregarded and the focus was restricted to the territory and surroundings. A kindergarten is seen as a safe oasis where a child serves as a co-creator of the environment, and nature is a perfect "partner" for co-creation (Lamekhova, 2020).

4.2.4 Communication

The next sub-theme discovers that a biophilic design was either intentionally or unintentionally implemented to ensure that people are pleasantly affected mentally and physically by imitating communication with nature in a constructed environment (Unal & Ozen, 2021). Various approaches to communicating with young children have been proposed, and numerous studies have emphasised the importance of early participation in building awareness of the physical world (Sahin & Dostoglu, 2014). However, space may be characterised as a basic communication channel that shapes a child's conduct and perspective of their environment and society, according to Ghunmi (2023). Examples of this include places with pets and/or interactive climbing walls, as well as the advantages of allowing children to engage with nature for cognitive development (To & Grierson, 2019; Vella-Brodrick & Gilowska, 2022; Ghunmi, 2023).

4.2.5 Spatial Organization

Based on biophilic design, the baseline data for the spatial design and planning in preschool, according to Park and Lee (2019), must have an engaging and recognisable spatial design with natural elements; they must also have a view of the surrounding natural ecosystem to boost children's concentration and provide a pleasant environment; a hiding places that take into account the children's developmental stage and learning ability. Open spaces for children to observe and monitor activities taking place in the preschool's different spaces, spaces without dead ends, obstruction, and walls, where children can have a full view of each other, see outside, and value the common senses of spaces (Tezuka & Tezuka, 2021). Lokken and Moser (2012) reflect that architectural spatial organisation includes materiality, which refers to the element of nature and physical qualities of artefacts. In a study by Abbas *et al.* (2016), where natural settings and classroom physical space are well-defined, appropriate children's behaviour is exhibited.

4.2.6 Green Technology or Energy Efficiency

Furthermore, this study finds that a few studies of preschool building designs concerning the incorporation of energy-efficient technologies include using minimal artificial energy sources, solar

thermal energy sources, building and structural designs that are similar to natural objects (organic shapes, bionics), using natural building materials (stone, clay, wood, etc.) and viewing a building as a living, breathing entity that grows, to bring the narrative of architecture as a habitat. This adaptation of architecture as a living metabolism minimises the negative environmental impact and reduces energy and resource consumption (Lamekhova, 2020). Summary of the first main theme, design management tools, described in Table 6.

Table 6.
Theme 1: Design Management Tools with 6 sub-themes

			Theme 1: Design Management Tools					
	Author	**Year**	PE	PB / SC	EC	CM	SO	GT / EE
R1.	Moser & Martinsen	2010	✓				✓	
R2.	Manhas & Qadiri	2010	✓				✓	
R3.	Spalie *et al.*	2011	✓	✓				
R4.	Lokken & Moser	2012	✓				✓	
R5.	Sahin & Dostoglu	2012	✓			✓	✓	
R6.	Shmis *et al.*	2014	✓	✓		✓	✓	
R7.	Michek *et al.*	2014					✓	
R8.	Acar	2014	✓			✓		
R9.	Mohidin *et al.*	2015	✓	✓			✓	
R10.	Atencio *et al.*	2015		✓				
R11.	Djordjevic & Stankovic	2015		✓				
R12.	Shaari & Ahmad	2016	✓					
R13.	Abbas *et al.*	2016	✓	✓		✓	✓	
R14.	Yilmaz	2016						
R15.	Güngör	2017	✓				✓	
R16.	Lerstrup & Bosch	2017	✓		✓			
R17.	Lysklett & Berger	2017	✓					
R18.	Mackinder	2017				✓	✓	
R19.	Giusti *et al.*	2018	✓					
R20.	Saleh *et al.*	2018	✓				✓	
R21.	Shaari *et al.*	2018	✓					
R22.	Iwan & Poon	2018	✓	✓		✓		✓
R23.	Pratiwi *et al.*	2018						✓
R24.	Park & Lee	2019	✓				✓	
R25.	Fauzi & Novikasari	2019	✓	✓				
R26.	Borg	2019	✓	✓		✓		
R27.	Shaari *et al.*	2020	✓		✓			
R28.	Lamekhova	2020	✓		✓		✓	✓
R29.	Unal & Ozen	2021		✓		✓		
R30.	Almers *et al.*	2021			✓	✓	✓	
R31.	Tezuka & Tezuka	2021	✓				✓	
R32.	Sudo *et al.*	2021	✓	✓	✓			
R33.	Zwierzchowska & Lupa	2021	✓	✓			✓	
R34.	Burns & Manouchehri	2021	✓	✓	✓			
R35.	Traynor *et al.*	2022	✓			✓		
R36.	Fadda *et al.*	2023						
R37.	Ghunmi	2023	✓	✓	✓	✓	✓	
R38.	Russo & Andreucci	2023	✓					
R39.	Nazri & Shaari	2023	✓	✓			✓	
R40.	MacRae & Jons	2023						
R41.	Beery *et al.*	2024		✓				

Legends
PE – Physical Environment PB- Place-based SC- Socio-Cultural influence EC- ecological design approach
CM- Communication SO- Spatial organisation GT- Green Technology EE- Energy Efficient technology

4.3 Assessment or Rating Tools

Under this theme, this study obtained seven sub-themes.

4.3.1 Quality of Physical Environment

The assessment tools developed to measure the overall quality of the physical environment of preschools are: i) CPERS5 - Children's Physical Environment Rating Scale and ii) BONDS-Behaviour Outlook Norwegian Developmental Study. The Children Physical Environment Rating Scale 5 (CPERS5) is an established post-occupancy appraisal tool to evaluate preschool design quality against the Piagetian approach (Shaari *et al*., 2020; Acar, 2013; Moser and Martinsen, 2010; Moore, 2012). Next, BONDS is an ongoing longitudinal study that addresses the social development of children from the age of six months onwards. BONDS are intended to incorporate comprehensive and frequent multi-methods, multi-informant measures of the main focal variables (children's behavioural problems and social competence), an extensive measure of related developmental processes and interpersonal interaction with parents and children, along with appropriate measures of various kinds of direct or indirect effects using standardized psychometric scales (Moser and Martinsen, 2010).

4.3.2 Biophilic Design and Parameters

Biophilic design and parameters is the second sub-theme, a solution towards better building design within natural environment, and how it benefits humans. Biophilic design is based on the concept of biophilia, which suggests that humans have a natural tendency to connect with and benefit from natural systems and processes (Wilson, 1984). The evolving human-nature interaction, which is considered one of the biophilic aspects, explores the presence of nature within individuals and the significance it holds for them. In other words, the evolutionary human-nature relationship emphasizes the most fundamental aspects of the internal human relationship with nature (Kellert, 1997). Studies done by Park and Lee (2019), Unal and Ozen (2021), Fadda *et al*., (2023), Nazri and Shaari (2023), and Beery *et al*. (2024) utilize the concept of Biophilic design parameters to evaluate the connectedness to nature and determined the characteristic of biophilic design in a preschool design setting. Recent studies by Browning and Ryan (2020) proposed the 3 design categories and 15 design patterns to evaluate building with nature experiences. The evolution of Biophilic design parameters application in schools is described in Figure 13 below.

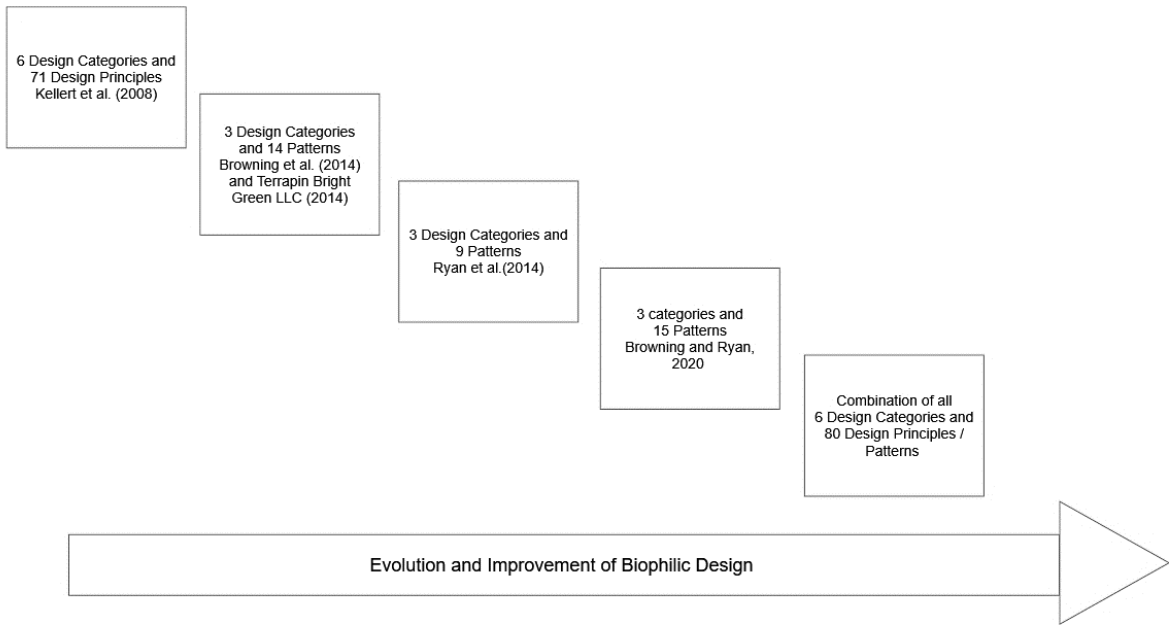


Figure 13. Evolution and improvement of Biophilic design parameters in school application

4.3.3 Child-nature Connection Theory

Child-nature connection emerged as the third sub-theme. Sequential exploratory research was developed by Giusti *et al*, (2018) using a combination of Human-nature connection (HNC) and Significate nature situations (SNS) called Children's Human Nature Situations (ACHUNAS) to assess the child-nature-connectedness of the environment. The SNS is affected by six qualities, namely restorative experiences, nature-free play, nature school (structured play), environmental epiphanies, entertainment, and animal engagement. The lists of abilities of HNC consist of 'being with nature', 'being for nature', and 'being in nature'. ACHUNAS quantifies and qualifies the child-nature connection toward different human connection activities, for example, children playing in a park versus children doing gardening activities.

A study framework developed by Zwierzchowska & Lupa (2021) reflecting the availability of green spaces associated with the local context, urban preschool setting, green infrastructure linked with the building's primary functions, associated outdoor spaces, frequencies of outdoor activities held in preschool green spaces, neighboring site, and its duration. In contrast with HNC and SNS, this study framework could not capture the quality of green space and the way children interact with nature.

Nazri & Shaari (2023) correlated the child-nature interaction influenced by the factors of design in preschools by summarizing it into five factors which are immediate context, size, shape, and terrain of the outdoor area, safety considerations, weather considerations, and budget. However, the design of the outdoor environment is related to each preschool's aims and objectives, which allows flexibility in design. It can be concluded that child-nature connection theory is a combination of psychological influences, site and geographical influences, and design influences. Figure 14 shows the mind mapping diagram summarizing the child-nature connection theory towards the preschool's environment.

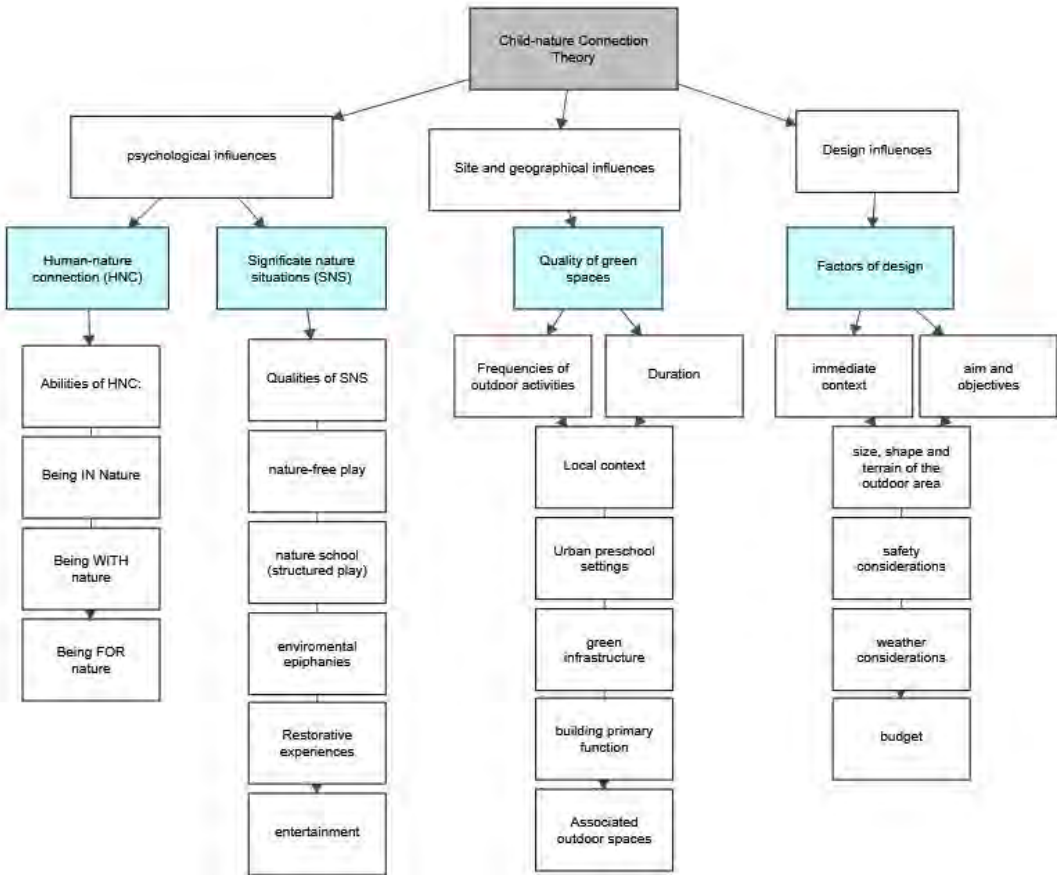


Figure 14. Mind mapping diagram summarizing the child-nature connection theory
Source : Giusti et al, (2018); Nazri & Shaari (2023); Zwierzchowska & Lupa (2021)

4.3.4 Research and Evidence-based

In a study done by Shaari & Ahmad (2016) concerning a holistic quality improvement of the physical learning environment in preschool, the implementations made by industrialised countries are mostly informed by extensive research in children's developmental theories, such as Piaget and Werner, which have been accumulated over the years. The insights gained from past studies are essential and vital for enhancing the quality of preschool education. Designers with limited comprehension of user behaviour may inadvertently repeat common design errors (Morrow, 2007). Although Western countries have achieved developed country status, ongoing research regarding children demonstrates their consistent efforts and activities to highlight the significance of children. Given the continued importance of studies on children, it is crucial for Asian countries, as a developing nation, to recognise and prioritize this matter. On the other hand, research findings by Almers *et al.* (2021) found that children's involvement in design improved the ecosystem of the schoolyards. Overall, the majority of research examining the correlation between nature-based play facilities and children's health outcomes primarily focuses on older children (aged 7 years and above). There is a scarcity of evidence available for children in the early years (0 to 7 years) attending preschool or kindergarten settings. To conduct effective evaluations in this field, it is important to initially assess the practicality of possible research designs (Traynor *et al.,* 2022).

4.3.5 Participation Design

The children develop their cognitive skills by exploring their natural, physical, and social environments. Exposure to various events in the immediate environment and participation in different activities boost the children’s cognitive development as they encounter new spatial features and elements and learn different new skills (Ghunmi, 2023; Sugiyama et al., 2021). Participation design in outdoor learning for preschools focuses on creating educational environments that actively engage children in learning and involve them in the design process to meet the needs and interests of the young learners (Bilton, 2020; Chawla, 2015; White, 2014;).

4.3.6 Leuven Scales

The Leuven Scale or Leuven Child Involvement Scale for children (Laevers 1997, 2000, Laever and Heylen 2003) was used to assess how "involved children are." Laevers (1997) created the Leuven Scales during the 1970s. According to Ebbeck *et al*. (2012), it is a globally utilized five-scale that measures active involvement towards low activity and uses observation as a primary approach. It has developed further and is applied in various contexts to evaluate the calibre of interactions in learning environments. Involvement has been recognized by Laevers (1997, 2000; Laevers and Haylen 2003) as a sign of high-quality human connection and education in any setting. Using observation, mapping, and the Leuven Scale, Mackinder (2017) conducted a study of footprints in the woods by 'tracking' a nursery child through a Forest School session in East Midlands, UK. Another study explored by MacRae and Jones (2023) concerning involvement in children's experiences within early years pedagogy, using emotional affordance children rating of Leuven scale.

4.3.7 Theory of Affordances

The final sub-theme focused on the theory of affordance. Affordances here refer to the meaningful action possibilities of the environment. A study done by Lerstrup and Bosch (2017) adopted the concept of affordance by a combination of Gibson' Theory of Affordances (1979) and Heft Taxonomy (1988) when observing preschool children during free play in their usual outdoor setting and modified features in outdoor settings. According to Attention Restoration Theory (ART) (Kaplan,

1995), in environmental perception, attention deficit can be restored by experiencing the natural environment (Crossan & Salmoni, 2021; Unal and Ozen, 2021). The concept of affordances highlights the ongoing user–environment–activity relationship significant for planning with children in mind, but clarification is needed when using the term, as the term is ambiguous according to the setting (Lerstrup and Bosch, 2017). Summary of the second main theme, assessment and rating tools described in Table 7.

Table 7.
Theme 2: Assessment / Rating Tools with 7 sub-themes

	Author	Year	Theme 2: Assessment / Rating Tools						
			QPE	BP	CNC	REB	PD	LS	ART
R1.	Moser & Martinsen	2010	✓						
R2.	Manhas & Qadiri	2010	✓						
R3.	Spalie *et al.*	2011							
R4.	Lokken & Moser	2012							
R5.	Sahin & Dostoglu	2012	✓				✓		
R6.	Shmis *et al.*	2014							
R7.	Michek *et al.*	2014	✓				✓		
R8.	Acar	2014	✓		✓				✓
R9.	Mohidin *et al.*	2015							
R10.	Atencio *et al.*	2015							
R11.	Djordjevic & Stankovic	2015							
R12.	Shaari & Ahmad	2016	✓			✓			
R13.	Abbas *et al.*	2016	✓				✓		
R14.	Yilmaz	2016							
R15.	Güngör	2017	✓						
R16.	Lerstrup & Bosch	2017	✓						✓
R17.	Lysklett & Berger	2017	✓						
R18.	Mackinder	2017			✓		✓	✓	
R19.	Giusti *et al.*	2018	✓		✓				✓
R20.	Saleh *et al.*	2018							✓
R21.	Shaari *et al.*	2018	✓						
R22.	Iwan & Poon	2018	✓						
R23.	Pratiwi *et al.*	2018							
R24.	Park & Lee	2019		✓	✓				
R25.	Fauzi & Novikasari	2019							
R26.	Borg	2019			✓		✓		
R27.	Shaari *et al.*	2020	✓				✓		
R28.	Lamekhova	2020							✓
R29.	Unal & Ozen	2021		✓	✓		✓		
R30.	Almers *et al.*	2021			✓	✓	✓		✓
R31.	Tezuka & Tezuka	2021							
R32.	Sudo *et al.*	2021	✓		✓		✓		✓
R33.	Zwierzchowska & Lupa	2021	✓	✓	✓		✓		✓
R34.	Burns & Manouchehri	2021	✓		✓				
R35.	Traynor *et al.*	2022				✓	✓		✓
R36.	Fadda *et al.*	2023		✓	✓		✓		✓
R37.	Ghunmi	2023	✓				✓		✓
R38.	Russo & Andreucci	2023	✓	✓	✓				
R39.	Nazri & Shaari	2023			✓				✓
R40.	MacRae & Jons	2023						✓	
R41.	Beery *et al.*	2024		✓	✓				

Legends
QPE- Quality of Physical Environment BP - Biophilic Design and Parameters CNC - Child-nature Connection Theory LS – Leuven Scales ART- Theory of Affordances REB – Research and Evidence-based PD – Participation design

4.4 Word Frequency Analysis

The analysis through Word Cloud Visualization in NVIVO.14 aims to find research problems with the highest repetition in exploration and research. The depictions of the 100 most frequent word occurrences in the selected 41 articles portray the spread-weighted percentage for the words (Figure 15). The words' children', 'nature', 'environment', 'design', 'urban', and 'education' are among mostly frequently utilized and highest count in the articles as shown in Figure 16 based on automatic coding.

Figure 15. Word Cloud Visualization using NVIVO.14

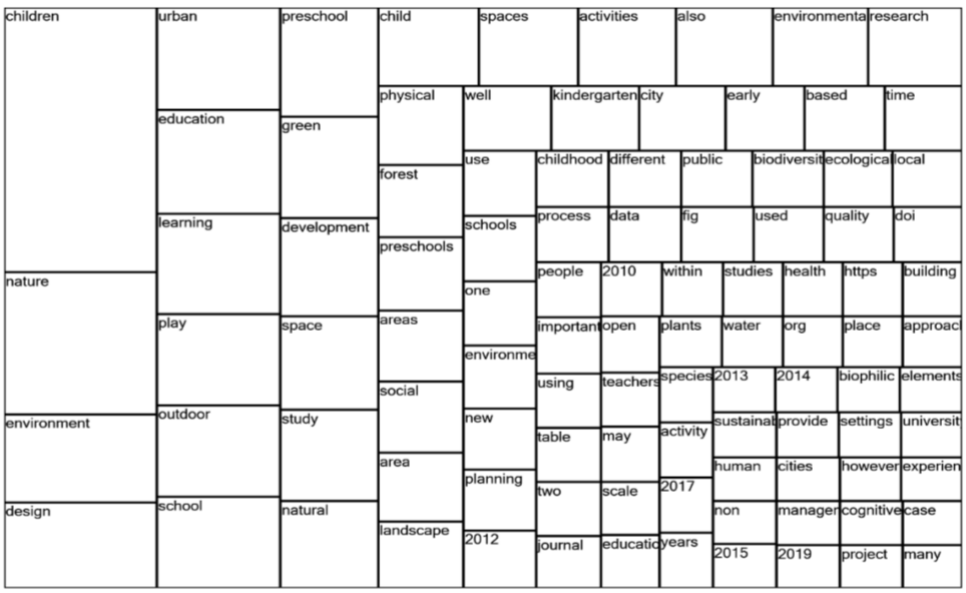


Figure 16. Treemap of research problems concerns and focus on nature-based experiences in urban preschools using NVIVO.14

Based on the result, the top ten most frequently referenced words quantity a total percentage of 6.14% which consisted of the words' children' with a percentage of 1.54%, followed by 'nature' at 0.83%, 'environment' at 0.51%, 'design' at 0.50%, and 'urban' and education both at 0.49%. In addition, the automatic coding results also show several interesting coding such as 'spaces, 'green', 'outdoor',

'natural', 'preschool', and 'environmental' as the first theme 'Nature-based design', followed by the word frequency of 'study', 'education', 'learning', 'development', and 'activities' as the second theme of experiences which are synonyms in the overall meaning. The combination of the two themes justified the search keywords of finding literature as 'Nature-based experiences in preschools'.

5.0 Research Findings

This section presented further research opportunities for the developed themes. The quality of the physical, social, and outdoor environment of the preschools affects child development, and improving the conditions through communicating and engaging with children, is one of the highlighted solutions. The design of the outdoor environment relates to each preschool's's aims and objectives which allows flexibility in design. Even though the theoretical concept of outdoor learning can be adopted from the European continent, a local context, neighboring community, and cultural richness influence the identity and behavior of children in outdoor learning. A review of the adaptability of the cross-cultural needs to be properly considered. In certain urban areas, the establishment of a natural outdoor environment can be a difficult task. However, offering areas of different surfaces and keeping the surface as natural as possible helps. This along with imagination, innovation, and making good use of natural resources and loose parts can transform an urban space and does not need to cost a lot (The Scottish Government, 2017). Although the area should be as natural as possible, the consideration of how children can stay outdoor when the weather changes, outdoor lighting will help the children feel safe during dark or raining, retractable canopy will provide shade during hot and sunny and allow them to enjoy different experiences of outdoor and being outside.

Designing nature-based preschool requires a good spatial organization, between indoor, semi-outdoor, and outdoor classrooms to incorporate learning in all weather conditions. The integration of facilities and amenities with the spatial organization needed for outdoor learning to suit the teaching pedagogy of the educator and school operator. The spatial design must consider various sensory experiences related to nature to increase children's experiences and provide a pleasant environment (Park & Lee, 2019). The development of an outdoor learning environment suggests that, not only promotes the health and well-being of the children but will further improve the ecosystem and biodiversity of the school and nearby area. The improvement of the preschool architecture will further expand children's learning opportunities toward sustainability and environmental education. Modern conveniences have deprived children of sensation (Tezuka & Tezuka, 2021). The rising trend of learning with nature suggested consideration of nature in space constraints, risk, and safety, which need an alternative solution (Nazri & Saari, 2023).

Therefore, to enhance the quality of the nature-based experience of urban preschools, we suggest the following: (1) comprehensive planning and design guidance of incorporating outdoor learning need to be produced as a baseline of what a city expects as the element of quality nature-based experiences that suit the urban local context, (2) Multidisciplinary collaboration between naturalists, ecologists, architects, and landscape architects will explore the idea of successful preschool design in support of the early learning curriculum focusing on sustainability and responsibility towards nature, and (3) Intervention or rating tools to assess the efficiency of the design, the ensure a design nature-based approach for effective learning with nature which suits the existing preschool design without cost or with minimal cost implication.

In summary, this paper systematically reviews the nature-based experience concept in preschools across the two continents. The thematic analyses developed two main themes and 13 sub-themes as in Figure 17.

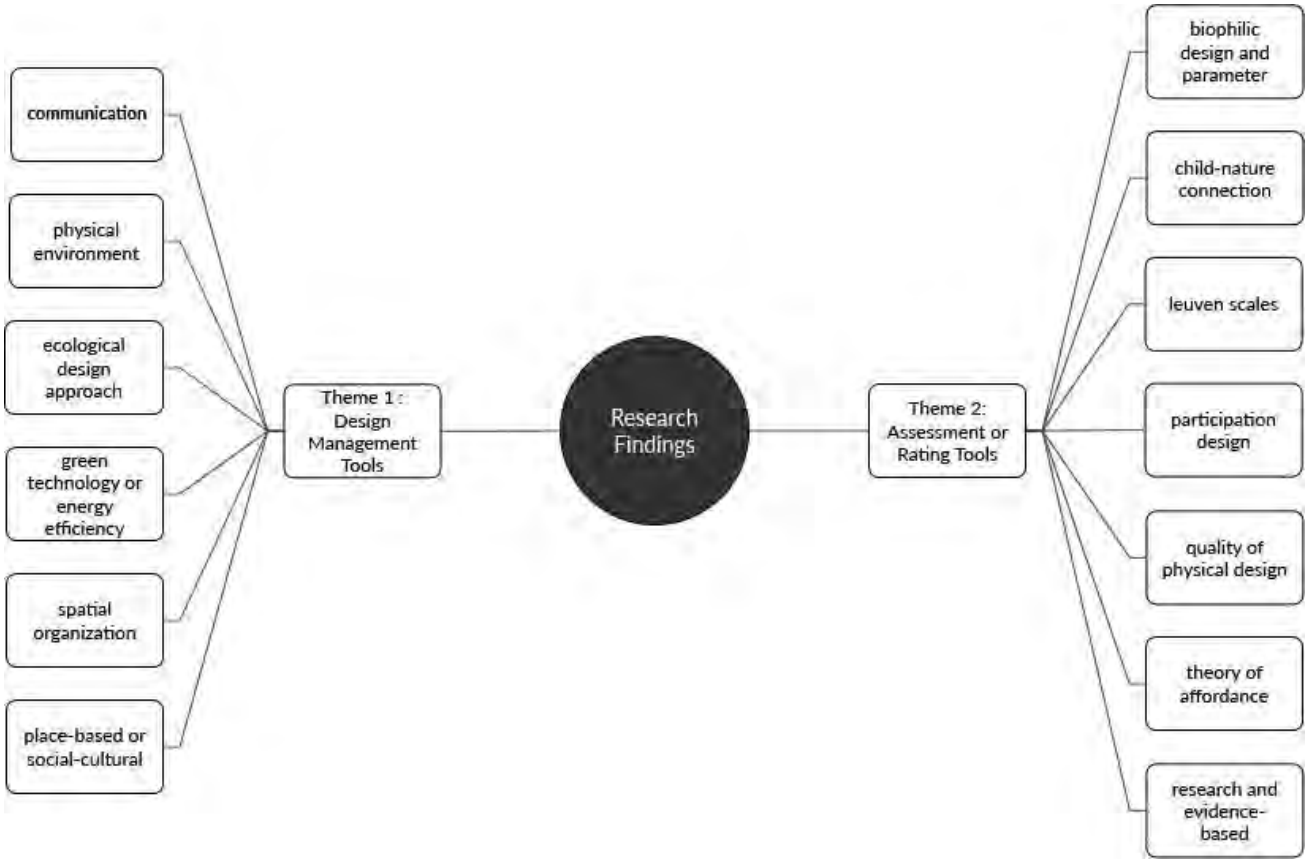


Figure 17. Research Findings: Themes and Sub-Themes coded using NVIVO 14

6.0 Conclusion and Future Works

The main purpose of this study is to provide insights into nature-based experiences in preschool environments and to identify the similarities and differences between nature-based experience concepts and approaches within preschool environments across two continents to find useful common ground. The results show that there have been several publications which explore the outdoor learning setting, the impact of the design changes in the physical environment and context, and understanding of the complexity of assessment tools and rating that provide many interrelated factors in urban preschool systems in the last 14 years from 2010 to 2024 with 41 studies. The urban preschool environment and architectural design were influenced by pedagogical, socio-cultural, religious and ethos, curricular, site geographical region and local context, municipalities' regulation matters, and socio-economic and motivational factors. Undoubtedly, this is not a straightforward matter involving architectural determinism (Mohammed et al., 2023; Iwan and Poon, 2018; Higgins *et al*., 2005). The need for a preschool establishment that is 'research' and 'evidence-based' and can lead to 'holistic' improvements and implementation of the preschool's physical aspects is highlighted. Key issues of the physical environment must be addressed and tailored to support children's development needs. In addition, this review answers the following question **RQ3: What are the gaps, limitations, and challenges identified in previous studies?**

An analysis of word frequency from thematic analysis finds that the popular research concerns related to nature-based experiences and learning in urban preschools. This study also discovered the first theme by using the method of coding related to preschool design management tools. The children's involvement in establishing the physical environment and experiences has vast opportunities in organizing the preschools' environment, spatial organization and selection of materials, detail solutions, organization of indoor classroom, optimization of outdoor usage area, hints for safety and

security, comfort and general psychology of children. It contributes to a significant effect on the children's behaviors and implications for future preschool design and curriculum. Preschoolers have the capacity and capability to make valuable contributions to the design and creation of diversity in urban planning and environment (Abbas *et al*., 2016; Ergler *et al*., 2015; Iwan & Poon, 2018; Park & Lee, 2019; Saari & Ahmad, 2015; Sahin & Dostoglu, 2012).

The second theme explored is the assessment and rating tools for preschools. The assessment of the quality of the preschool physical environment focuses on the design aspect of nature-based preschool but does not take into consideration the maintenance and sustainability of the design (Nazri & Shaari, 2023), and bias may still be unavoidable in the evaluation process if only one evaluator during the study. The outcomes of the outdoor environment's quality assessment can be exploited for thoughtful, knowledge-based reflections; nevertheless, researchers must consider the benefits and pedagogical strategies of outdoor learning. Therefore, to assess how the primary objectives and subject established the education framework plan with varied places and environments, future practice-oriented research should be carried out on a comparative basis. More qualitative, in-depth investigations, as well as quantitative recordings of what kids are doing in outdoor environments, are needed to evaluate the richness and availability of spaces and materials (Moser and Martinsen, 2010). The Biophilic design and parameter methods need to be developed in visual image-scale and text-based scale with cultural awareness (Kellert et. al, 2011). Biophilic design has several elements that can be incorporated into spaces, however, assessing all elements is quite challenging, and out of focus. The question of how children are affected by biophilic design remains unanswered in the auditory domain, most research focused on visual attention (Fadda et al., 2023; Dias, 2024).

Next, the results from the coding analysis of the selected literature highlighted the underlying issue of three key dimensional factors which are architecture, nature, and curriculum. These factors focused on closing the gap between architecture-nature-child by introducing interventions, restorative environments, and experiences for preschoolers (Mohammed *et al*., 2023; Brussoni *et al*., 2017). Through design interventions in existing facilities, this systematic contextual mapping study has helped stakeholders—including educationalists and architects—as well as governing bodies make better investment decisions for future education facilities by improving the provision of access to nature in preschool architecture. It has also informed the way to improve investment decision-making for future education facilities. The need for an adequate professional development framework to provide architectural design guidelines for outdoor learning pedagogy by teachers and educators to substantially embed outdoor learning through a curriculum in Southeast Asian urban context which suits the city's landscape and context (Atencio *et al*. 2015; Iwan & Poon, 2018). Involvement of the community and parents is also needed when setting up a quality of learning with nature, who are going to decide what is the best for their children. Thus, parents' view of learning through nature-based experiences can be studied for future research (Saleh *et al*., 2018).

The solution to combat the hot-humid climate in Southeast Asian countries is recommended for future works. For example, the study and exploration of retractable shades, local source material, efficient natural and mechanical ventilation systems, plantation of shading trees, and selection of local wildflowers and bushes, are highly recommended to ensure the foreign design concept of outdoor learning are applicable to maximize children's interaction with nature (Shaari *et al*, 2018; Watchman *et al*., 2021). The exploration of perception in interdisciplinary research between architects and educators in architectural design in future works also has acknowledged its need to find common grounds in terms of practicality and aesthetical works.

In addition, future research must be conducted on children's satisfaction and the importance of design spaces that consider children's developmental stages. In trying to prove the effects of nature and outdoor learning in preschool environments, child-nature-architecture assessment tools are highlighted to demonstrate the potential of architecture to contribute positively to preschool children's experiences of nature, enhance their learning opportunities, and improve their overall health and well-being. Future upgrading school grounds and ecosystem projects should involve children through the

development of work to promote ecological literacy (Almers *et al*., 2021). However, a comprehensive framework that outlines what to quantify and qualify when assessing the 'child-nature-architecture' connection needs to be developed for future study. The need for local-based, quality rating tools for specific climates and contexts with the use of providing more holistic assessment. The results can be used as baseline data for spatial design and planning of childcare facilities based on biophilic design and parameters. (Park & Lee, 2019; Shaari *et al*, 2018; Atencio *et al*., 2015; Saari & Ahmad, 2015).

Lastly, the concept of affordances emphasizes the ongoing user–environment–activity relationship important for planning with children in mind, but clarification is needed when using the term, as the term is ambiguous according to a confusing setting (Lerstrup & Bosch, 2017). The lack of exploration in the architecture field area of research in the nature-based experiences of preschool reveals the gaps in the body of knowledge between education, social sciences, health, and built environment. The Leuven Scale of participation was reviewed by Siray-Blatchford and Wong (1999) as based on practitioner or observer interpretation, although they acknowledge that well-researched, well-evidenced, and neutral rating scales can support the observers' interpretation. The distance of the practitioner looking at the child during observation leads to speculation and needs further proposition of measurement (MacRae and Jones, 2023).

6.1 Conceptual Framework

Finally, the framework proposes to integrate early years learning curriculum, architectural intervention, and nature through the perception of young children by observing the children's behaviour and evaluating their overall physical well-being in the context of an urban preschool environment. The proposed framework aims to explore how architectural design characteristics of preschools can shape and bring nature closer to children. This conceptual framework as shown in Figure 18 uses the basis from the outcome of systematic contextual mapping of both themes, design interventions, and assessment towards the quality of the environment of natural-based experiences for future works.

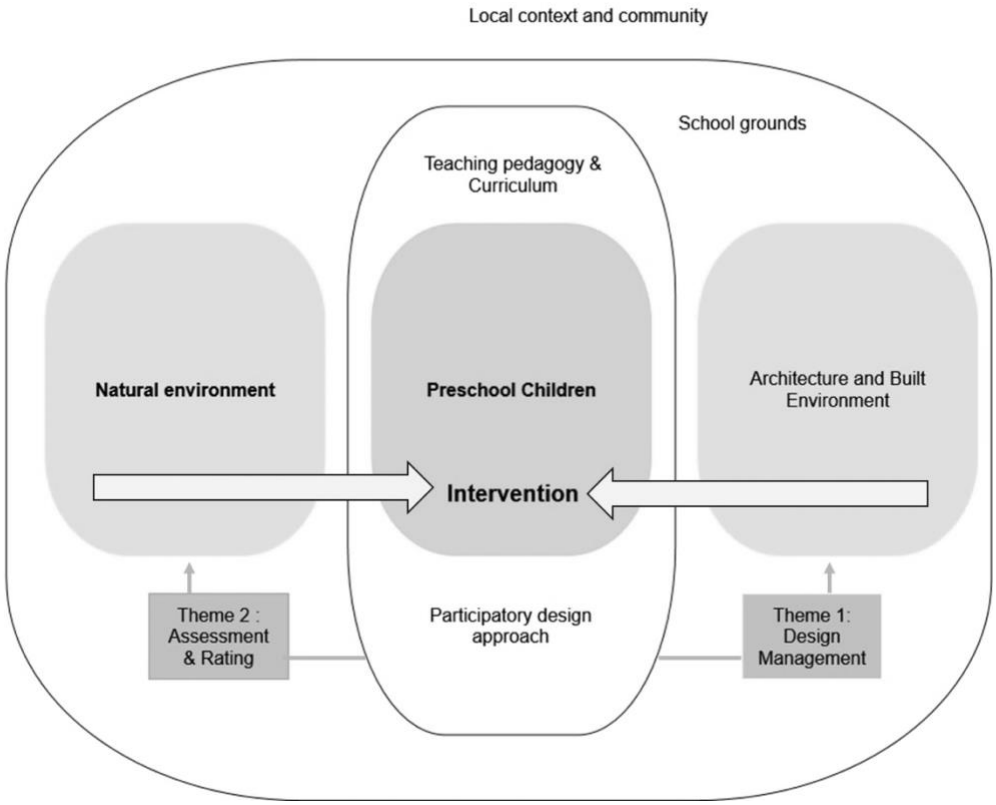


Figure 18. Conceptual Framework of Nature-based Experiences in Urban Preschool

Acknowledgement

This research was funded by the Graduate Excellence Programme (GrEP) of Majlis Amanah Rakyat to support the studies.

References

Abbas, M. Y., Othman, M., & Rahman, P. Z. M. A. (2016). Pre-School Children's Play Behaviour Influenced by Classroom's Spatial Definitions?. *Asian Journal of Environment-Behaviour Studies*, *1*(1), 49-65.

Abd Rahim, S. N. F., Badzis, M., & Abdul Rahman, N. S. N. (2020). How do children experience nature at preschool? A preliminary study. *In 4th UUM International Qualitative Research Conference (QRC 2020),* (pp. 135-147).

Abu Samah, A., Shaffril, H. A. M., Fadzil, M. F., Ahmad, N., & Idris, K. (2021). A systematic review on adaptation practices in aquaculture towards climate change impacts. *Sustainability*, *13*(20), 11410.

Acar, H. (2014). Learning Environments for Children in Outdoor Spaces. *Procedia - Social and Behavioral Sciences, 141*, 846-853.

Alliance, N. S. (2019). *Nature-based preschool professional practice guidebook: Teaching, environments, safety administration.* North American Association for Environmental Education (NAAEE) https://naturalstart.org/nature-based-preschool-professional-practice-guidebook

Almers, E., Askerlund, P., Samuelsson, T., & Waite, S. (2021). Children's preferences for schoolyard features and understanding of ecosystem service innovations–a study in five Swedish preschools. *Journal of adventure education and outdoor learning*, *21*(3), 230-246.

Aquino, L. N., Mamat, N., & Mustafa, M. C. (2019). Levels of Competence in the Learning Domains of Kindergarten Entrants. *Southeast Asia Early Childhood*, *8*(1), 37-46.

Atencio, M., Tan, M., Ho, S., & Chew Ting Ching. (2015). The place and approach of outdoor learning within a holistic curricular agenda: development of Singaporean outdoor education practice. *Journal of Adventure Education and Outdoor Learning,* 15(3), 181–192. https://doi.org/10.1080/14729679.2014.949807

Atler, K. H. (2024). *Experiences of Early Childhood Leaders in US Nature-Based Learning Programs* [Doctoral dissertation, Walden University].

Barfod, K., & Mygind, E. (2022). Udeskole—Regular teaching outside the classroom. In *High-quality outdoor learning: Evidence-based education outside the classroom for children, teachers and society* (pp. 287-297). Cham: Springer International Publishing.

Beames, S., & Atencio, M. (2008). Building social capital through outdoor education. *Journal of Adventure Education & Outdoor Learning*, *8*(2), 99-112.

Beames, S., Higgins, P., & Nicol, R. (2012). *Learning Outside the Classroom*. Routledge.

Beauchamp, A. A., Lacoste, Y., Kingsbury, C., & Gadais, T. (2022). When are you taking us outside? An exploratory study of the integration of the outdoor learning in preschool and primary education in Quebec. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.955549

Beery, T., Fridberg, M., Præstholm, S., Uhnger Wünsche, T., & Bølling, M. (2024). Connectedness to nature: a tale of three scales. Environmental Education Research, 1-23. https://doi.org/10.1080/13504622.2024.2320342

Boell, S. K., & Dubravka Cecez-Kecmanovic. (2015). On being "systematic" in literature reviews. Palgrave Macmillan UK EBooks, 48–78. https://doi.org/10.1057/9781137509888_3

Bentsen, P., Mygind, E., & Randrup, T. B. (2009). Towards an understanding of udeskole: education outside the classroom in a Danish context. Education 3–13, 37(1), 29-44.

Beery, T., Fridberg, M., Præstholm, S., Uhnger Wünsche, T., & Bølling, M. (2024). Connectedness to nature: a tale of three scales. *Environmental Education Research*, 1-23.

Bilton, H. (2010). Outdoor learning in the early years: Management and innovation. Routledge.

Bilton, H. (2020). Values stop play? Teachers' attitudes to the early years outdoor environment. *Early Child Development and Care*, *190*(1), 12-20.

Boileau, E., & O'Donoghue, L. (2024). Learning to embrace outdoor pedagogy: early childhood education student experiences of a nature-focused practicum. *Journal of Outdoor and Environmental Education*, 1-23.

Borg, F. (2019). A case study of a Green Flag-certified preschool in Sweden. *Hungarian Educational Research Journal*, *9*(4), 607-627.

Boverket. (2015). The National Board of Housing, Building and Planning. Gör Plats för Barn och Unga! En Vägledning för Planering, Utformning och Förvaltning av Skolans och Förskolans Utemiljö. Available online: https://www.boverket.se/globalassets/publikationer/dokument/2015/gor-plats-for-barn-och-unga.pdf. (In Swedish)

Braun, V., & Clarke, V. (2022). Conceptual and design thinking for thematic analysis. *Qualitative Psychology, 9*(1), 3–26. https://doi.org/10.1037/qup0000196

Brussoni, M., Ishikawa, T., Brunelle, S., & Herrington, S. (2017). Landscapes for play: Effects of an intervention to promote nature-based risky play in early childhood centres. *Journal of Environmental Psychology*, *54*, 139-150.

Burns, E. A., & Manouchehri, B. (2021). Reconnecting children with nature: foundation and growth of the nature schools movement in Iran. *Interdisciplinary Journal of Environmental and Science Education*, *17*(3), e2244.

Byun, H. R., Choi, M. W., & So, K. S. (2013). A study on characteristics of building, outdoor playground & equipment in child care center. *Journal of the Korean housing association*, *24*(6), 9-18.

Castells, M. (2010). *End of Millennium (Vol. 10)*. John Wiley & Sons. DOI:10.1002/9781444323436

Chawla, L. (2015). Benefits of nature contact for children. *Journal of planning literature*, *30*(4), 433-452. https://doi.org/10.1177/0885412215595441

Chawla, L. (2020). Childhood nature connection and constructive hope: A review of research on connecting with nature and coping with environmental loss. *People and Nature*, 2(3), 619–642. https://doi.org/10.1002/pan3.10128

Cohen, S., & Horm-Wingerd, D. (1993). Children and the Environment: Ecological Awareness among Preschool Children. *Environment and Behavior*, 25(1), 103-120. https://doi.org/10.1177/0013916593251005

Crossan, C., & Salmoni, A. (2021). A simulated walk in nature: Testing predictions from the attention restoration theory. *Environment and Behavior*, *53*(3), 277-295.

Cumming, F., & Nash, M. (2015). An Australian perspective of a forest school: shaping a sense of place to support learning. *Journal of Adventure Education and Outdoor Learning*, *15*(4), 296–309. https://doi.org/10.1080/14729679.2015.1010071

Dahlgren, L. O., & Szczepanski, A. (2005). *Outdoor education: Literary education and sensory experience: An attempt at defining the identity of outdoor education*. Beijing Company Ltd Beijing China.

Dias Ignacio Junior, P. (2024). Quantifying the Benefits of Multisensory Biophilic Restorative Experiences: An Empirical Study Measuring Effects on How Engineers Feel, Think, and Design. [Doctoral's Thesis: Virginia Polytechnic Institute and State University]

Djordjevic, S. S., & Stankovic, D. (2016). Arrangement of outdoor space at preschool institutions in the city of Nis. *Facta Universitatis, Series: Architecture and Civil Engineering*, *13*(3), 273-282.

Dwiningrum, S. I. A., Pratiwi, P. H., & Sumunar, D. R. S. (2022). Integrated the green-school in ecosystem-based disaster risk reduction (Eco-DRR): lesson learned from educational practices in the schooling. In International Conference AIWEST-DR.

Education Scotland. (2009*). Outdoor Learning: Practical guidance, ideas and support for teachers and practitioners in Scotland*. https://education.gov.scot/media/0fklf35p/hwb24-ol-support.pdf

Ergler, C., Smith, K., Kotsanas, C., & Hutchinson, C. (2015). What makes a good city in pre-schoolers' eyes? Findings from participatory planning projects in Australia and New Zealand. *Journal of Urban Design*, *20*(4), 461-478.

Fadda, R., Congiu, S., Roeyers, H., & Skoler, T. (2023). Elements of Biophilic Design Increase Visual Attention in Preschoolers. *Buildings*, *13*(5). https://doi.org/10.3390/buildings13051160

Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. *FASEB journal : official publication of the Federation of American Societies for Experimental Biology*, *22*(2), 338–342. https://doi.org/10.1096/fj.07-9492LSF

Fauzi & Novikasari, I. (2020). Learning Values Model in Early Childhood Education: A Case of a Nature School in Central Java, Indonesia. *In 1st Borobudur International Symposium on Humanities, Economics and Social Sciences (BIS-HESS 2019)* (pp. 289-293). Atlantis Press

Felani Shaari, M., & Nazri, B. (2023). Learning with Nature in Malaysia: Methods of Incorporating Nature in Kindergarten Outdoor Physical Environments. *ONLINE JOURNAL FOR TVET PRACTITIONERS*, *8*(3), 1–13. https://doi.org/10.30880/ojtp.2023.08.03.001

Frances, L., Quinn, F., Elliott, S., & Bird, J. (2024). Outdoor learning across the early years in Australia: Inconsistencies, challenges, and recommendations. *The Australian Educational Researcher*, 1-19.

Ghunmi, N. A. H. M. A. (2023). Involvement of Children's Conceptualization of Space in Design of Kindergartens to Enhance Children's Creative Potential.

Guerriero, S. (2017). Pedagogical Knowledge and the Changing Nature of the Teaching Profession. Centre for *Educational Research and Innovation*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264270695-en

Gibson, J. J. (1979). The theory of affordances. The ecological approach to visual perception. *The people, place and, space reader*, 56-60.

Giusti, M., Svane, U., Raymond, C. M., & Beery, T. H. (2018). A framework to assess where and how children connect to nature. *Frontiers in psychology*, *8*, 2283.

Güngör, S. (2017). Examining the Gardens of Preschool Educational Institutions in Terms of Landscape Design and Space Usage: Example of Selçuklu District. *Journal of Agricultural Faculty of Gaziosmanpaşa University (JAFAG)*, *34*(1), 153-163.

Gusenbauer, M., & Haddaway, N. R. (2020). Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Research synthesis methods*, *11*(2), 181-217.https://doi.org/10.1002/jrsm.1378

Hadzigeorgiou, Y., Prevezanou, B., Kabouropoulou, M., & Konsolas, M. (2011). Teaching about the importance of trees: A study with young children. *Environmental Education Research*, *17*(4), 519–536. https://doi.org/10.1080/13504622.2010.549938

Häfner, P. (2002). Kindergarten in nature and forest in Germany: an alternative to traditional kindergarten in the Preschool education. *Bürgstadt: Universität Heidelberg*

Harzing, A. W. K., & Van der Wal, R. (2008). Google Scholar as a new source for citation analysis. Ethics in science and environmental politics, 8(1), 61-73

Herrington, S. (1998). The garden in Fröbel's kindergarten: beyond the metaphor. *Journal of Garden History*, *18*(4), 326–338. https://doi.org/10.1080/14601176.1998.10435556

Higgins, P., & Nicol, R. (2002). *Outdoor Education: Authentic Learning in the Context of Landscapes (Volume 2)*. Kinda Education Centre.

Hilmarsson, G.; Larusson, K. *Design of Compulsory Schoolyard in Regard to Movement*. 2007. Available online: https: //skemman.is/bitstream/1946/739/1/Heildarskjal.pdf (accessed on 6 June 2024). (In Icelandic)

Howe, N., Perlman, M., Bergeron, C., & Burns, S. (2020). Scotland Embarks on a National Outdoor Play Initiative: Educator Perspectives. *Early Education and Development*, *32*(7), 1067–1081. https://doi.org/10.1080/10409289.2020.1822079

Iwan, A., & Kenneth K. Y. Poon. (2018). Architects' and early childhood educators' notions of quality preschool environments: case studies of award-winning Green Preschools in Bali, Berkeley, and Hong Kong. *Intelligent Buildings International, 10(3*), 162–181. https://doi.org/10.1080/17508975.2018.1434476

Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between Nature Exposure and Health: A Review of the Evidence. *International Journal of Environmental Research and Public Health/International Journal of Environmental Research and Public Health*, *18*(9), 4790–4790. https://doi.org/10.3390/ijerph18094790

Jordet, A. N. (2008). Outdoor schooling in Norway–research and experiences. In *Verschriftlicher Vortrag zur Konferenz Healthier, Wiser and Happier Children. Outdoor Education–Learning with Mind, Heart and Body,* Conference Branbjerg University College, Jelling, 24th-25th January.

Jung, E., & Han, S. (2018). Early childhood education in Korea. In *Handbook of international perspectives on early childhood education* (pp. 187-199). Routledge.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology*, *15*(3), 169-182.

Kellert, S. R., Heerwagen, J., & Mador, M. (2011). *Biophilic design: the theory, science and practice of bringing buildings to life*. John Wiley & Sons.

Kenyon, A., & Pearce, J. (2019). The socio-spatial distribution of walkable environments in urban scotland: A case study from Glasgow and Edinburgh. SSM-population health, 9, 100461

Kiviranta, L., Lindfors, E., Rönkkö, M. L., & Luukka, E. (2024). Outdoor learning in early childhood education: exploring benefits and challenges. *Educational Research,* 66(1), 102-119

Knight, S. (2013). *Forest schools and outdoor learning in the early years* (2nd ed.). Sage

Kuo, F. E., & Andrea Faber Taylor. (2004). A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence From a National Study. *American Journal of Public Health*, *94*(9), 1580–1586. https://doi.org/10.2105/ajph.94.9.1580

Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*, *10*(FEB). https://doi.org/10.3389/fpsyg.2019.00305

Lamekhova, N. V. (2020). The role of ecological and environmental approach in shaping the architectural environment for preschool education. In *IOP Conference Series: Materials Science and Engineering* (Vol. 962, No. 3, p. 032090). IOP Publishing.

Lee, S. (2019). *Early Childhood Teachers' Perspectives of Outdoor and Nature Play in Seoul, South Korea and Montreal, Canada* (Doctoral dissertation, Concordia University).

Lerstrup, I., & Konijnendijk van den Bosch, C. (2017). Affordances of outdoor settings for children in preschool: revisiting heft's functional taxonomy. *Landscape Research*, *42*(1), 47–62. https://doi.org/10.1080/01426397.2016.1252039

Løkken, G., & Moser, T. (2012). Space and materiality in early childhood pedagogy–introductory notes. *Education Inquiry*, *3*(3), 303-315.

Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Algonquin books.

Lysklett, O. B., & Berger, H. W. (2017). What are the characteristics of nature preschools in Norway, and how do they organize their daily activities? *Journal of Adventure Education and Outdoor Learning*, *17*(2), 95–107. https://doi.org/10.1080/14729679.2016.1218782

MacRae, C., & Jones, L. (2023). A philosophical reflection on the "Leuven Scale" and young children's expressions of involvement. *International Journal of Qualitative Studies in Education*, *36*(2), 234-246.

Mackinder, M. (2017). Footprints in the woods:'tracking' a nursery child through a Forest School session. *Education 3-13, 45*, 176 - 190.

Mackinder, M. (2023). A balancing act: a constructivist perspective of the adult's role in Forest School in England and Forest Kindergarten in Denmark. *Education 3-13*, 1–14. https://doi.org/10.1080/03004279.2023.2250803

Manhas, S., & Qadiri, F. (2010). A comparative study of preschool education in early childhood education centres in India. *Contemporary Issues in Early Childhood*, *11*(4), 443-447.

Mann, J., Gray, T., Truong, S., Brymer, E., Passy, R., Ho, S., Sahlberg, P., Ward, K., Bentsen, P., Curry, C., & Cowper, R. (2022). Getting Out of the Classroom and Into Nature: A Systematic Review of Nature-Specific Outdoor Learning on School Children's Learning and Development. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.877058

Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & Emilio Delgado López-Cózar. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of Informetrics,* 12(4), 1160–1177. https://doi.org/10.1016/j.joi.2018.09.002

Matterson, E. (1989). *Play with a purpose for under-sevens* (3rd ed). Penguin. https://cir.nii.ac.jp/crid/1130000798323718784.bib?lang=en

Michek, S., Nováková, Z., & Menclová, L. (2015). Advantages and Disadvantages of Forest Kindergarten in Czech Republic. *Procedia - Social and Behavioral Sciences*, *171*, 738–744. https://doi.org/10.1016/j.sbspro.2015.01.186

Mikalsen, H. K., Ninive, G., & Lagestad, P. (2022). School's outdoor area as an educational and health-promoting resource for young teenagers. In *Frontiers in Education* (Vol. 7, p. 858913). Frontiers Media SA.

Ministry of Education (2012). Malaysia Education Blueprint 2013 – 2025. Prime Minister's Office of Malaysia

Mohammed, I., Zeynep Onur, & Çiğdem Çağnan. (2023). An Exploration of Biophilic Design Features within Preschool Interiors. Sustainability, 15(15), 11913–11913. https://doi.org/10.3390/su151511913

Mohidin, H. H. B., Ismail, A. S., & Ramli, H. B. (2015). Effectiveness of kindergarten design in Malaysia. *Procedia-Social and Behavioral Sciences*, *202*, 47-57.

Morrow, L. M. (2007). Developing literacy in preschool. New York, NY: Guildford Press.

Moser, T., & Martinsen, M. T. (2010). The outdoor environment in Norwegian kindergartens as pedagogical space for toddlers' play, learning and development. *European early childhood education research journal*, *18*(4), 457-471.

Mygind, E. (2007). A comparison between children's physical activity levels at school and learning in an outdoor environment. *Journal of Adventure Education and Outdoor Learning*, 7(2), 161-176

Mygind, L., Stevenson, M. P., Liebst, L. S., Konvalinka, I., & Bentsen, P. (2018). Stress response and cognitive performance modulation in classroom versus natural environments: A quasi-experimental pilot study with children. *International Journal of Environmental Research and Public Health*, *15*(6). https://doi.org/10.3390/ijerph15061098

Mygind, E., Bølling, M., & Seierøe Barfod, K. (2019). Primary teachers' experiences with weekly education outside the classroom during a year. *Education 3-13*, 47(5), 599-611

Nugent , C. (2017). *Multicase study of nature-kindergarten practices: Exploring three examples in Denmark, Finland and Scotland* [Doctoral thesis, University of Edinburgh]. Edinburgh Research Archive. https://era.ed.ac.uk/handle/1842/25918

Nah, K. O., Waller, T., Ärlemalm-Hagsér, E., Lee-Hammond, L., Lekies, K., & Wyver, S. (2017). The rise of outdoor play and education issues in preschools in South Korea. The Sage handbook of outdoor play and learning, 242-250.

Nazri, B., & Shaari, M. F. (2023). Incorporating nature in outdoor physical environment of kindergartens for learning with nature in Malaysia. *AIP Conference Proceedings*, *2881*(1). https://doi.org/10.1063/5.0167640

NVivo - Lumivero. (2024). Lumivero. https://lumivero.com/product/nvivo/

OECD (2021), *Education at a Glance 2021: OECD Indicators*, OECD Publishing, Paris, https://doi.org/10.1787/b35a14e5-en

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change*, *47*, 88–94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

PLANMalaysia (2017). *Garis Panduan Perancangan dan Penubuhan Tadika dan Taska 2017.* Malaysia https://www.planmalaysia.gov.my/planmalaysia/modules_resources/database_stores/17/46_17.pdf

Park, S. J., & Lee, H. C. (2019). Spatial design of childcare facilities based on biophilic design patterns. *Sustainability (Switzerland)*, *11*(10). https://doi.org/10.3390/su11102851

Pawilen, G. T. (2023). Science Around Us: Development of a Community-based Science Curriculum for Local Preschools in the Philippines. Unnes Science Education Journal, 12(1), 24-31

Parker, R., Bo Stjerne Thomsen, & Berry, A. (2022). Learning Through Play at School – A Framework for Policy and Practice. *Frontiers in Education*, *7*. https://doi.org/10.3389/feduc.2022.751801

Podawca, K. (2018). Analiza zagospodarowania przestrzennego terenów usług wychowania przedszkolnego. (Analysis of the spatial development of the areas of pre- school education services) *Zeszyty Naukowe Uczelni Vistula*, (61 (4) Architektura), 104-118 (In Polish).

Pranckutė, R. (2021). Web of Science (WoS) and Scopus: The titans of bibliographic information in today's academic world. *Publications*, 9(1), 12

Pratiwi, S. L. H., & Geraldi, A. (2019). Incorporating Outdoor Learning into School System in Indonesia: A Preliminary Study. *Advances in Social Science, Education and Humanities Research (ASSEHR), volume 330 6th International Conference on Educational Research and Innovation (ICERI 2018).* Atlantis Press.

Rakennustieto. (2019) *Spaces of Day Care and Comprehensive Schools: Planning Outdoor Facilities*. Available online:https://www.rakennustietokauppa.fi/sivu/tuote/rt-103084-paivakodin-ja-perusopetuksen-tilat-ulkotilojen-suunnittelu/ 2742562 (accessed on 12 June 2024). (In Finnish)

Ramsay, C. R. (2002). *Sir Edmund Hillary & the People of Everest*. Andrews McMeel Publishing.

Rice, C. S., & Torquati, J. C. (2013). Assessing connections between young children's affinity for nature and their experiences in natural outdoor settings in preschools. *Children, Youth and Environments*, *23*(2), 78-102.

Russo, A., & Andreucci, M. B. (2023). Raising healthy children: promoting the multiple benefits of green open spaces through biophilic design. *Sustainability*, *15*(3), 1982.

Rutkauskaite, R., Gisladottir, T., Pihu, M., Kjonniksen, L., Lounassalo, I., Huovinen, T., ... & Fjørtoft, I. (2021). Schoolyard affordances for physical activity: A pilot study in 6 Nordic–Baltic countries. *Sustainability*, *13*(21), 11640.

Sahin, B., & Dostoglu, N. (2012). The Importance Of Preschoolers'experience In Kindergarten Design. *METU Journal of the Faculty of Architecture*, *29*.

Sahin, B., & Dostoglu, N. (2014). Evaluation of Kindergarten Group Rooms in the Context of Size: Children and Teacher's Perspective in Turkey. *European Journal of Contemporary Education*, *10*(4), 253-264.

Saleh, S. F., Latip, N. S. A., & Rahim, A. A. (2018). Assessment of learning with nature in preschool. *Planning Malaysia*, *16*.

Sawalludin A. F., Jia, C., & Mohamad. (2020). *The Struggle of Orang Asli in Education: Quality of Education*. ResearchGate; Secholian Publication

Schnaufer, J. (2021). *The Pursuit of Virtue in Outdoor Sport and Recreation* [Bachelor's Thesis, Rochester Institute of Technology]. Rochester Institute of Technology Libraries Digital Institutional Repository. https://repository.rit.edu/theses/10822/

Shaari, M. F., & Ahmad, S. S. (2016). Physical learning environment: Impact on children school readiness in Malaysian preschools. *Procedia-Social and Behavioral Sciences*, *222*, 9-18.

Shaari, M. F., Ahmad, S. S., & Ismail, I. S. (2018). Rethinking preschool physical design: Enhancing environmental stewardship among children. *Asian J. Behav. Stud*, *3*, 128-139.

Shaari, M. F., Ahmad, S. S., Ismail, I. S., & Zaiki, Y. (2020). Preschool physical environment design quality: Addressing Malaysia's PISA rankings. *Asian Journal of Environment-Behaviour Studies*, *5*(16), 45-57.

Shmis, T., Kotnik, J., & Ustinova, M. (2014). Creating new learning environments: challenges for early childhood development architecture and pedagogy in Russia. *Procedia-Social and Behavioral Sciences*, *146*, 40-46.

Siraj‐Blatchford, I., & Wong, Y. (1999). Defining and Evaluating 'Quality' Early Childhood Education in an International Context: Dilemmas and Possibilities. *Early Years*, *20*(1), 7–18. https://doi.org/10.1080/0957514990200102

Spalie, N., Tahir, M., & Ani, C. (2011). Reconstructing sustainable outdoor learning environment in Malaysia from the understanding of natural school design and approaches in Indonesia. *Procedia-Social and Behavioral Sciences*, 15, 3310-3315

Stadler-Altmann, U. (2021). Indoors and outdoors: Schoolyards as learning and playing opportunities. *Journal of Physical Education and Sport*, *21*, 553–559 DOI:10.7752/jpes.2021.s1062

Sudo, T., Lin, S. Y., Hasegawa, H., Ito, K., Yamashita, T., & Yamashita, I. (2021). Natural environment and management for children's play and learning in kindergarten in an urban forest in Kyoto, Japan. Urban Biodiversity and Ecological Design for Sustainable Cities, 175-198

Sugiyama, N., Hosaka, T., Takagi, E., & Numata, S. (2021). How do childhood nature experiences and negative emotions towards nature influence preferences for outdoor activity among young adults?. *Landscape and Urban Planning*, *205*, 103971.

Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2002). Views of nature and self-discipline: Evidence from inner city children. *Journal of environmental psychology*, *22*(1-2), 49-63.

Tezuka, T., & Tezuka, Y. (2021). Fuji Kindergarten: Architecture of open play and learning. In *Childhood Education* (Vol. 97, Issue 5, pp. 60–65). Routledge. https://doi.org/10.1080/00094056.2021.1982296

Thabane, L., Cambon, L., Potvin, L., Pommier, J., Kivits, J., Minary, L., ... & Alla, F. (2019). Population health intervention research: what is the place for pilot studies?. *Trials*, *20*, 1-6.

The Scottish Government (2017) Space to Grow: Design guidance for early learning and childcare and out of school care settings. The Scottish Government. cspace-grow-design-guidance-early-learning-childcare-out-school-care/documents/

The Scottish Government. (2017,). *Early learning, childcare and out of school care services: design guidance*. Gov.scot; The Scottish Government. https://www.gov.scot/publications/space-grow-design-guidance-early-learning-childcare-out-school-care/

The Scottish Government. (2020). *Out to Play - creating outdoor play experiences for children: practical guidance*. Gov.scot; The Scottish Government. https://www.gov.scot/publications/out-play-practical-guidance-creating-outdoor-play-experiences-children/

Thorburn, M., & Allison, P. (2010). Are we ready to go outdoors now? The prospects for outdoor education during a period of curriculum renewal in Scotland. *The Curriculum Journal*, *21*(1), 97-108.

Thorèn, K. H., Nordbø, E. C. A., Nordh, H., & Ottesen, I. Ø. (2019). Uteområder i barnehager og skoler: Hvordan sikre kvalitet i utformingen. NMBU (Outdoor areas in kindergartens and schools: How to ensure quality in the design).

Traynor, O., McCrorie, P., Chng, N. R., & Martin, A. (2022). Evaluating Outdoor Nature-Based Early Learning and Childcare Provision for Children Aged 3 Years: Protocol of a Feasibility and Pilot Quasi-Experimental Design. *International Journal of Environmental Research and Public Health*, *19*(12), 7461.

To, P. T., & Grierson, D. (2024). A study on children's multi-sensorial experiences of nature: design approaches and preferences for primary school architecture case studies in Glasgow, Scotland, UK. *Archnet-IJAR: International Journal of Architectural Research*, *18*(2), 225-246.

To, P. T., & Grierson, D. (2019). An application of measuring visual and non-visual sensorial experiences of nature for children within primary school spaces: Child–nature–distance case studies in Glasgow, Scotland. *Archnet-IJAR: International Journal of Architectural Research*, *14*(2), 167-186.

Ünal, N., & Özen, E. S. (2021). Biophilic approach to design for children. *ICONARP International Journal of Architecture and Planning*, *9*(2), 943-965.

Vella-Brodrick, D. A., & Gilowska, K. (2022). Effects of nature (greenspace) on cognitive functioning in school children and adolescents: A systematic review. *Educational Psychology Review*, *34*(3), 1217-1254.

Waite, S. (2020). Teaching and learning outside the classroom: Personal values, alternative pedagogies and standards. In Outdoor learning research (pp. 8-25). Routledge

Waite, S., Husain, F., Scandone, B., Forsyth, E., & Piggott, H. (2021). 'It's not for people like (them)': structural and cultural barriers to children and young people engaging with nature outside schooling. *Journal of Adventure Education and Outdoor Learning*. https://doi.org/10.1080/14729679.2021.1935286

Waite, S. (2022). International views on school-based outdoor learning. In High-quality outdoor learning: Evidence-based education outside the classroom for children, teachers and society (pp. 301-319). Cham: Springer International Publishing

Watchman, M. (2021). Biophilic primary schools in cold climates: Design opportunities fostering multisensory experiences and well-being.

Wilkinson, R. (2013). *Outdoor learning in the early years: the benefits of outdoor learning in a natural environment* [Doctoral dissertation, University of Akureyri] https://skemman.is/handle/1946/15693

White, J. (2011). Outdoor provision in the early years.

Yılmaz, S. (2016). Outdoor environment and outdoor activities in early childhood education. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *12*(1).

Zwierzchowska, I., & Lupa, P. (2021). Providing contact with nature for young generation-A case study of preschools in the City of Poznań, Poland. *Urban Forestry & Urban Greening*, *65*, 127346.