

**THE INFLUENCE OF BIOPHILIC ARCHITECTURE ON
EARLY CHILDHOOD DEVELOPMENT:
Towards a Children's Development Facility
In eThekweni, South Africa**

BY

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A Dissertation submitted in partial fulfilment of the
requirements for the degree of Master of Architecture to
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DECLARATION

I state that this dissertation denotes the original work of the author. All borrowed ideas from other authors and sources have been properly accredited and referenced. None of the work has been previously submitted for any other degree or examination in any other university.

This dissertation is submitted in partial fulfilment of the requirements for the degree of Master of Architecture in the School of the Built Environment and Development Studies, College of Humanities, University of KwaZulu-Natal. My research has been done under the supervision of Magdalena Catharina Cloete who specialises in architecture and childhood development research.

Opinions articulated and conclusions reached are those of the author and are not to be attributed to the School of the Built Environment and Development Studies.



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10/07/2023

Date



Magdalena Catharina Cloete

16 Feb 2024

Date

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DEDICATION

My son,

Mikaeel Khan

My inspiration for this study

&

for being so patient during most of his

Early Childhood Development

Years.

ABSTRACT

The education system in South Africa requires improvement due to the learners' dropping out of school mainly because of their poor literacy and numeracy skills. The nation's inadequate access to early childhood education initiatives is a key factor contributing to the challenges confronting the system. There is increasing evidence showing that biophilia can positively influence the growth and development of young children. It has been shown that kids who are nurtured by nature are more likely to have a good start in life. The objective of this study is to create a framework that will help design a child-friendly environment, which can promote their growth and evolution.

Based on a review of the literature on early childhood developmental and biophilic architectural concepts and theories, the case study was conducted qualitatively. Interviews and observations were conducted to understand the various factors that affect the development of children.

The study revealed that nature plays a significant role in shaping the development and evolution of children, and it was concluded that designing an environment that is conducive to their growth is crucial.

Keywords: Architecture, Built Environment, Natural Environment, Biophilia, Biophilic Design, Early Childhood Development, Children, Universal Design, Qualitative Study

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CHAPTER ONE
INTRODUCTION TO RESEARCH



1.1 INTRODUCTION

1.1.1 BACKGROUND

1.1.1.2 INTRODUCTION

Early childhood development centres are places that offer early education and development to young children before entering formal schooling. Parents can benefit from being given the ability to leave their children in safe places that can nurture their development while the parent can work or study.

According to Aubrey (2017), estimates of non-enrolment in preschool or other ECD activities have been as high as 70%, although government funding for ECD has increased. She also states that reliable data on the number of children enrolled, the state of infrastructure, and levels of staff qualifications are lacking. There is an urgent need for higher quality ECD centres in South Africa to cater to various populations within the country, especially for the lower income households.

There are several parts to early childhood development, inclusive of parents, caregivers, or teachers, as well as their peers. One of the leading factors that affect early childhood development is the environment. This learning environment consists of a mixture of spaces and content which will impact the way a child develops. The environment is commonly thought of as the “third teacher”, where the parents and educator come first. Apart from the home, which is designed towards the benefit of a family as a unit, children's development centres are specifically geared towards the development of children. (Roy 2015)

The purpose of this study is to understand the link and effects biophilic architecture has to play in the development of young children and how these studies can be incorporated into the spaces designed to improve the quality of childhood development.

1.1.1.2 MOTIVATION/JUSTIFICATION OF THE STUDY

Early Childhood Development (ECD) has become a priority sector within South Africa, mainly with regard to making sure the youngest members (ages 0 to 6 years old) of the population have a fair chance of development and high-quality care. South Africa is also

burdened with high levels of poverty, inequality, and unemployment as well as unequal levels of service delivery and public provision of infrastructure. Furthermore, child poverty remains a major concern in the country, particularly concerning the geographical and living conditions where children live, learn, and play. (Mbarathi, Mthembu & Diga 2016)

Most environments that children learn and play in aren't effective learning and growing spaces. Children simply aren't engaging enough with environments that stimulate their minds and senses in a way that benefits their development. Due to the high cost of land in urban areas, many child development facilities lack both indoor and outdoor engagement. They don't have opportunities for free nature play like people did a few generations ago which impacts their social, physical, and cognitive development. The main motivation for this study is due to the lack of children's development facilities that connect both the built and natural environments.

1.2 DEFINITION OF THE PROBLEM, AIMS, AND OBJECTIVES

1.2.1 DEFINITION OF THE PROBLEM

Many of South Africa's education challenges, marked in part by poor literacy and numeracy skills, as well as high drop-out rates, could be due to the limited quality education children receive at the foundation level. A larger proportion of the children fortunate enough to be enrolled are cared for at home or community-based facilities that are poorly structured and equipped, and thus unable to provide quality education-oriented ECD programmes. (Mabugu & Rakabe 2015)

1.2.2 AIMS

This research aims to explore the effects architecture and its environment has on the lives of young children. The study further aims to establish how designers can aid in connecting nature to educational facilities for the youngest beneficiaries, which in turn would give the child a stronger foundation.

1.2.3 OBJECTIVES

- To understand early childhood development
- To evaluate early childhood development strategies in South Africa.
- To understand the relationship between childhood development and biophilia.
- To understand biophilic design
- To build a framework for the design of an ECD centre, keeping in mind the connection between the natural and the built environment.

1.3 SETTING OUT THE SCOPE

1.3.1 DELIMITATION OF RESEARCH PROBLEM

This dissertation does not suggest that architectural environments and spatial properties limit the developmental growth of young children nor does it discard other childhood development theories. This study, rather, intends to demonstrate that the built environment can play a positive role and improve basic early childhood development and it aims to establish what the specific architectural design guides and strategies are.

While the method of early childhood development will be briefly considered as a basis for the study, it will not be an in-depth investigation into all aspects of the topic. For the purpose of this study, children aged 0 to 6 years old will be focused on.

Early Childhood Development and Biophilic Architecture will be researched first as a whole then the link between Early Childhood Development and Biophilic Architecture will be explored, thereafter a framework will be created focusing on architecture and the built environment. The research needs to be inclusive of all socio-economic groupings and ways in which all children receive a steady educational foundation giving individuals an equal position at benefiting in their own life goals.

1.3.2 DEFINITION OF TERMS

Biophilia:

A hypothetical human tendency to interact or be closely associated with other forms of life in nature.

Bracketing:

Bracketing is the preliminary step in the philosophical movement of phenomenology describing an act of suspending judgment about the natural world to instead focus on analysis of experience.

Classroom Environment:

The surroundings and conditions where the teacher and children go about their daily activities.

Early Childhood Development:

Early childhood development (ECD) refers to the physical, psychological, cognitive and social development that a child experiences between birth and school-going age.

Natural Elements:

Elements produced by nature, without the intervention of man.

Phenomenology:

Phenomenology is the philosophical study of the structures of experience and consciousness.

Transductive Reasoning:

The tendency of a child, in the preoperational stage of cognitive development to see a connection between unrelated instances, using neither deductive nor inductive means to do so.

1.3.3 STATING THE ASSUMPTIONS

The principal assumption made is that architectural design can play a role in the development of young children by incorporating biophilic design into their environment. If addressed, it would provide research into designing spaces towards early childhood development centres, which to my knowledge, lacks integration into the natural environment. It is believed that there is a lack of well-designed developmental facilities in Durban, South Africa which do not integrate nature into the environments of children. Furthermore, it is assumed that early childhood education centres play a vital role in the development of children since they learn extensively through nature and being outdoors.

1.3.4 KEY QUESTIONS

1.3.4.1 Primary Question:

How can biophilic architecture respond to the environments of young children between 0 and 6 years?

1.3.4.2 Secondary Questions

- What are the main ideas surrounding early childhood development?
- What strategies are used in early childhood development centres in SA?
- How does biophilia affect children?
- What is biophilic architecture?

1.3.5 HYPOTHESIS

Young children, between the ages of 0 and 6 years, facilitate most of their developmental milestones through nature and playing outdoors. The design of appropriate play and learning spaces that engage with both the natural and built environment facilitates superior development.

1.3.4 CONCEPTS AND THEORIES / LITERATURE REVIEW

1.3.4.1 Introduction

Today's kids and families have limited opportunities with the natural world around them. In his book, Richard Louv talked about the importance of connecting with nature. He noted that children suffer from what he referred to as "nature deficit disorder." (Louv 2005) According to Louv (2005), the modern family has drastically changed over the last two decades. Nowadays, kids spend more time glued to their computers and televisions than engaging in physical activities. (Natural Learning Initiative 2012) The goal of this literature review is to establish guidelines for designing children's learning spaces. It also looks into the link between nature and children's development.

1.3.4.2 Phenomenology

One of the main components of the theory of Phenomena is the Heidegger theory. This provides a structure for comprehending the mysterious phenomenon unfolding in the natural world. (Peoples 2017)

Christian Norburg Schulz, an architect, utilized the Heidegger theory to define the essence of architecture. (Farzam Khaveri 2019) Architecture's phenomenology aims to analyze different philosophical ideas about the field. "Genius Loci, Towards a Phenomenology of Architecture" by Christian Norburg Schultz (1980) is a good reference for information about the architect's works. The concept of phenomenology involves matching the characteristics of a given environment or place to its traditions and culture. (Spacey 2017)

This study, which partly focuses on children's perception of the world, looks into the works of Maurice Merleau-Ponty. (1962) According to Pallasmaa (2011), the senses are a hierarchy of senses that spans the lower sense of touch to the highest sense of vision. The concept of the senses is related to nature, and it involves the recognition of light and fire, sound, taste, and water.

1.3.4.3 Childhood development

According to the Centre on the developing child at Harvard University (2019, 2021), building strong bonds and developing core skills can help children develop. In addition, these concepts can be applied to reduce stress and improve children's performance. Within these principles, we look to psychologists such as John Bowlby (1969) regarding attachment theory and Jean Piaget (1954) regarding the theory of cognitive development.

1.3.4.4 Learning environment

One of the most critical factors that we need to consider when it comes to learning is the design of the environment. A well-designed classroom can stimulate children's senses and provide them with a variety of experiences. The educational company, Kaplan Early Learning Company (2010) released a handbook that features seven principles towards early childhood classroom design. Designing with these principles will allow you to create a space that is both stimulating and fulfilling. Once implemented, these attributes will motivate both the individuals who use the space and those who are starting to lose interest.

Rich environments in the early stages of development are vital due to the brain re-wiring itself based on experience and diverse settings. Children's brains are constantly applying new knowledge to those of past experiences in old environments as well as new experiences in new environments. According to Roy (2015), the design of a learning environment should take into account the importance of providing a variety of interactive experiences. This will allow children to develop their skills and confidence.

1.3.4.5 Biophilia

Edward Wilson used the word biophilia to describe his belief that humans are naturally drawn to the world around them. (eds. Kellert and Wilson 1993) Throughout history, researchers have relied on Wilson's theories in their studies. Numerous studies have shown how natural elements help hospital patients recover more quickly, natural daylight improves students' learning in school, and people who work in offices with indoor plants get sick less often.

1.3.4.7 Benefits of incorporating biophilia into the environments of children

This section features literature that tries to connect the dots between biophilia and children. It seeks to find architectural-relevant ideas that can be beneficial.

According to a study conducted by Taylor et al. (2002), children who have physical and visual contact with nature are more likely to perform well on tests of concentration and self-discipline.

Play in nature is especially important for developing capacities for creativity, problem-solving, and intellectual development (Kellert 2005) The benefits of free play are well-documented. It can help children develop their gross and fine motor skills, as well as their cognitive and sensory abilities. (Bowen 2015) A study conducted by Deming and Bell (2006) revealed that children who experience school grounds with diverse natural settings are more physically active, more aware of nutrition, more civil to one another and more creative.

Contact with the natural world can significantly reduce symptoms of attention deficit disorder in children as young as five years old (Kuo & Taylor 2008).

1.3.4.8 Biophilic architecture

The biophilic approach involves the use of various techniques and natural materials to create designs that can be both aesthetically appealing and sustainable. This method highlights the utilization of air, water, and sun for enhanced light and functionality. The biophilic design framework discussed in this study was proposed by Stephen Kellert. (2008) It is composed of six elements. It covers the theory, practice, and science of bringing structures to life.

1.3.4.9 Conclusion

Free play outdoors is a great way to promote the healthy development of children's sensory and motor skills. It can help them wake up and reinvigorate their minds and engage all of their senses at the same time. In nature, kids can learn how to overcome their fears and take risks. It's important for children to have the opportunity to play outside every day. They should also be given the freedom to try new play schemes and theories. (Hanscom 2016)

The various frameworks and theories examined have been able to translate into relevant literature, which highlights the link between biophilic architecture and early childhood development. Integrating Biophilia into a facility's design, it can help promote healthy growth and enhance the child's development.

1.5 RESEARCH METHODS AND CASE STUDY

1.5.1 INTRODUCTION

The topic of research is focused on creating an environment that is beneficial to the development of young children between the age of 0 and 6 years old. The variables and outcomes are based largely on the children's experiences and studies regarding their development in terms of children's biophilia and their approach towards nature. This research methodology will supply both a contextual as well as a global perspective within the topic researched and approached at a qualitative angle to gather information based on understanding, feeling, observation and appearance

1.5.2 RESEARCH PHILOSOPHY AND STRATEGY

The methodological approach to this research study will be a qualitative study into the understanding of how architectural design incorporating natural elements will affect babies and toddlers up to the age of six. It will take into account how children are stimulated positively, and find strategies, in which we can support children's development, as well as environments that have positive impacts on the way they learn and play in these spaces. The purpose of the study is to analyse the way young children in South Africa are trained, supported and cared for. This study will also find the best ways in which architects can design ECD centres to help improve early childhood development.

1.5.3 SECONDARY DATA COLLECTION

Secondary data collection in the form of reviewing literature and analysing precedent studies will be done. The literature review will gain research in terms of the theoretical and conceptual framework studied towards fulfilling the needs of understanding the objectives and research questions outlined. Renowned authors will be quoted to give this research a good foundation and a comparison of multiple literature sources will assist in providing the main design framework connecting biophilic architecture to the development of young children between the ages of 0 and 6 years. By analysing precedent studies it will provide examples of international architecture of similar function, and study concepts and themes within the topic of interest. This data will be sourced from books, journals, articles, reports, academic papers, theses and credible online sources.

1.5.4 PRIMARY DATA COLLECTION

Primary data collection and analysis will be approached using research methodologies regarding both child development as well as biophilic architecture due to the study being fixed in both areas of interest, therefore requiring suitable methods of data collection. The built environment research method adopted is in the form of purposive case studies while the child development research methods include comparative research through interviews as well as observation, self-report and case studies. These will require semi-structured interviews, observations, and either questionnaires or focus groups.

Case studies are to be done at two ECD centres, one of which isn't afforded to the ordinary South African parent and one which targets parents with lower to middle-class incomes to gain insight into a comparative study based on economic welfare and its impact on most South African children's foundation level. The angle of the study will follow through with the research topic and its related variables.

Within the case studies, interviews will be carried out with the principal and either 1-2 educators or child-minders from each of the four institutions to better understand the values within these ECD facilities. To gather their understanding of the relevant themes within the study and how it is implemented in their environments as well as further knowledge about the topic that may arise. An interview will also be completed with a

key informant, an architect that has engaged in such projects, to gather the design framework and major factors that contribute to this study.

Questionnaires or focus groups between parents will be decided upon after visiting the ECD institutions based on the availability and interest of parents. This portion of the research is mainly to generate information about the type of children present at such ECD facilities and their backgrounds which could also have an impact on the study. 5-10 parents at each of the 2 institutions should be relevant.

1.5.5 RESEARCH MATERIALS

Research Materials would consist of both primary and secondary sources. The internet, books, magazines, journals as well as other published and non-published literature will be used as secondary sources. Observation schedules, a camera, field notes and sketches will be used when engaging in the case studies. Semi-structured interview schedules will be used for interviews with the institutions' facilitators towards gaining direct information. Questionnaires or focus group schedules will be completed by parents to better engage with children, the main focus of who this study benefits.

1.5.6 RESEARCH ANALYSIS

Research findings from the primary data will be analysed and discussed using a thematic approach that relates to the theories and concepts of biophilic architecture and early childhood developments collected through secondary data collection. In addition, findings from the studies will be reviewed for similarities and will be represented through narrative and verbatim quotes. The objectives will be gained through the literature review and analysis of precedent studies, case studies and other primary data collection which is to be organised into categories best suited for this research.

1.5.7 SUMMARY

RESEARCH METHODS MATRIX

Objectives	Explore the effects architectural design has on the lives of young children aged 0 to 6years old.	To understand the relationship between early childhood development and biophilic architecture.	To evaluate early childhood development strategies used throughout the world and those adopted by South African ECD Centers.	To build a framework towards the design of an ECD centre, keeping in mind the connection between the natural and built environment that is needed.
Data Sources	Primary & Secondary Data	Secondary Data	Primary & Secondary Data	Primary & Secondary Data
Sample Size	<ul style="list-style-type: none"> ● 2 ECD centres ● 6 - 8 Educators / child-minders ● Unlimited Secondary Data Collection 	<ul style="list-style-type: none"> ● Unlimited Secondary Data Collection 	<ul style="list-style-type: none"> ● 2 ECD centres ● 6 - 8 Educators / child-minders ● Unlimited Secondary Data Collection 	<ul style="list-style-type: none"> ● 2 ECD centres ● 1 Architect with knowledge in the field of study ● Unlimited Secondary Data Collection
Data Collection Methods	<ul style="list-style-type: none"> ● Case Study ● Observation ● Semi-structured interviews ● Literature Review 	<ul style="list-style-type: none"> ● Literature Review 	<ul style="list-style-type: none"> ● Case Study ● Observation ● Semi-structured interviews ● Precedent Studies ● Literature Review 	<ul style="list-style-type: none"> ● Case Study ● Observation ● Semi-structured interviews ● Blueprints ● Precedent Studies ● Literature Review
Data Analysis Method	<ul style="list-style-type: none"> ● Thematic 	<ul style="list-style-type: none"> ● Thematic 	<ul style="list-style-type: none"> ● Thematic ● Descriptive 	<ul style="list-style-type: none"> ● Thematic
Data Presentation Forms and Style	<ul style="list-style-type: none"> ● Narrative ● Verbatim Quotes 	<ul style="list-style-type: none"> ● Narrative ● Verbatim Quotes ● Sketches ● Images ● Illustrations 	<ul style="list-style-type: none"> ● Narrative ● Sketches ● Images ● Illustrations ● Tables 	<ul style="list-style-type: none"> ● Narrative ● Sketches ● Images ● Illustrations ● Tables

CHAPTER TWO
LITERATURE REVIEW



2.1 INTRODUCTION

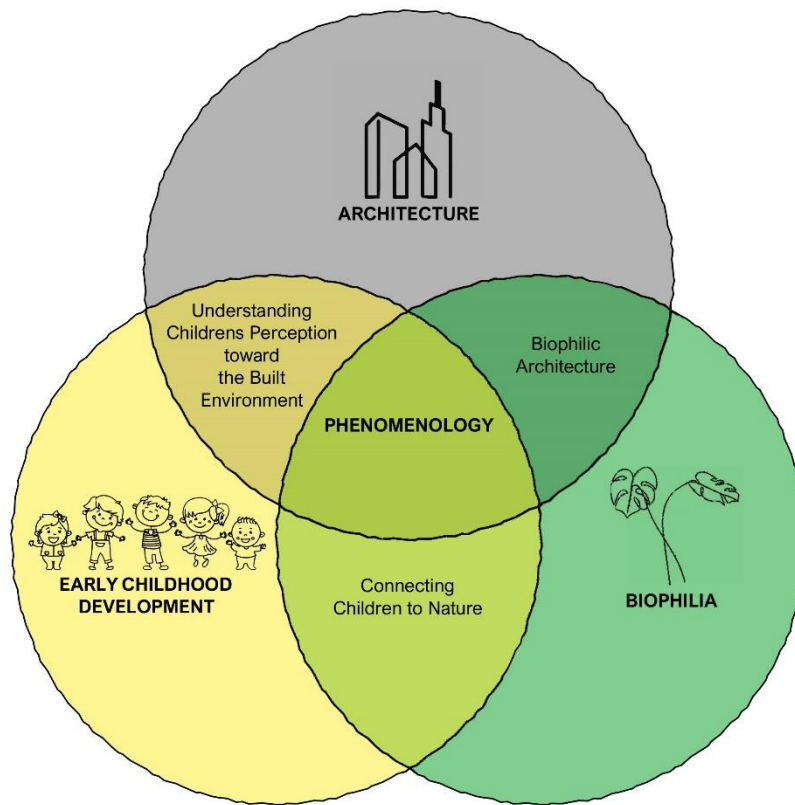


Figure 1: Theoretical Relationship Diagram (2023)

Source: Author

The literature review considers recent research combined with a theoretical and conceptual framework that will address the research problem which focuses on poor infrastructure that affects the quality of ECD education and specifically the marginal consideration given to nature being a part of learning spaces. This issue stems from research investigating the relationship between nature and child development. Richard Louv coined the term “Nature-deficit disorder” in his book titled “the last child in the woods”. This phenomenon has brought forward the notion of how the natural environment positively affects children’s development. The fast-paced, technologically inclined world we live in today doesn’t allow much interaction between people and nature. (Natural Learning Initiative 2012)

This chapter aims to introduce the reader to the concept of architectural phenomenology. In addition, it explores the different aspects of this field. The chapter then tackles the topic of early childhood development, focusing on the needs of the

developing child. Finally, the chapter looks into biophilic design, which is defined as a process in which the relationship between nature and architecture is established. In it, we explore the link between nature, architecture, and children.

2.2. THEORY OF PHENOMENOLOGY

Phenomenology is the essence of something described in terms of how it functions in the lived experience and how it shows itself in consciousness as an object of reflection. This study will look at Martin Heidegger's theory rather than Edmund Husserl's because he believed there was no way to use bracketing in connection to our experiences and there isn't a way to separate ourselves from being in the world. His philosophy uses the Hermeneutic Circle, which is a description of understanding. The interpretation is constant revision as new information is gathered. (Peoples 2017) The experiences of children cannot be researched in a vacuum but rather in their environments to integrate different theories to create something whole to suit the user best.

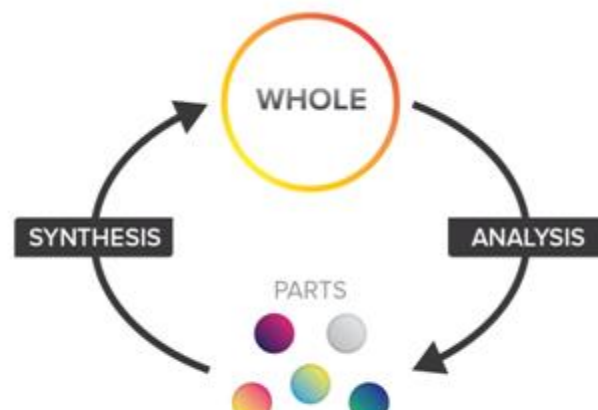


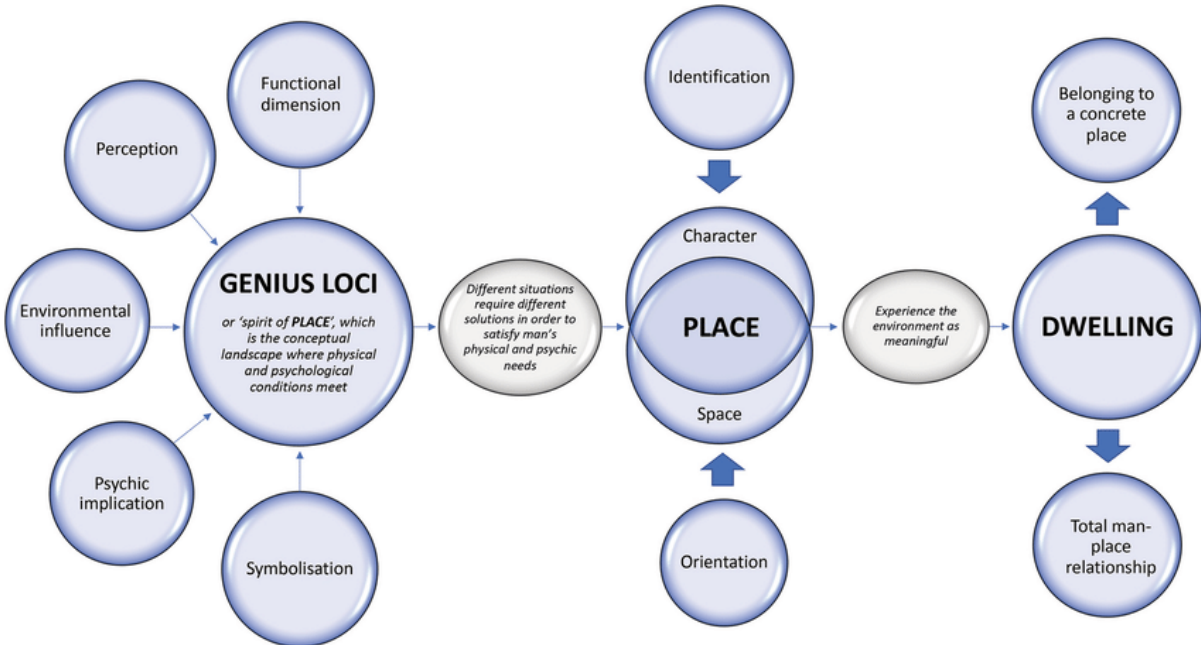
Figure 2: Hermeneutic Circle (2015)

Source: <https://www.uxbooth.com/articles/hermeneutics-for-designers/>

Phenomenology in Architecture took off with Norwegian architect and author, Christian Norberg-Schulz. He needed something less abstract than modern architecture to respond to our architectural requirements and believed that phenomenology was the answer. Some other theorists and architects shared his passion and contributed to the theory within the field. These theorists include Juhani Pallasmaa, Peter Zumthor, Steven Holl and Alberto Perez-Gomez. Swiss architect, Peter Zumthor and New-York based architect, Steven Holl have designed a range of projects with the phenomenological framework as an undertone. (Farzam Kharveri 2019)

Phenomenology recognises a world where both people and their environment coincide and define one another. It is subject to human scrutiny, interaction, and creative participation. (Bognar 1985) The natural world has many characteristics that support positive emotional connections, consequently leading to well-being. Often these connections are developed during childhood and advance into adulthood as a fundamental aspect towards individual experiences of wellbeing. (Schweitzer, Glab and Brymer 2018) The theory of phenomenology is vital when building a theoretical framework towards architectural design with a key function of helping the public by designing spaces for children (Cloete 2016)

2.2.1 ARCHITECTURAL PHENOMENOLOGY



Architectural phenomenology aims to understand the various philosophical ideas that

Figure 3: Conceptual Diagram of Genius Loci (2022)

Source: https://www.researchgate.net/figure/Conceptual-diagram-of-genius-loci_fig1_362937586

are related to the field of architecture. It is a realist attempt to present a comprehensive analysis of the field. Norberg-Schulz's book 'Genius Loci: Towards a Phenomenology of Architecture', is a valuable reference. It provides a comprehensive analysis of architectural phenomenology and can explain how this notion could be applied to design.

According to Spacey 2017 the term 'Genius Loci' was originally used to describe a place's spirit. It was derived from the idea that districts of Rome had their own protective spirits. In current usage, it is a design practice that aims to match a place's

environment, culture, and traditions. The author discusses concepts that arise from this phenomenon. Organic Architecture creates structures that blend into their surroundings, landscaping that matches the site's characteristics and Urban Design, which aims to reflect the area's history and culture.

2.2.2 ENVIRONMENTAL APPROACH

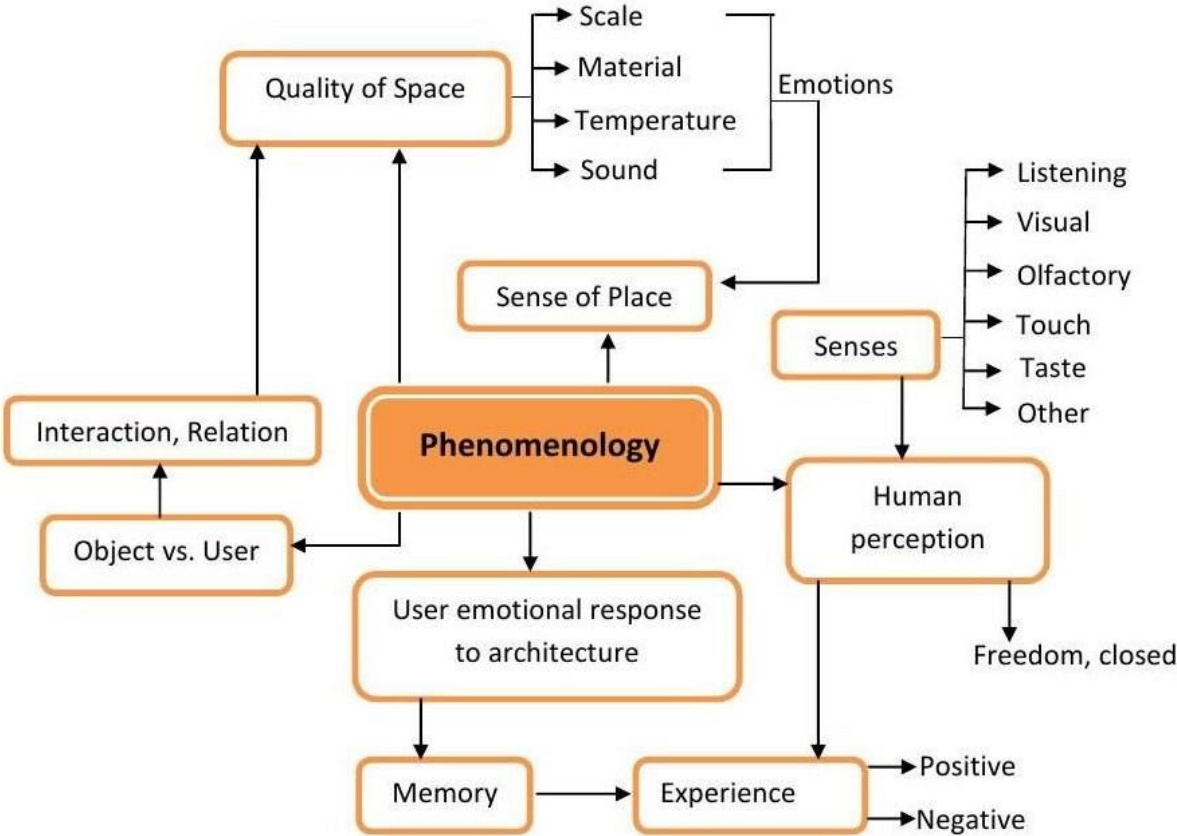


Figure 4: Phenomenology and its Aspects (2017)
 Source: <https://pa101216harishkumarkeytexts.wordpress.com/2017/04/03/the-meaning-of-space/>

[Table 1] shows the schedule of Forest Kindergarten and how they incorporate play-based learning throughout the day.

Table 1: Daily Schedule of Forest Kindergarten

Source: Kahrیمان-Pamuk & Ahi (2019)

Daily Schedule of Forest Kindergarten	
08.15	Opening of the school Free time in the playground Breakfast
08:45	Yoga-Conscious awareness activities Preparation for the forest
09.30-12.00	Forest time Discovery in the forest Free play in the forest Non-structured, semi-structured and structured activities in the forest
12.00-13:00	Lunch
14:00	Free play or activities in the forest or school. Branch courses (English/Music/Drama)
15.00	Time for foodstuff Free play
16:30	Closure of the school

2.2.3 THE PERCEPTION OF YOUNG MINDS



**“Growing children need life-rich food.
They don’t grow up healthy on deprived diets.
Nutrition doesn’t only enter us by the mouth,
But through all the senses.” (Day 2004)**

In kindergartens, schools and parks, children are the main users. The design development of those spaces are handled by architects that need to take the responsibility of ensuring that the built environment has something to offer its users. Children need places to play and explore. They need the physical place to be designed specific to their needs and the digital age also needs to be considered. (Castro 2021)

According to Sardello (1974), Maurice Merleau-Ponty's work shows that childhood and adult perceptions differed in content and organisation. Ponty wanted to understand the way childhood consciousness was structured within child psychology. A child’s awareness of their surroundings needed to be looked at positively, not to be compared to an adult whereby the child is then seen as either having incomplete or imperfect adult consciousness. While adults live in a material reality that is known and unchanging, children often live in an imaginary world. This means that even single rooms, gardens, and forgotten places can be filled with various moods and geographies. (Day and Midbjer 2007) There could be three approaches concerning childhood awareness. Apart from the classical point of view where we look at what is lacking, many psychologists look at the expressions of childhood awareness. This approach however has been studied in terms of adult awareness. The final approach,

which is more of interest to this research due to its positive nature, is the phenomenological approach. It is a form of qualitative study that strives to express the formal structures of childhood awareness by characterising it with particular situated descriptions. (Sardello 1974)

Pallasmaa, (2011) conceptualised senses as a hierarchical system that spanned from the uppermost sense of vision to the lowest sense of touch. The concepts of the senses are related to nature and linked to, sight or vision with light and fire, hearing with air, taste with water, smell with vapour, and touch with the earth. The various senses are used to describe the interactions between people in architecture facilitating the perception of the world around them. The author discusses that designers use the multiple sensory factors that are involved in the design process to create a sense of beauty and harmony and that an architectural experience is designed to silence the external noise around us allowing us to experience the inner peace of being alone. One of the strongest memories of space is its odour. A certain smell can trigger an urge to return to a space that has been erased from our memories. The nostrils can also project a forgotten image, making us enter a dream. (Pallasmaa 2011) He theorised that, through the utilisation of architecture, people can better comprehend tradition and time.

2.3 CHILDHOOD DEVELOPMENT

According to Heckman & Krueger 2003, as cited in Western Cape Government 2011-2016, early childhood education can yield higher economic returns than any other intervention at any given time. In particular, their research found that these programs for disadvantaged children are more cost-effective than those that are later introduced, such as job training or reducing the teacher-pupil ratios.

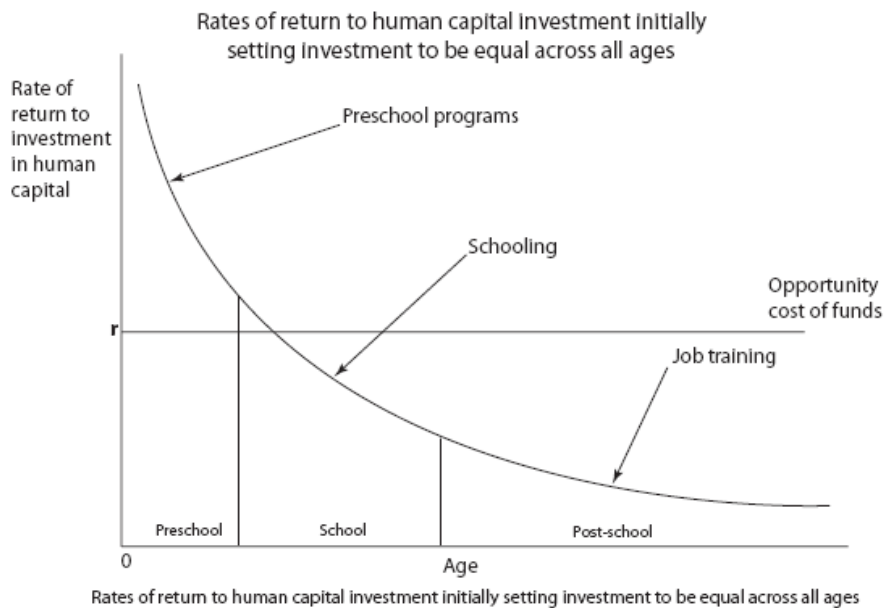


Figure 5: Economic benefits of interventions early in Life (2003)

Source: Heckman & Krueger 2003 as cited in Western Cape Government 2011-2016

The effects of kindergarten programs on children's behavioural and educational outcomes can be seen in Figure 5. Although most studies on the subject only look at the effects of behavioural problems, it is important to note that these problems are often linked to mental disorders in later life. (American Psychiatric Association 1994 as cited in Western Cape Government 2011-2016)

According to the Centre on the developing child at Harvard University (2021), we can build a good foundation for childhood development by strengthening relationships, building core skills, and reducing stress. These principals as seen in [Figure 6] work closely hand in hand with each other.

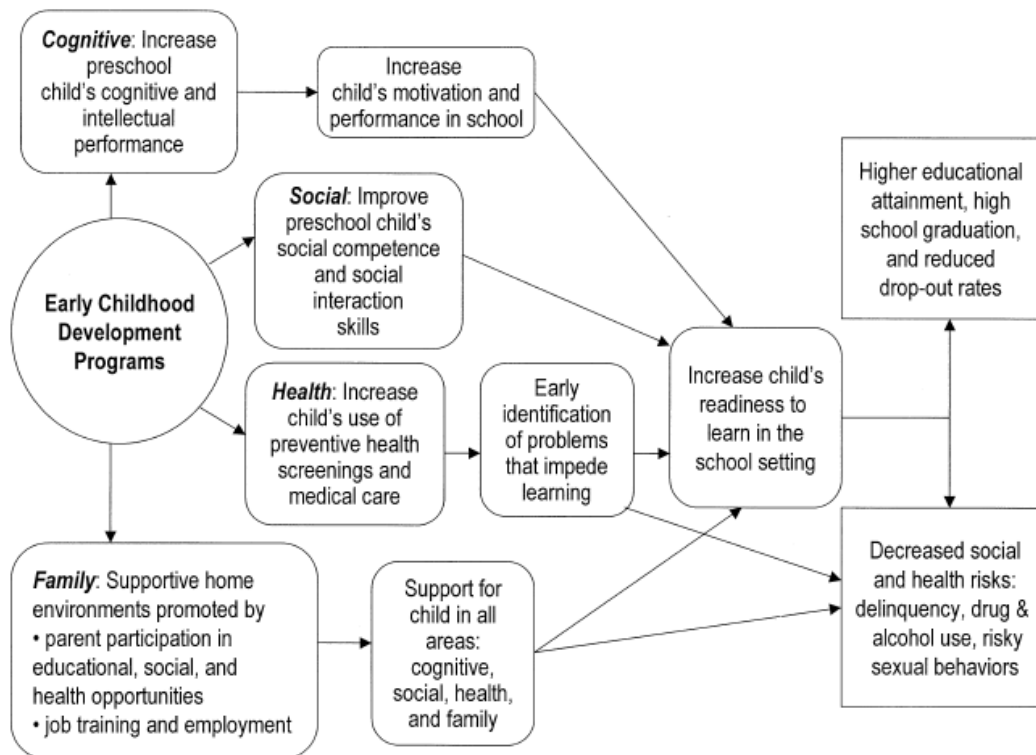


Figure 6: the postulated mechanisms through which access to high quality kindergartens improves educational, social and health outcomes. (2003)

Source: Anderson et al 2003, as cited in Western Cape Government 2011-2016

2.3.1 EARLY CHILDHOOD DEVELOPMENT IN SOUTH AFRICA

According to the Department of Basic Education (2021) in the State of the Nation Address made in 2019, President Cyril Ramaphosa stated that the functions of the ECD would be transferred from the Department of Social Development to the Department of Basic Education in April 2022. The DBE relies on the information collected through the baseline assessment and South Africa's Early Years Index to report on the implementation of the United Nation's "Sustainable Development Goals," shown in [Figure 7]. These goals are seventeen interlinked objectives that were conceptualised as an outline for global peace and prosperity. By 2030, girls and boys should have equal access to pre-primary education and quality early childhood care. This will enable them to be ready for primary school. The DBE also aims to monitor the improvement of the quality of early childhood education and childcare over the next ten years. (Department of Basic Education 2021) Programs in South Africa differ from those in other countries due to how they prioritise social transformation. In addition, the nation has a sordid history of racial division and inequality, as well as its workforce needs to be professionalised. (Department of Basic Education 2015)



Figure 7: The Sustainable Development Goals in South Africa (2023)

Source: <https://southafrica.un.org/en/sdgs/8>

According to the Republic of South Africa (2015), the objectives of South Africa's ECD Policy are as follows:

- Stage appropriate and comprehensive age-related ECD services and guarantee universal access.
- Ensure that all ECD users have equitable access to the services.
- Empower parents and ensure that they have equal access to ECD services.
- The harmonisation and alignment of programs and policies across different sectors should be ensured.
- Make sure that leaders are competent and effective.

South Africa is still in the process of building its ECD offering however according to Mouton, Louw & Strydom (2012), poverty, crime, and drug abuse are some of the factors that commonly affect people in disadvantaged communities. In addition, political corruption and economic problems are also prevalent in the South African education system. (Mouton, Louw & Strydom, 2012) The authors point out that there are still areas of excellence in South Africa, but they are mainly due to the efforts of capable individuals. To ensure that the system's success rate continues to improve, it

is important that the various factors that affect education, such as the social fabric, are put in place, therefore effort must be put into communities, schools, families, and individuals. (Mouton, Louw & Strydom, 2012) The South African ECD framework requirements can be found in Appendix 7, entitled, “South African Government Regulations and Policies for Registration of Early Childhood Development Centres”

Through the program, known as P.L.A.Y. (Powerful Learning Around You), teachers and professionals from various fields were trained, aiming to strengthen the use of play as a method and tool for early learning. It will also contribute to the development of children's health, nutrition, and protection by helping them develop their skills more systematically. (DBE 2021)

Limpopo Education (2023) discusses in a provincial budget speech that a government program provides school children with nutritious food, described as the Sustainable School Nutrition Initiative, named the National School Nutrition Programme (NSNP). Through collaboration with the Agriculture Department, it aims to produce sustainable food. The program's participating schools are then encouraged to participate in an annual awards competition. The school won both the provincial and national categories of the Best School Awards in the 2022/23 financial year. The kitchen, which will be constructed for R800 000, will be used by the staff members to provide nutritious meals to the learners. 10 460 Voluntary Food workers also assisted them. The government also appoints volunteers to assist the beneficiary schools in preparing nutritious meals for the children within those schools (Limpopo Education 2023)

2.3.2 CORE PRINCIPALS OF DEVELOPMENT

Three core-scientific principles can guide societies to help children and their families flourish. These principles involve strengthening relationships between children and their caregivers, building core skills and lastly reducing stress. (Centre on the developing child at Harvard University 2019)

2.3.2.1 Strengthen relationships

Attachment Theory (John Bowlby and Mary Ainsworth)

Psychologist John Bowlby was the first to coin the term as his work focused on childhood development and how it depends greatly deal on a child's ability to create a

well-built relationship with a principal caregiver; commonly, this would be a parent. (Psychologist World 2022)

Bowlby's studies in natural childhood development concluded that when a child forms a well-built attachment towards a parent or caregiver, it provides an essential sense of security and foundation. Without this type of relationship, Bowlby found that much of the energy used on development is spent in the search for stability and security. Children without these attachments are more fearful and less keen on engaging and learning from new experiences, whereas a child that has developed that strong attachment to their parent tends to be more risky and enthusiastic about experiencing something new, which is important to learning and development. (Psychologist World 2022)

Psychologist, Mary Ainsworth (1963) observed infants, finding that those children who seemed more strongly attached to their caregivers protested the least or experienced the least separation anxiety, instead, they showed the strength of their attachment to the primary caregiver by using the care-giver as a secure base from which they could discover the world and increase their perspective. (Bowlby 1969)

2.3.2.2 Building Core Skills

Theory of Cognitive Development (Jean Piaget)

Jean Piaget, a Swiss psychologist, and one of the most widely known theorists of cognitive development has studied how children and youth develop towards being logical and scientific in different stages of their lives. He proposed four main stages of cognitive development; sensory-motor intelligence, preoperational thinking, concrete operational thinking and formal operational thinking. Each stage is correlated with an approximate age period of childhood. The first two stages embody the development of children between birth and 7 years; therefore the focus would lie on those stages towards this study. (Cherry 2022)

According to the Dictionary of Psychology, sensorimotor intelligence is the knowledge that is gained through sensory awareness and motor actions involving objects in the environment. This form of cognition distinguishes children in the sensorimotor stage.

Piaget believed that children took an active position by building understanding while interacting with the world during this cognitive development stage. (Cherry 2019)

Piaget and the Sensorimotor Stage

Piaget understood that there was constant maintenance of reaching cognitive balance or equilibrium when joining new knowledge with what we learned prior. (Piaget, 1954) This becomes much more challenging with children because they are tackling new scenarios, words and objects continually. Our brains organise the information in a place like a bank which is known as a Schema. The processes that feed into the organisation of the information learned are called assimilation and accommodation. (Lally & Valentine-French 2019) Assimilation of knowledge is experienced when new ideas are met and then organised into the existing schema. Accommodation of knowledge is more significant, as it requires modifying and reshaping what we believe we know already. (Heick, 2022) For example, distinguishing the difference between a horse and a zebra means the child has accommodated their knowledge to include both a horse and zebra schema. (Lally & Valentine-French 2019) The processes of Assimilation and accommodation lead to understanding; without it, the new idea would need to be further studied or discarded. (Lally & Valentine-French 2019)

Piagetian thought states that infants learn about the world through their sense of touch and sensory abilities. These abilities help them develop the cognitive skills that they will need to succeed in the future. The first stage of cognitive growth is referred to as the Sensorimotor Period. It occurs in six sub-stages. [Table 2] below shows the ages of each sub-stage.

Table 2: Infant Ages for the six sub-stages of the sensorimotor period

Source: <https://courses.lumenlearning.com/suny-lifespandevelopment/chapter/piaget-and-the-sensorimotor-stage/>

Sub-stage 1	Reflexes (0–1 month)
Sub-stage 2	Primary Circular Reactions (1–4 months)
Sub-stage 3	Secondary Circular Reactions (4–8 months)
Sub-stage 4	Coordination of Secondary Circular Reactions (8–12 months)
Sub-stage 5	Tertiary Circular Reactions (12–18 months)
Sub-stage 6	Beginning of Representational Thought (18–24 months)

Lally & Valentine-French (2019) discuss the 6 sub-stages in their book entitled, *Lifespan Development: A psychological perspective*, which has been summarised below:

Early infants start to learn about the world through their reflexes, such as when they grasp, reach, and suck. They eventually develop a more purposeful and deliberate use of these reflexes. During the next three months, babies start to actively involve themselves in various forms of repeated activities. Their interest in a particular activity can trigger their primary circular reaction. For instance, if an infant accidentally engages in a behaviour, such as making a vocalisation, this activity can help them learn a new skill. Early childhood development between 4 to 8 months involves the development of secondary circular reactions by children as they start interacting with objects in their environment. Initially, they may accidentally interact with certain objects, but then they start to deliberate and repeat these actions. They are also more likely to be involved in other activities outside of their home. (Lally & Valentine-French 2019)

In the fourth sub-stage, babies start to develop secondary circular reactions. They then combine these with their basic reflexes to achieve a specific goal. They can also participate in behaviours that other people perform. Because of the continued development of their prefrontal cortex, they can carry out planned and objective-directed actions. For instance, as an infant sees a toy car under a kitchen table, they start to reach and grab it. Toddlers are referred to as little scientists because they start experimenting with the world in a trial-and-error manner between 12 and 18 months.

They use their planning and motor skills to explore it. For instance, they can throw a ball down the stairs to see how it will fall. Their active involvement in learning helps them better understand their environment. The sensorimotor period ends with the appearance of representational or symbolic thought. During this time, a toddler has a basic understanding of objects being used as symbols. They can also solve problems using various mental strategies, such as remembering and repeating what was said days before. This initial movement from a hands-on approach to learning about the world gradually leads to the development of preoperational thought. (Lally & Valentine-French 2019)

The second stage in Jean Piaget's theory of cognitive development is the Preoperational Stage of Cognitive Development. This stage starts when a child is two years and ends until roughly seven years. Children think at a symbolic level during this stage, although they don't use cognitive operations. (McLeod 2018)

Piaget's Preoperational Stage of Cognitive Development

During the preoperational period, children develop two phases: the Symbolic Function Sub-stage and the Intuitive Thought Sub-stage. The first stage is when children can mentally represent a non-existent object and develop a dependence on perception. The second stage is when they can rely more on intuitive thinking. At this stage, children start asking many questions as they try to understand the world around them. (Lally & Valentine-French 2019)

Pretend Play: During this time, playing pretend is a favourite activity. It allows children to develop their cognitive skills by pretending to be something different. For instance, a toy can be used to represent a character or a certain object. According to Piaget, children can develop new schemata through play. The play reflects the children's thoughts and conceptions at the time and teaches them valuable lessons. (Lally & Valentine-French 2019)

Early childhood development is characterised by egocentrism which prevents children from taking the perspective of others. This condition prevents them from perceiving the world around them as a whole and from identifying with other people's perspectives. (Lally & Valentine-French 2019)

In an experiment conducted by Piaget and Barbel (1967), children were shown a three-dimensional model of a mountain and were asked to describe what a doll would look like from a different angle. By the age of 7, children are less self-centred. They tend to prefer to use pictures that represent their perspective instead of the doll. Also, when talking to other people, they sometimes use different vocabulary and sentence structures when addressing older or younger individuals. This indicates that they are aware of other people's points of view. (Lally & Valentine-French 2019)



Figure 6: "What does Dolly see" (2019)

Source: <https://courses.lumenlearning.com/suny-lifespandevelopment/chapter/piaget-and-the-sensorimotor-stage/>

2.3.2.3 Reducing sources of stress

Stress is a common life factor and children are not excluded. These stresses come in both positive and negative forms. As much as engaging in stress can motivate us, too much of it can be overpowering creating something very negative within our lives. Childminders need to be aware of the factors that cause children to experience different forms of stress so that they can design programs to help children cope better. (Childcare 2019)

According to Childcare (2019), examples of stressful situations children in childcare experience due to the following:

- changes in routines
- a new childcare setting
- conflict with peers or bullying
- lack of sleep
- overcrowded child care settings
- a new sibling
- loss of a loved one
- conflict at home

Both children and adults need to learn how to manage stress effectively. In a study, Mincemoyer (2019) noted that various stress-relieving activities can be incorporated into the daily routines of children in childcare facilities. Although stress is often associated with grown-ups, children can still experience it. It can be caused by various factors such as school, homework, and family conflicts. There are various ways children experience stress. It can be referred to as a physical reaction such as a headache or crying, or a behavioural or emotional reaction like shyness or worry. Its effects can vary depending on the age of the child. Early childhood development practitioners can help children identify and manage their stress levels by implementing effective stress-relief strategies. (Mincemoyer 2019)

Exercise

One of the most effective stress-relieving activities that children can do is participate in organized sports or easily spend time playing outside with their friends. This can help them feel less stressed and decrease their chances of experiencing a negative reaction to their environment.

Deep breathing

Kids can also learn how to practice deep breathing exercises to reduce stress. With the help of adults, children can count to four as they breathe in and four as they exhale. The exercise should be repeated several times until the child is calm.

Muscle relaxation

Relaxation exercises can help children relieve stress. With the help of adults, kids can learn to relax and tense up various muscle groups while lying down. The activity begins at the top of their head and involves moving toward their toes. The child then releases the tension from one muscle group and continues moving toward that group until their entire body is warmed up.

Visual imagery

This activity can help children develop positive and relaxing thoughts and images. They can then identify a favourite place or time in their lives. After closing their eyes, they can imagine themselves there.

Sensory activities

Various sensory activities can also help children relieve stress. One of these is playing with play dough, which provides a fun and relaxing experience. It can be used to help children free stress by allowing them to pound, squeeze, and manipulate it. A stress ball is a similar type of activity that children can enjoy because it lets them squeeze a ball. Other great activities include finger painting as well as using sand and water in other sensory activities.

Hobbies

Children can engage in any activity that they enjoy doing. Participating in a hobby can give them a break from stressful situations with something they get pleasure from and a chance to look at the situation from a different perspective. If they don't have a passion for a particular hobby, providers can offer them different types of activities. Some of these include music, art, science, and reading.

Music

Some kids can reduce their stress levels by dancing to music or exercising. Practitioners can also help them relax by introducing them to various styles and types of music.

Healthy lifestyles

Kids should eat nutritious snacks and meals throughout the day to get the energy they need to face the day. Although caffeinated and sugar-filled food can give them a short

energy boost, they eventually feel tired once it wears off. Getting enough sleep is also important to help them think clearly and face upcoming challenges.

Talking about stress

Even the smallest problems can be addressed by caregivers. They can listen to and provide advice if the child wants it, though some may just want to talk to an adult. With storytime, if the teacher selects an appropriate narrative, children can relate to the characters that are going through difficult situations. They can also learn how to solve personal problems through these stories.

Many activities are considered part of an architectural brief. They help inform the design process and provide a deeper understanding of the space overall. The brief is created to identify the various needs of the project. It then provides a detailed analysis of the space and its potential. This helps the designer come up with a solution that is ideal for the client.

2.3.2.4 Why should the health sector play a role in ECD services?

Both child development and health are interrelated. One of these is the impact of poor health on a child's development, while the other is the sector's potential to improve it. South Africa's health care system is the only one that can effectively address the needs of all kids under three years old. Having a positive influence on a child's development is very important for professionals. Through regular clinic visits and antenatal care, healthcare providers can help influence the development of a child's health. They can also provide other services such as psychological and social support. (Slemming & Saloojee 2013)

According to the WHO (2011), health is a state of well-being and including early childhood development in the health system is consistent with this. Health systems play a vital role in addressing the needs of children with special needs and those at risk of developing social or biological issues. They can also promote good parenting practices and provide early stimulation for all children. The health sector has the best access to mothers and babies during the first few years of a child's life.

2.3.2.5 Community Involvement in ECD Facilities

Being involved in the community is beneficial for various aspects of life. It can have a positive impact on the work environment and company culture of companies, schools, and towns all around the world. One of the most inspiring examples of how it can make a difference in society is by helping children develop early. Children develop physical, emotional, and intellectual abilities through relationships and community. They may find this in their homes, schools, or playgrounds. Being involved in the community can also have long-term benefits for children. It can help them develop a sense of belonging and build their identity. According to the National Education Association the proverb, “A village can raise a child.” It goes on to say that the entire community plays a vital role in children’s growth. Family members, and parents, play a significant role in their child's life, but so does the community as a whole. (all4kids 2018)

2.3.3 BUILDING A STRONG FOUNDATION THROUGH PLAY

Ecology is a natural process that evolves and children are naturally designed to learn about their living environments and to mature and develop within that world through free play. (Moore 1997)

Play is an active way of supporting all three core principles set out by the Centre on the developing child at Harvard University (2019) as a means towards the development of children. The social interactions that children experience, strengthen relationships, while their core skills are developed through the same interactions as well as the interactions they have with their environments which help in structuring their brains. The factor that supports reducing sources of stress is the emotional attachment to those spaces and the pure happiness that the children experience when playing. This is what helps children withstand tremendous hardships.

Said (2007) discusses how children gain most of their childhood developmental experiences through fantasy, wonder and most importantly through play. Their imagination and dramatic roles help reinvent their worlds. Early childhood development is a time of fantasy, wonder, and play. Children know the world as an opportunity for imagination and drama where their worlds are being reinvented all the time. They are continuously trying on new characters, and find it difficult to play their parts seamlessly. While engaging in sensory and motor activities children gain skills in language and

communication. Their surroundings play a big part in the physical movement that is experienced. The functions and features of these spaces encourage this movement, where indoors the influence comes from things like furniture and toys (Olds 1987, as cited in Said 2007), and outdoors, its plants and animals that influence the child's movement. (Kellert, 2002) "Their responses to the environments are immediate and inseparable from the sources of stimulation around them" (Olds 1987, as cited in Said 2007) For example, a study by Said (2006) established that children who recognised foreign environments reacted negatively, as opposed to, when they played in the garden, with the presence of plants, animals and insects their cognitive function improved.

Apart from being child-centred, forest schools are also known to provide kids with various opportunities to develop their skills outside of the classroom. These schools use natural resources to carry out play-based learning activities, which are designed to improve children's self-esteem, collaboration, and problem-solving abilities. A study revealed that these schools help children develop their physical and academic abilities by exposing them to various activities and environments rich in natural resources. They also help them build their positive attitudes toward learning by encouraging them to explore and take risks. (Kahrman-Pamuk & Ahi 2019)

The importance of creativity, imagination, persistence, and curiosity characterises early childhood development. Through sensory architecture, children can develop their sense of wonder and imagination. This stimulates their emotional response and turns their sensations into memories. (Saieh 2010).

First Discoverers (n.d) recognise Charlotte Buhler's early attempt at dividing play into four categories based on the content. The first category is functional play, which involves the practice of basic movements such as clapping and kicking. During the second year of a child's life, fiction play often involves behaviours such as treating dolls as real babies. The receptive play follows shortly after, and it's where children engage with photos or listen to stories. Constructive play is often observed around the end of the second year of a child's life. This type of play involves using various materials such as sand, mud, and bricks. The fifth category is a play involving rules, which is typically introduced around the nursery school years. The first four categories usually peak

around seven years old, while the last one, sports, becomes more important as children age.

At around the age of three to six months, babies start to actively interact with other people. They then start playing baby games and using their caregivers for entertainment. This stage is characterised by repetitive play, with varying intensity levels based on the baby's responses. At the age of two, the social interactions of toddlers with other kids will extend beyond their caregivers. Children ages three to six develop their cognitive abilities and social skills through play. For instance, kids in this stage can imagine a concept and then develop it into a situation that they can act out with their peers. At around the age of four to five, children start to form friendships, with some choosing to be with their preferred group and forming similar fantasy personas with their peers. As they grow older, they develop more complex conflicts because of the play's narrative direction, resulting in more time spent playing together and strategies to resolve disputes. (Scott & Cogburn 2022)

The idea of children playing with other children of the same age is a relatively new one. It has been made starker by the current education system, which separates children based on their age. Throughout history, children have played with other children of various ages in multi-group settings. Unfortunately, it is very rare to find activities that cater to the mixed-age population. (Gallo 2020) According to Gray (2007) playing mixed-age games can help children develop their moral reasoning and increase their cognitive abilities. It can also help them understand concepts that they may not have considered before. (Gray 2007) According to Dr Peter Gray, children can learn from older siblings even when they're not playing together. He said that kids tend to imitate the actions of older kids when they see them doing something. For instance, they might climb trees or learn to solve puzzles simply by being in the presence of older children and watching those children engage in those activities. Research has shown that interacting with younger children can also be beneficial by growing kinder children. In different cultures, it has been observed that playing together with other children helps them develop their social skills and attitudes toward others. When children are in mixed age groups, they tend to adopt new behaviours to meet the varying needs of the group. (Gray 2007)

2.3.4 THE LEARNING ENVIRONMENT

Different types of landscapes, such as physical, psychological, and emotional environments, have an impact on learning. (WGU 2021) This encompasses classroom management techniques, as well as how teachers handle student interactions and how the space is organized and maintained. (Watts nd) Fosterable, caring, and safe environments promote the development of children from infants to preschool age. They also help prevent difficult behaviours and play a vital role in the treatment of kids with special needs. (Schwartz nd) The DEC (Division of early childhood) recommendations highlight the importance of environmental practices in supporting children's learning.

They help families and practitioners design environments that can be modified to support childhood learning across different developmental stages. (Schwartz nd) Most childcare and preschool professionals are not sure how to design environments that support children's learning in different developmental stages. (Schwartz nd) Learning environments can have a huge impact on a student's success. For example, positive environments can help boost a children's motivation and academic performance. On the other hand, a negative one can make it harder for them to retain what they learn and reduce their achievement. (Watts nd) Studies reveal that the design of environments that support children's learning in different developmental stages is related to their relationship with various physical and emotional aspects. (Baars, Schellings, Joore, *et al* 2023) These three categories that influence the learning environment are further explained below.

2.3.4.1 The Physical Environment

The various elements that characterize a work environment, such as equipment, furniture, and buildings, are collectively referred to as the "physical environment." This also includes the learning environment that utilizes technology. (Aksovaara & Maunonen-Eskelinen 2014) Brooks (2010) study revealed that the type of learning environment that children are in can have a significant impact on their academic performance. It found that those who were exposed to an active learning setting performed better than those who were in a conventional environment.

In the past few years, distance learning and at-home learning have become a part of the school environment. For parents, this has resulted in them having to make various adjustments to their homes to accommodate their children. Some of these include creating a separate area for them to study and attend class, as well as leaving that environment behind once the class has ended. (WGU 2021)

The domination of adults in the design and planning of children's space can be seen in many kindergartens. The practice most likely confines the young children inside the building and occasionally allows the children to engage with outdoor spaces such as the garden and lawn area. Indoor, the children may engage in experiences with a variety of furniture and plastic toys in a controlled micro-climate where temperature, lighting and humidity are similar throughout their stay in the building. In other words, much of the children's cognitive development results from a routine experience in a confined space. Eventually, the children understand that architecture is an element that affords little change. This phenomenon contrasts Piaget's Theory of childhood development that children are active and motivated learners (McDevit and Ormrod, 2002).

a) Seven Principles of classroom design

Kaplan Early Learning Company (2010) derives seven principles towards early childhood classroom design. The principles focus on, colour, furnishings, texture, displays, elements and focal points. The classroom plays a significant role in learning and development and therefore must be featured in this research.

Nature Inspires Beauty

Children must be exposed to nature for them to comprehend the world around them. This can be achieved through their interactions with their surroundings as illustrated in [Figure 8] and [Figure 9]



Figure 8: Using Natural Elements during outdoor play (2022)
Source: Author compiled



Figure 9: Using natural elements in the classroom (2022)
Source: Author Compiled

Colour Generates Interest

Colour can play a significant role in the design of a room, whether it's neutral, positive or negative. It can create a mood or provide a suitable environment for kids. (KELC 2010) A warm and welcoming environment can help children feel safe and comfortable. Creating a space that's sterile can be achieved by adding color. When it comes to decorating a classroom, teachers should consider the various factors that affect the children's feelings. For instance, orange and red can make them feel anxious, while green and blue can calm them down. Dark colors can also negatively affect the natural sunlight in a room, making people feel drowsy and disoriented. (Bucholz & Sheffler 2009)

Furnishings Define Space

Classroom furniture is often utilised to determine the areas where kids can play. Having the right items and sizes can help improve their playtime. (KELC 2010) Studies have been conducted on the idea that the PLE (Personal Learning Environment) should be able to meet the various learning styles that are used in innovative education. Fisher (2006, 2007) suggests using at least three learning methods in the PLE. The teacher-centered approach involves using furniture arrangements that are designed to accommodate presentations. The student-centered method involves using concentric arrangements for collaboration. Lastly, the informal approach involves using casual furniture sets for interactions. According to studies, such spaces can stimulate the development of more student-centered pedagogies. They can also help teachers adapt their teaching styles. In addition, the students are more likely to engage in creative and active learning activities when they are in these environments. (Baars, Schellings, Joore, *et al*/2023)

Texture Adds Depth

Children develop observational and fine motor skills through various tactile experiences. These include textiles, sculptures, and weaving.

Displays Enhance Environment

Displaying and organising different materials, and keeping the clutter at bay can make a classroom feel welcoming and encouraging.

Elements Heighten Ambiance

A tranquil and uplifting atmosphere can be achieved through the use of various sources of light. It can help children develop their social skills and imagination.

Focal Points Attract Attention

A well-designed area with a focal point can create an inspirational and tranquil environment that encourages kids to interact with others and develop their imagination. It can also highlight the different educational resources that are available.

b) Ergonomics and Anthropometrics

An anthropometric is a field that studies the functions and dimensions of the human body. There are two types of assessments in this field: static and dynamic. The former measures the body's rest, while the latter measures the activities that are defined as work. The diversity of the human population can cause Dimensional variations. (The American Institute of Architects, Hall & Giglio 2016)

According to The American Institute of Architects, Hall & Giglio (2016), a designer must identify the subject groups that fall under the anthropometric categories to utilise the charts effectively. Human variations can be caused by various factors such as race, gender, and age. Patterns of growth that are influenced by human culture can also affect the human measure. The frequency of occurrence of various types of deviations from the standard is referred to as the percentiles. These are the mean, small, and large extreme percentiles. In ergonomics, the use of human factors data is carried out to design products.

The US Army coined the term ergonomics when it started to design machines that fit humans instead of trying to find them to fit machines. (The American Institute of Architects, Hall & Giglio 2016) The authors discuss how human factors data are utilised in this field to design products. Age, race, gender, and ethnicity are the factors that cause people to have variations in their physical appearance. Anthropometrics also provides information about the human body's functional capacity and dimensions. (The American Institute of Architects, Hall & Giglio 2016)

The American Institute of Architects, Hall & Giglio (2016), found the concept of universal design aims to empower and enable a diverse population by improving the health and wellness of individuals. Ergonomics and Anthropometrics explore the various requirements for creating an accessible design. It also offers suggestions on how designers can exceed these minimums to provide a more welcoming environment.

When designing a children's facility, the designer should consider the needs of children and their interactions with their environment while accommodating their preferences. As technology improves, accessibility will continue to change. (The American Institute of Architects, Hall & Giglio 2016)

2.3.4.2 The Psychological Environment

According to Aksovaara and Maunonen-Eskelinen (2014), the psychological component of learning pertains to the cognitive realm, which enables the acquisition of knowledge. The use of psychological resources can help students feel safe and welcomed in a school setting. (Watts 2023) By fostering a positive psychological atmosphere, students develop their personal and academic skills and enhance their engagement with the curriculum. (WGU 2021)

Children have psychological needs related to love, security, novelty, power, and belonging. It's crucial that teachers and the school address these necessities at all times to help them progress. (WGU 2021) According to WGU (2021), teachers can foster a secure environment conducive to learning by developing trust and making everyone feel at ease. (Movchan 2023) In addition, allowing children to ask questions (Watts 2023) through curiosity (WGU 2021), risk-taking, and giving feedback (Watts 2023; WGU 2021), they can help improve the process efficiency (WGU 2021) to cultivate a positive mind set. (Movchan 2023)

Learning environments that accommodate these needs can help children become more engaged and happier. There will be fewer behavioural issues in such settings, which also helps children develop the right attitudes toward learning. (Movchan 2023)

2.3.4.4 The Emotional Environment

The various elements of a social learning environment, such as the structure and social network, are influenced by the individuals who are involved in the process. (Aksovaara & Maunonen-Eskelinen 2014) Interactions between educators, students, and other personnel within the learning centre can have a substantial impact on the establishment of a favourable learning atmosphere. (Movchan 2023)

The emotional well-being of students can be affected by school stress at any age, which is why they require a positive space that enables their educational journey. (WGU 2021) One of the most important factors that a school must consider when it comes to creating a safe environment for students is the availability of their emotional freedom and self-expression. (WGU 2021) A learning environment should stimulate positive emotions like happiness and hope, while it also minimizes negative emotions like fear or doubt about a learner's ability to complete a particular task or learn new materials successfully. (Movchan 2023)

Teachers can help children develop their emotional intelligence by supporting their feelings and emotional needs. (WGU 2021) They can also create routines that will encourage students to develop their independence and make them feel valued. (WGU 2021) This type of environment can also be created when teachers get to know the children's individual interests apart from their academic work. (Movchan 2023)

2.4 BIOPHILIA: a natural connection

Biophilia is a term that refers to the idea that people need to connect with nature to thrive. It was first coined by Erich Fromm in 1964 and was popularized by Edward Wilson in the 1980s. (Hunt 2020) Edward Wilson used it to discuss his belief that humans are drawn to the natural world. (eds. Kellert and Wilson 1993) Studies demonstrate that views of nature help hospital patients recover more quickly, natural daylight improves students' learning in school, and people who work in offices with indoor plants get sick less often. Browning, Ryan and Clancy (2014), and Kellert and Calabrese (2015) proposed frameworks meant to guide designers on how to create healthy, productive spaces. Biophilia and its connection with the built environment give this research an in-depth understanding of the research problem.

2.4.1 CHILDREN AND NATURE

In his article, Kellert (2002) discusses that a considerable portion of children today, go on to have rich rewarding opportunities by experiencing nature. This theory is in line with the research by Taylor (2002) stating that children with visual and physical contact with nature score higher on tests of concentration and self-discipline. The more interaction with nature results in better scores, furthermore Dymont & Bell's (2006) research paper states that children who experience school grounds with diverse natural settings are more physically active, more aware of nutrition, more civil to one another and more creative.

Play in nature is especially important for developing capacities for creativity, problem-solving, and intellectual development (Kellert 2005). The benefits of free play in the great outdoors improve gross motor, fine motor, sensory and cognitive skills through nature's therapeutic design. Free play challenges children to develop social skills which are fundamental in everyday life. (Bowen 2015)

Previous research has established that biophilia can positively affect stress management and healthcare. The natural world offers a tranquil influence on the body and mind, dissipating stress and improving academic performance. (Kaushik 2023) Contact with the natural world can significantly reduce symptoms of attention deficit disorder in children as young as five years old (Kuo & Taylor 2008).

Most children will not engage in good quality natural settings until the adults that plan, teach, develop, lead and grow those children change their perspectives regarding nature's positive influence on its users. We need a fundamental modification in how we design and build our environments and we need communities that intentionally seek to integrate biophilia as a core principle of children's lives. (Kellert 2002) Biophilia can be utilised in the classroom in various ways. For instance, it can be brought to life by plants, natural light, and art, as well as by taking pupils on field trips or nature walks, where they can get closer to the outdoors. In addition, pupils can learn about environmental topics and gardening through outdoor activities. (Kaushik 2023)

2.4.3 BIOPHILIC DESIGN

Nature needs to be essential when designing our urban and suburban settings; however, in the past architecture has estranged us from nature and ruined our environments by doing so. Biophilic Architecture is an advanced and creative way of designing the places where we live, work, and learn. The evolution of green architecture in recent years has lowered the ecological impact of the built environment, but it fell short of reconnecting us to the natural world. It is where buildings connect people and nature, hospitals where patients' health is restored sooner, schools where children achieve better results, offices where employees are more productive and creative, and neighbourhoods where families flourish and people are acquainted with their communities. Biophilic Design has been developed to create healthy and productive environments for modern humans. (Cerini 2016)

Outdoor environments connect the user to nature; however, it doesn't stop there. It is also imperative to stimulate the user towards environmental values, like recycling and saving energy at school. We must instil these values towards children. Although it may seem tricky to communicate those values, architecture and design have an effective way of achieving that concept. (Citelli 2009)

According to Stephen Kellert, in *Biophilic Design: The Architecture of Life, 2012*, the relationship between humans and nature is not an unavoidable feature of modern life. Instead, it is a design issue that needs to be addressed. He presents various creative solutions that aim to restore a sense of community and harmony in the built environment. He may have quietly introduced the biophilic design term to the architectural community by developing a framework for addressing the design issues that influence the built environment. According to Kellert, the most challenging aspect of living in harmony with the natural world is finding ways to make our homes and communities more harmonious. (Finnegan 2012)

Kellert's biophilic standards were developed to codify the principles of restorative environmental design. Although they provide a basis for biophilic practice, they do not automatically translate into design. According to him, biophilic architecture should be culturally relevant. (Finnegan 2012) The six biophilic elements explored in the book, "Biophilic Design: The Theory, Science and Practice of bringing buildings to Life" by

Stephen R Kellert. (2008) are presented in [Table 3]. The full framework explained can be found in [Appendix 10].

Table 3: Stephen Kellerts Design Elements and Attributes

Source: *Kellert (2008)*

Elements and Attributes of Biophilic Design		
Environmental features	Natural shapes and forms	Natural patterns and processes
<ul style="list-style-type: none"> • Colour • Water • Air • Sunlight • Plants • Animals • Natural Materials • Views and Vistas • Façade Greening • Geology and Landscape • Habitats and Ecosystems • Fire 	<ul style="list-style-type: none"> • Botanical Motifs • Tree and columnar supports • Animal (mainly vertebrae) • Shells and Spirals • Egg, oval, and tubular forms • Arches, vaults, domes • Shapes resisting straight lines and right angles • Simulation of natural features • Biomorphy • Geomorphology • Biomimicry 	<ul style="list-style-type: none"> • Sensory variability • Information richness • Age, change, and the patina of time • Growth and efflorescence • Central focal point • Patterned wholes • Bounded spaces • Transitional spaces • Linked series and chains • Integration of parts to wholes • Complementary contrasts • Dynamic balance and tension • Fractals • Hierarchically organised ratios and scales
Light and space	Place-based relationships	Evolved human-nature relationships
<ul style="list-style-type: none"> • Natural light • Filtered and diffused light • Light and shadow • Reflected light • Light pools • Warm light • Light as shape and form • Spaciousness • Special variability • Space as shape and form • Spatial harmony • Inside-outside spaces 	<ul style="list-style-type: none"> • Geographic connection to place • Historic connection to place • Ecological connection to place • Cultural connection to place • Indigenous materials • Landscape orientation • Landscape features that define building form • Landscape ecology • Integration of Culture and Ecology • Spirit of place • Avoiding placelessness 	<ul style="list-style-type: none"> • Prospect and refuge • Order and complexity • Curiosity and enticement • Change and metamorphosis • Security and protection • Mastery and control • Affection and attachment • Attraction and beauty • Exploration and discovery • Information and cognition • Fear and awe • Reverence and spirituality

2.4.3.1 Environmental features

One of the most common elements of biophilic design is the use of natural features. This includes the utilisation of notable elements from the world around us. (Kellert 2008) Elements such as air, sunlight, water, soils and living matter, like plants and animals. These features also include natural colours and materials (Architect 2012)

2.4.3.2 Natural shapes and forms

The second biophilic design element is natural shapes and forms. This element includes representations and simulations of the natural world often found on building façades and within interiors. (Kellert 2008) The recreation of shapes and forms found in nature includes plant and animal forms. Design mimicking body parts, trees and leaves, shells, honeycombs, insects, and other animal species. (Architect 2012) Contemporary design is strongly influenced by nature. Sometimes architects and designers use organic silhouettes and biophilic ideas are converted from nature to the fabricated environment by architects. Other Architects use nature's inspiration more lightly when building on their ideas (Spaces Team 2022).

2.4.3.3 Natural patterns and processes

Another biophilic design concept is the utilisation of natural processes and patterns. This emphasises the connection between the built environment and the natural world. (Kellert 2008) The principles, functions, and structures that are characteristic of the natural world are often instrumental in the development and evolution of humans. For instance, designs that stimulate the senses can help facilitate the understanding of complex ideas. (Architect 2012).

2.4.3.4 Light and space

Light and spatial features representing the sense of being in a natural environment are often used to evoke feelings. These include using natural light and space, and subtle expressions such as merging mass and light. (Architect 2012). The use of filtered and natural daylight can provide various benefits. In addition to providing beneficial light, it can also help create visual features and shapes. In addition to fostering a sense of harmony and openness, space can also help create a connection between outdoor and indoor environments. (Kellert 2008)

2.4.3.5 Place-based relationships

Stephen Kellert (2008) refers to place-based relationships as the successful integration of culture and ecology. This element highlights people's need for territorial control over their environment. During human evolution, they have been able to control various aspects of resources and security. "The yearning for home remains a deeply held need for most people." (Kellert 2008) Using various materials and techniques, such as landscape and geological features, buildings can be connected to the distinctive cultural, ecological, and geographical characteristics of their local communities. (Architect 2012).

2.4.3.6 Evolved human-nature relationships

The last and sixth biophilic design element refers to the relationship between humans and nature. Although the term biophilic design implies that all the elements are related to human affinity within the natural environment, the attributes in this section mainly focus on the fundamental aspects of this relationship. (Kellert 2008) According to Kellert, the number of people moving into the city has increased significantly over the past 50 years. This has prompted many people to seek out the natural world daily. Unfortunately, despite the abundance of natural resources, the design of buildings has to be carefully considered to accommodate the needs of the people. (Architect 2012)

2.5 CONCLUSION

This chapter provides a comprehensive overview of the various factors that influence the development of children. It also explores how they can be managed effectively. Child development is a complex and intricate process that requires a comprehensive understanding of scientific principles. These can help guide societies in their efforts to help young children flourish. The establishment of three fundamental principles can aid their development. These are: strengthening relationships, building core skills, and reducing stress.

The various theories prevalent in early childhood development are designed to help children build their cognitive, social, and physical skills. They revolve around the idea that children are best equipped to learn and grow when they are equipped with the

right resources. The relationship between play and cognitive development is very important for children.

Biophilic design can help create environments that are conducive to developing these principles when children play in environments that are designed with biophilic elements. They can explore and learn more about the world around them while also developing their physical and mental skills. Incorporating nature into a child's environment can significantly reduce their stress levels. It creates a safe and nurturing space that encourages them to grow up without being overwhelmed.

This chapter also explores the various aspects of the biophilic design framework as illustrated in [Figure 10] and provides an overview of how biophilic design can be used to create effective and nurturing environments for children.

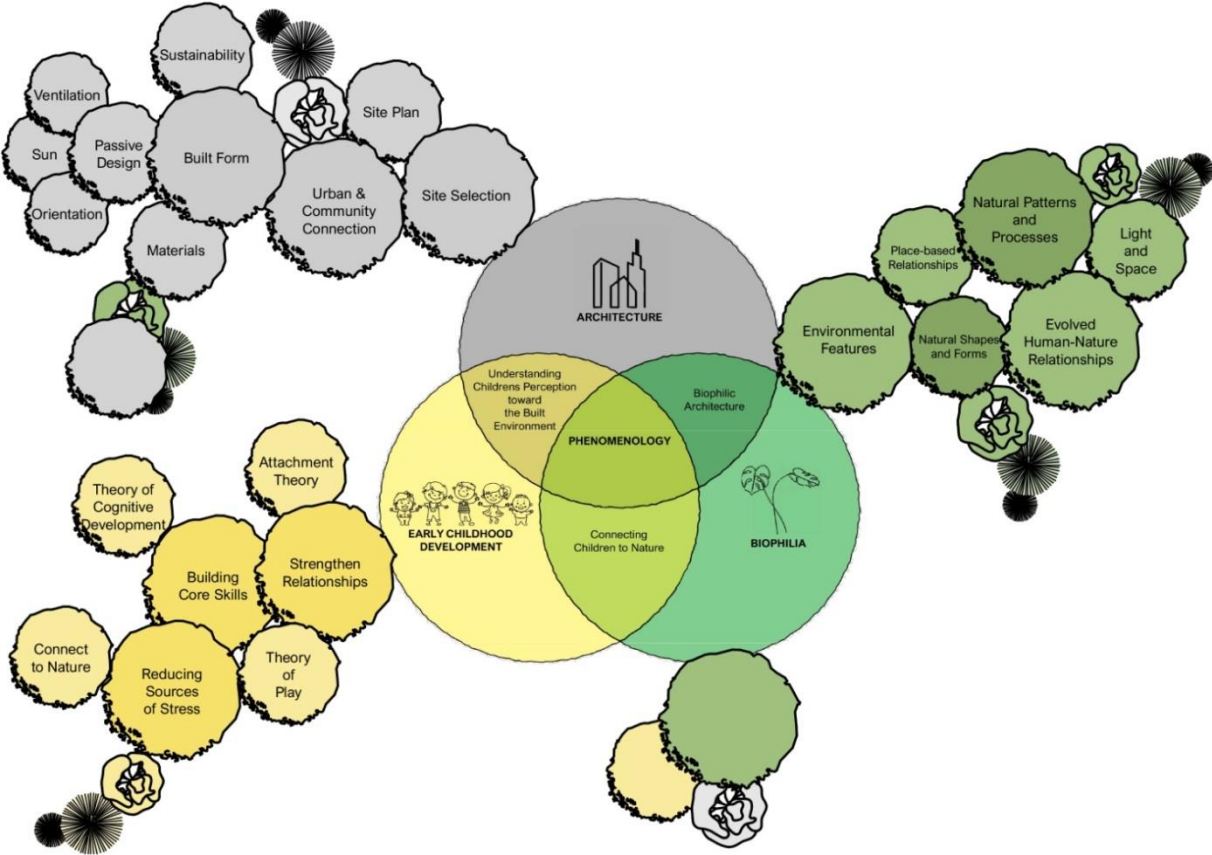


Figure 10: Brainstorming Concepts and Theories within the Literature Review (2022)
Source: Author

CHAPTER THREE
PRECEDENT STUDIES



3.1 INTRODUCTION

As discovered, an architecture that focuses on early childhood development may be achieved through the integration of three main principles of early childhood development; strengthening relationships, building core skills and reducing stress. (Centre on the developing child at Harvard University 2019) and biophilic architecture is accomplished by using Kellert's six biophilic design elements and attributes; Environmental Features, Natural Shapes and Forms, Natural Patterns and Processes, Light and Space, Place-Based Relationships, and Evolved Human-Nature Relationships.

The literature review has been developed to integrate theories of Early Childhood Development and Biophilia to create an architecture focused on children's requirements but simultaneously inspired by nature and its attributes.

Precedents that echo these principles within its architecture are identified in this chapter. The first precedent that will be explored is the Green School South Africa in Paarl, South Africa, designed by Gass Architecture Studios. The second is the Children's House in Bris-Sous-Forges, France, designed by MU Architecture and Archiicop. The third precedent has been selected to understand play spaces and is an art installation designed by architect Itai Palti, called the Urban Thinkscape in Philadelphia, USA.

3.2 GREEN SCHOOL SOUTH AFRICA, PAARL, SOUTH AFRICA

Architect: GASS ARCHITECTURE STUDIOS



Figure 11: Green School South Africa (2022)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery

3.2.1 INTRODUCTION AND JUSTIFICATION

The Green School South Africa, as illustrated in [Figure 11], is a place where curiosity, innovation, and creativity flourish. It is a school that aims to equip its learners with the necessary tools and resources to thrive in the future. The campus is designed to spark the senses and provides children and adults with a sense of wonder. This school is committed to providing its students with the necessary tools and resources to thrive in the future. Through a learner-centred approach, the aim is to prepare the children for a constantly changing world. The educational program is designed to ignite a passion for learning and provide the students with the skills they need to succeed. There is a belief that each child has a unique learning style, and the school provides a personalised approach to help them succeed.

The Green School movement was founded in 2008 by Bali-based Green School Bali. Since then, Green School South Africa has become the third school in the global network. It opened its doors in 2022 in Mexico along with other New Zealand and Australia schools. Starting in 2022, Green School South Africa offered kindergarten

and primary grades. It will soon expand to become a school that can provide continuous education to Grade 12 by 2025.

3.2.2 LEARNING SPACES

The school has a lot of outdoor space for students to learn. It provides them with an excellent opportunity to explore the world around them. It also allows them to develop their physical and mental skills. They can participate in various activities such as field trips and excursions. It is a great way to develop their skills and knowledge. Through experience, young children can develop their critical thinking, creativity, and communication skills. It enables them to become more independent and contributes to their growth.



Figure 12: After rain activities (2022)
Source: Green School South Africa (facebook)

[Figure 12] illustrates how the outdoor play area allows exploration and learning through play. When it rains, the umbrellas and gumboots come out. The “Green

Schooler” brings along wet weather gear, and they are eager to try out new activities. They get to explore the school grounds, play in the tiny lakes, and stomp through streams. During the Early Years, the kids explore the possibilities of building boats using materials they collected. They test their buoyancy and wind propulsion because of the rain that fell the previous day. (GSSA Facebook)

[Figure 13] illustrates the use of natural materials in educational settings. When it comes to creating educational facilities, architects consider the development of a structure that will engage and teach young learners. This can be achieved through the utilisation of construction and materials. (Patriquin 2023) Colour can also play a significant role in the design and construction of educational facilities. [Figure 14] demonstrates the use of colour in educational settings. According to Chia (2021), The importance of colour in children's development is acknowledged. This is why kindergarten interior designers must help kids form colour vision. "It's not about being colourful but having fun" (Chia 2021)



Figure 13: Classroom Interior (2022)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery



Figure 14: Library (2023)
 Source: Green School South Africa (facebook)

3.2.3 BIOPHILIC INTEGRATION



Figure 15: Site Development (2022)
 Source: <https://worldarchitecture.org/article-links/emnccg/gass-architecture-studios-built-green-school-with-rounded-walls-and-leaf-like-roofs-in-south-africa.html>

3.2.3.1 Environmental features

The various building and zone positions have been considered to create harmonious spaces that are designed to connect people with nature. [Figure 15] illustrates the vast green spaces that separate the building clusters showing the connection created between the natural and built environments. These clusters are created for different functions of the facility. This concept is further enhanced by keeping the walls to a minimum to create expansive openings (Archdaily 2021), as shown in [Figure 18].

Organic Pod Planning

The concept of reoccurrence refers to the behaviour of natural systems. The buildings' architecture is based on the organic shapes created by the mountains and the Paarl Boulders. These shapes are designed to accommodate the varying needs of the building's users. (Abdel 2022)

These organic-shaped buildings create an inviting and playful environment with their large over-arching roof structures. They also feature punched openings to frame views, thick walls, and clerestory windows that are designed to filter natural light. (Abdel 2022)

The administrative building is located on the main campus axial circulation spine and links the other public buildings together. Some of these include the multi-purpose space, the deli, the co-working space, and the heart of the school. The Heart of the School is located in the centre of the precinct, and it links the other paths. The building's three boulders represent the path that leads from the arrival plaza. One of the sides features the dining hall, kitchen, and Life Lab, while the other has a library, a music studio, and an Ablution facility. (Abdel 2022)

The main circulation spine features winding paths that lead to various areas, such as the kindergarten and primary schools. These secondary routes also lead to the Kindergarten cluster and the gardens. The walkway leading to the cluster is covered in a hand-woven tunnel. (Abdel 2022)



Figure 16: Birds-eye view of buildings set in pods (2021)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery

Natural Materials

Biophilic design principles suggest that people have a preference for natural products due to how they exhibit various organic processes, such as weathering and ageing. The appearance of natural substances can help people appreciate how nutrients and energy can be moved through the ecosystem. (Kellert 2009)



Figure 17: Architecture natural materials (2022)

Source: Green School South Africa - Facebook

[Figure 17] shows a close-up view of the natural materials used in the construction of this project. It gives us a feel for the scale of the project and how it interacts with the environment. The walls are created by ramming earth in intervals which creates horizontal bands, glazed surfaces are large and work well in contrast to the rammed earth's heavy look. the soffit of the eaves is covered in particle board, almost hinting at the timber interiors. A very interesting feature is the pavers along the apron that is made of logs. There was almost no effort in making it smooth with the earth in-between or it just moulded with time, which plays on the imperfection encountered within a natural environment.

Rammed Earth Construction

Rammed earth walls are both fire-resistant and non-toxic, making them an ideal choice for projects. They eliminate the harmful effects of chemicals used in other constructions, which helps improve the air quality of the space, especially for those who suffer from allergies. In addition, they're less prone to getting damaged by pests and termites, which makes them an ideal choice for buildings. (Earth Structures Africa 2022)



Figure 18: Nature inspired Playground (2022)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery

Natural Landscape Integration

As illustrated in [Figure 18] and [Figure 19], these development features include various architectural features and landscape elements that create playful and engaging environments for children. (Abdel 2022) The buildings within the development cluster around various areas, including spill-out areas, vegetable gardens, orchids and walkways. (Abdel 2022)



Figure 19: Hand-Woven Sapling Growing Tunnel (2022)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery



Figure 20: Building Elevation set into natural setting (2022)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery

Geomorphology

The structure metaphorically embraces the landscape when it is placed in proximity to it. This affinity allows the appearance of permanence to the built environment and places it more in line with the natural world around it. (Kellert 2008), as illustrated in [Figure 20] following Biophilic principles (Kellert 2008)

3.2.3.2 Natural Shapes + Forms

Organic shapes and soft furnishings are key elements of this process seen in [Figure 21]. These are created to enhance the functionality and comfort of the environment while also being aesthetically pleasing.



Figure 21: Classroom Interior (2022)

Source: https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios?ad_medium=gallery

3.2.4 CONCLUSION

Green School South Africa's case study lays the foundation for Biophilic Design within the learning space; on the other hand, it is set within the openness of farmlands where housing estates form the residential communities of the area and their property boundaries are much larger than we face in the majority of urban and suburban areas of South Africa. However, this project was able to inspire a design that connects its user to their natural surroundings and use those surroundings to create unique architecture.

3.3 CHILDREN'S HOUSE, BRIS-SOUS-FORGES, FRANCE

Architect: MU ARCHITECTURE and ARCHIICOP



Figure 22: Childrens House (2015)

Source: <https://www.archdaily.com/771226/childrens-house-mu-architecture/55bedd7ce58ece0a2b0000bc-childrens-house-mu-architecture-photo>

3.3.1 INTRODUCTION AND JUSTIFICATION

The Children's House, shown in [Figure 22] was designed to provide after-school and holiday-time programs for elementary and kindergarten students. The facility is in a wooded area, with a playground and small accommodations for the teachers. The design for the school was by two firms from Paris, Mu Architecture and Archicop. It serves kids aged three to twelve. (Griffiths 2015) This project sets itself well into its landscape and uses its surroundings for biophilic interaction in a subtle way.

The Children's House includes maternal leisure and an elementary leisure centre. The maternal centre accepts school kids from 3 to 6 years old. Children aged 6 to 12 are allowed to use the elementary centre. These centres provide children with a variety of activities that are designed to meet their varying needs. They are supervised by a group of experienced facilitators who are dedicated to developing their independence. The facility operates during school holidays and every Wednesday. It serves lunch in the school canteen, and snacks are also provided at the end of each afternoon. (Briis 2018)

According to Archicop (2012), the project is subject to an environmental approach based on the following 5 highly qualified expert targets:

- Relationship of the building with its immediate environment
- Integrated choice of construction products, systems and processes
- Energy Management
- Water management
- Visual comfort.

The village is committed to providing the best possible services to children and young people to help them develop their skills and talents. It is also dedicated to ensuring that their school environment is conducive to academic success. (Briis 2018)

3.3.2 LEARNING SPACES

The learning spaces are brightly coloured with green floors, illustrated in [Figure 23], doors and accent features against neutral white walls. Due to its low wavelength, green is a great colour for promoting relaxation and concentration. It can also be used in classrooms as it encourages creativity, while the blue in it calms and helps with concentration. Green can be used on various surfaces, such as storage units and chairs. A lighter green would be more stimulating, while a darker one would be more calming.

The residence has an external staircase leading to a living area and a kitchen connected to a terrace on the school's roof. (Griffiths 2015)



Figure 23: Natural views through large windows and green interior (2015)
Source: <https://www.archdaily.com/771226/childrens-house-mu-architecture>

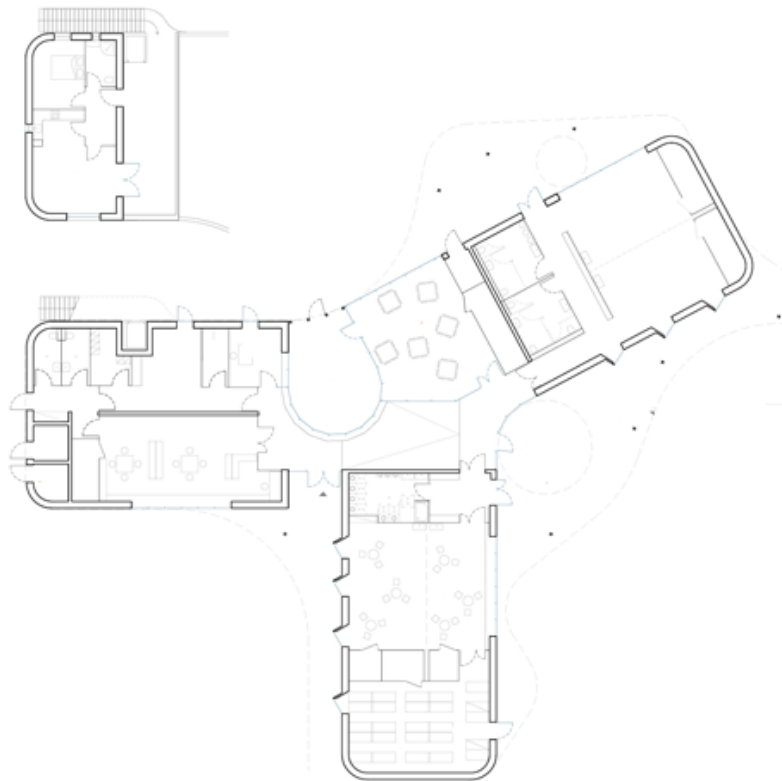


Figure 24: Plan
Source: <https://www.archdaily.com/771226/childrens-house-mu-architecture>

3.3.3 BIOPHILIC INTEGRATION

Wavy Roof

A free-form structure features walkways and courtyards beyond its walls. Openings that let the trees grow through their natural centres interrupt the roof as shown in [Figure 25]. Timber columns and the curved lines of the building provide a visual connection to the trunks. (Griffiths 2015)



Figure 25: Roof structure integration (2015)

Source: <https://www.archdaily.com/771226/childrens-house-mu-architecture>

Woodland natural surrounding

The Children's House is visible from the road, and its low profile can be seen through the trees. The building features a two-storey turret, and it also has three sheltered playgrounds that are designed to accommodate different age groups. "The imposing presence of the forest on the site has always been a leading point to our design," says architect Grégoire Dubreux (Griffiths 2015)

Every year, the children of Briisous-Forges have been able to spend their time in the middle of the forest, learning about the different changes that occur in the seasons. This allows them to observe the beauty of the forest and its inhabitants. Since the project's completion, the vision of the building in the forest has become more convincing due to the growth of the trees around it. The trees in the area can be seen

as you walk along the building's curves. You can also sense the strength of these trees through the building's circular patio while experiencing the rhythm of the tree shadows as they walk through the clearings. (MU Architecture & Archicop 2015)

"On one hand, we defined the shape and the implantation of the building with the rhythm and the density of the trees, and on the other hand we interpreted the forest vocabulary like the reinterpretation of the clearing, with the softness of the curves, the raw material, the brown colours and the green roof." (Grégoire Dubreux 2015)

Timber-clad facade

The building's curved facades are composed of vertical strips of larch wood, echoing the surrounding area's trees. (Griffiths 2015) For children and adults, the building serves as a representation of the forest's poetic and playful nature. (MU Architecture & Archicop 2015)

According to Dubreux, the curved surfaces of the building's playground areas help create an illusion that the building is moving around. To enhance the appearance of the roof, the building's cladding was composed of thin vertical strips that slide off from the wall. They also curved the overall appearance of the building. (Griffiths 2015)

Floor-to-ceiling glazing

The building's main entrance is set into a portion of the facade that's glazed, illustrated in [Figure 26], which adds a bit of open space and a bright and sunny feel to the reception area. This feature wall also encloses a garden. The rest of the building's open circulation area is enclosed in glass which creates a feature providing a view of the forest from the building's interior. (Griffiths 2015)



Figure 26: Distribution/Circulation Space (2015)

Source: <https://www.archdaily.com/771226/childrens-house-mu-architecture>

3.3.4 CONCLUSION

The Children's House utilizes several ECD strategies that are sometimes connected to biophilic design in its interior spaces. To add interest and contrast the building's natural outdoors contrast with the brightly coloured interiors. The project is not very ambitious in its approach to creating a biophilic environment. Instead, it focuses on providing a functional and beautiful structure that is aesthetically pleasing and possibly financially feasible.

3.4 URBAN THINKSCAPE, PHILADELPHIA, USA

Architect: Itai Palti



Figure 27: Urban Thinkscape Installation (2019)

Source: <https://playfullearninglandscapes.com/project/urban-thinkscape/>

3.4.1 INTRODUCTION AND JUSTIFICATION

Despite the amount of time children spend outside of school, the public is still not investing in their education. This is because communities have not considered the places where kids and parents interact. These include bus stops, sidewalks, and corners. (Harvard University 2022)

The Urban Thinkscape project brings together the elements of play and learning, which can be found in a public setting such as a bus stop. Benches feature movable parts that can stimulate spatial awareness and allow children to explore numbers, colours, and language. There is signage within the design that shares a website that provides a variety of resources for families. (Playful Learning Landscapes 2019) It is a project that aims to transform public spaces into places where children and families can play. Through its activities, the organization encourages interaction and creativity while providing a framework for learning. Some of the projects include movable parts that

can be placed on park benches, puzzles at bus stops, and educational signage. (Harvard University 2022)

The goal of Urban Thinkscape was to energise Philadelphia's Belmont neighbourhood by creating playful learning opportunities in a public setting, to combine math, science and literacy with collaboration and communication into learning through play. A bus stop was selected for the installation. Kids can now explore story art and climb through the canopy as they create portraits of fruits and vegetables, and the interactive mural of Martin Luther King was created by over a hundred community members and youth to mark his historic speech in 1965 regarding freedom which took place near the bus stop. (Playful Learning Landscapes 2019)

Most families are very busy on a typical day. Aside from running errands, adults have to commute to work, look after their kids, and attend after-school activities. During this time, caregivers and parents may not have the opportunity to interact with their kids in various ways. That interaction can help children develop their social, emotional, and academic skills. For instance, going to the store or waiting for a bus can allow children to interact with adults and build life skills. (Harvard University 2022)

Children need to be involved in the community to have a good experience. This installation is a great example of how kids can be part of a group setting. It provides them with a sense of belonging and responsibility. Softening the site edges with human interaction creates a welcoming and safe environment while fostering community engagement as an urban design driver

3.4.2 LEARNING SPACES

According to Harvard University (2022) Urban Thinkscape works with communities and families to share three key messages about play. It believes that there is a connection between learning and play and that it can help children develop their academic skills.

Through its program, Urban Thinkscape works with architects, psychologists, and community members to design structures and spaces that can help children develop their spatial, language, and emotional skills. The goal is to transform the learning

outcomes of children by creating environments that are designed to encourage play and interaction.

The program is expected to have a positive impact on the community through three levels. These include increasing the level of engagement and interaction between families and the public space. Through the program, the conversation between caregivers and children about public spaces will be enhanced to create hotspots for learning. Families will begin understanding the link between learning, play, and the environment. They will also start to see how their daily environments can promote children's development.

Puzzle Wall

The goal of this activity, shown in [Figure 28] is to encourage kids' spatial and math skills by having them solve puzzles on the back wall of a bus stop. (Playful Learning Landscapes 2019)

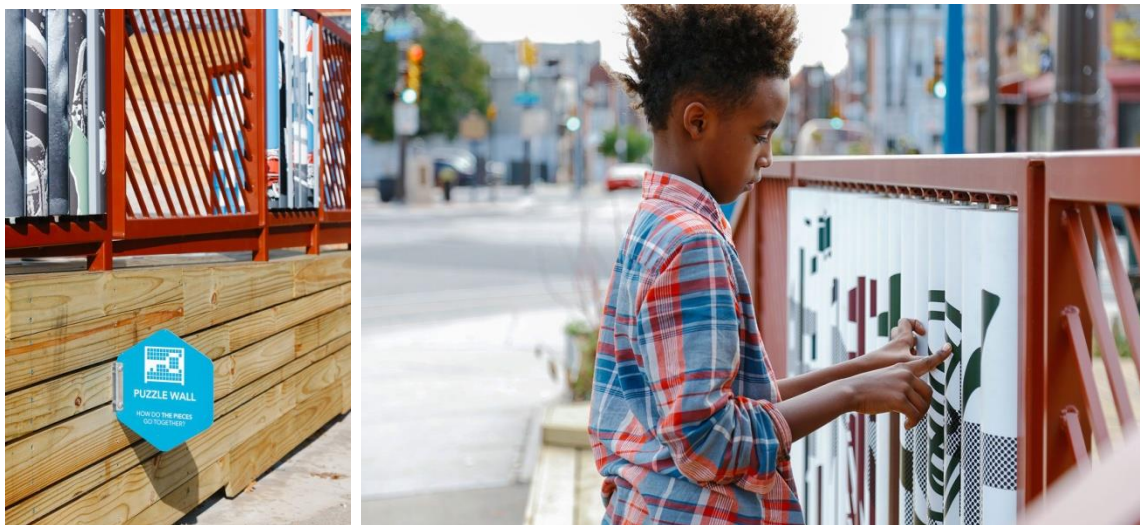


Figure 28: Urban Thinkscape: Puzzle Wall (2019)

Source: <https://playfullearninglandscapes.com/project/urban-thinkscape/>

Jumping Feet

[Figure 29] illustrates Jumping Feet: Kids will likely jump as the shoe prints encourage them to move while disrupting the pattern will make them think about their next move. This activity can also help them develop their impulse control skills, related to academic success. (Playful Learning Landscapes 2019)



Figure 29: Urban Thinkscape: Jumping Feet (2019)
Source: <https://playfullearninglandscapes.com/project/urban-thinkscape/>

Hidden Figures

Children's curiosity is activated by looking for images of animals, food, and other objects in the metalwork. This type of learning helps them develop their problem-solving skills and spatial abilities. Parents can also help kids find the objects by guiding them through the process of searching for them. (Playful Learning Landscapes 2019)

Stories

Children can develop their own story by moving from one cue to another as illustrated in [Figure 30]. This activity can help them improve their reading skills and build their narrative skills. With younger kids, their parents can also ask them to identify objects in the pictures. (Playful Learning Landscapes 2019)



Figure 30: Urban Thinkscape: Story (2019)
Source: <https://playfullearninglandscapes.com/project/urban-thinkscape/>

3.4.3 BIOPHILIC INTEGRATION

The play space is constructed on the edge of a road. It is surrounded by vegetation and grass and serves as a safe and enjoyable outdoor space for all children. The story floorboards simulate the landscape and features of various hills and valleys. It provides children with an opportunity to explore and learn about the world around them.

3.4.4 CONCLUSION

According to the preliminary results, families are now engaging in conversations about numbers and shapes while they are at the bus stop. They are also talking about STEM, literacy, and language. (Playful Learning Landscapes 2019) This study aimed to analyze the various activities and learning opportunities that children engage in through play.

3.5 CONCLUSION

These studies were conducted according to the Early Childhood Development traits and Biophilic characteristics. Green School South Africa's natural setting has played an important role in its design, which is in contrast to Children's House, which doesn't have a lot of ambition when it comes to creating a bio-friendly environment. Its focus was placed on providing the needs of the children with learning opportunities. A structure that is aesthetically pleasing while functioning as a children's care space. The Urban Thinkscape on the other hand focuses on childhood development through play and it has been a successful intervention. Each of the precedent studies contributes different, but complimentary principles that can be applied to the design ECD environment which emphasises the role of nature in children's development

CHAPTER FOUR
CASE STUDIES



4.1 CASE STUDY (*TREE TOPS SCHOOL*)

4.1.1 INTRODUCTION AND JUSTIFICATION

The Nursery School was established in 1932 by Maud Hindson, who was the daughter of a farmer on the North Coast. In 1934, the school moved to a small cottage at 107 Essenwood Road. In 1939, Joyce Ilsley joined the staff and helped implement Miss Hindson's vision and methods. As the school grew and needed more accommodation, other properties were purchased nearby to cater for more children so that it didn't have a negative impact on outdoor space. The Bellevue campus caters to the 2.5 years to younger than 4 year old children, while the older 4 years to 6 year olds children are at the Silverton campus. There is a third campus that doesn't form part of this study which caters for older kids up to grade 3.

The main reason the case study was selected was due to its natural setting. It can provide the users with an opportunity to interact with the environment and learn from it as discussed in the literature review chapter. This engagement has provided me with an opportunity to gain a first-hand perspective on the topic and to reflect on the previous data collected gaining a better understanding of the research problem.

4.1.2. LEARNING SPACES

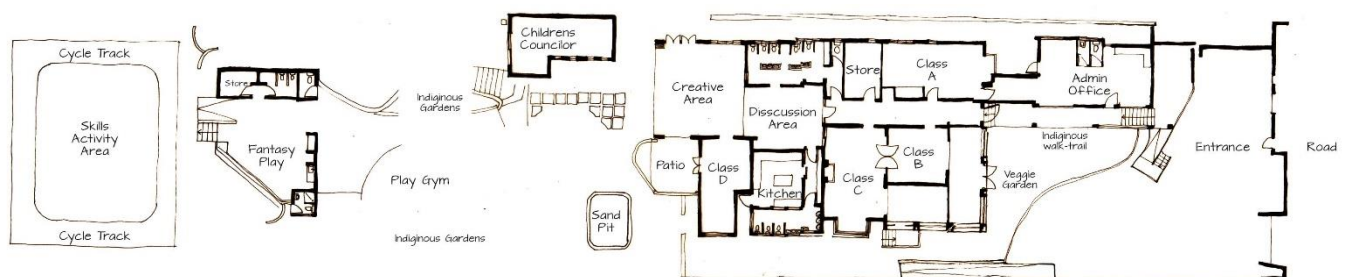


Figure 31: Bellevue Campus Ground Floor Plan (2022)

Source: By Author

Programme

The school's program is designed to provide children with the opportunity to work together in small groups or classes while also exploring larger open spaces. Although the curriculum is modified to meet the varying needs of each student, the programs for those up to grade R at the Silverton campus are similar to the Bellevue campus. Both of these campuses emphasize the importance of environmental awareness and mutual respect.

The formal program begins at around 7.45 am. Children arrive at the school at 7.25 am and keep their bags, snacks, and shoes away. They then start playing with various toys and equipment and have a private chat as their teacher introduces them to the “tabletop” activity, which usually involves drawing, painting, cutting, pasting, collaging, and printing. They then tidy up and gather for the morning greeting. Each morning three rings involve a teacher-led activity or lesson. These activities or lessons usually involve a whole class or group. The morning is filled with routines that revolve around the importance of hygiene, independence, and manners.

Circle Time (Rings)

During circle time, the children are usually seated on the floor while grouped together and have a chance to interact with each other. This is a great opportunity for them to develop their social skills and build their confidence. The school has three times a day when it has circle time. These sessions allow the children to relax and enjoy themselves. They also learn new things each time they participate. The school offers three types of rings: early morning, mid-morning, and story time. These sessions are designed to keep the children engaged and focused. They are also fun and have many activities for them to do.

Free Play Sessions

These play sessions can be held for two half-hour periods. Although it's fun for children to have imaginative and creative activities, it's important to remember that this isn't a free activity for everyone. The play environment aims to provide kids with various chances to learn.

The creative activities session seeks to enhance the children's abilities in various creative pursuits, including cutting, painting, dough exploration, and pasting.

Kids can have fun with various motor skills such as swinging, sliding, and jumping. The area can also be used for digging and building. Equipment like scooters, two-wheelers, and plastic bikes can be used in this play environment.

Different tactile activities can be performed, such as using various materials like gravel, shells, dried leaves, and pebbles. These are designed to help children develop their tactile and imaginative abilities.

Children can also create their fantasy play scenarios by crafting a scene using props. These can be used to promote different activities or establishments.

Children who prefer to be alone can also pick up puzzles, books, and building blocks.

Indoor Play Session

Daily, the program includes a half-hour of indoor playtime. This is designed to help the children develop their fine motor skills. It is also a chance for them to explore and interact with other kids.

Grade R Group

Tree Tops follows a rule regarding admitting pupils aged six to enrol in its Grade R program. The school's personalised approach ensures that every student receives the best possible education, and it's confident that the current syllabus conforms to the department's assessment policy statements and Common Assessment Practices (CAPs).

Worksheets are rarely used, as the program focuses more on active learning. When it comes to teaching reading and writing, the preferred psycho-linguistic method is to use a bottom-up approach. This method emphasises how important it is to develop these abilities as a part of an ongoing process.

Children in Grade R participate in gymnastics weekly. They also take swimming lessons during the summer and they engage in sporting activities like ball skills in the winter.

Accompanied by their peers in grade R, the kids host an annual sleepover and dinner for their parents, culminating in the making and serving of various food items. Moreover, they create candle holders, arrange flowers, and decorate dinner plates.

The end of the school day is at 12:45 and it's a flexible period where parents can collect their children at a staggered time so that the traffic flow is smoother.

Classrooms should exhibit the wonders of the environment just like you do when you are immersed in it. Children will develop their appreciation for their environment as they interact with it. Nature is one of the main factors within the school's design and focus when engaging in educational discussions. However when you are within the confines of the

classroom, most views are blocked, the windows are mainly high up and full-length glazing has been sandblasted above the children’s sight line as seen in [Figure 32]. The children during this time have screens on their desks because of covid19 protocols and isn’t great for interaction, therefore isn’t a permanent fixture.



Figure 32: Interior Classrooms at Silverton Campus(2022)
Source: Tree Tops School - Pre-Primary and Junior Primary (facebook)

Their surroundings are living and growing spaces. The colour scheme within the facility is dark peach walls with dark green accents and red pavers, which blend into the natural surrounding and the spaces, read as one. Furnishings are mainly timber, which brings warmth and nature into the classrooms.

4.1.2 BIOPHILIC INTEGRATION

At Tree Tops, children from different age groups are taught about mutual respect and environmental awareness.

Nature and Biodiversity

The school aims to develop their biodiversity and attract nature into their gardens by incorporating indigenous gardens on its sites, as shown in [Figure 33]. New plants are selected to draw birds and insects into these gardens where the children are at the forefront, ploughing, sowing and caring for their gardens as shown in [Figure 33]. The nature within the campus is used as a learning space whereby the trees and plants are labelled and there are posters of the birds, insects and other creatures put up so that the children can easily spot and identify them. The learning includes nature walks and lessons within the gardens, while children are taught to respect and nurture their natural surroundings.



Figure 33: Indigenous Garden walking trail at Silverton Campus (2022)
Source: School Supplied Photos

The beautiful Albizia tree, which has become the school's logo, at the Silverton Campus is proudly displayed near the entrance. There are also other Indigenous trees on all of the campuses that are marked with WESSA signs.

Healthy Living – Food Gardening

A variety of food gardens are featured at the school sites. The children of Tree Tops enjoy watching the vegetables grow. They also help with the planting and maintenance of the gardens, as shown in [Figure 34] and [Figure 35].



Figure 34: Food Garden at the entrance at Bellevue Campus (2022)
Source: School Supplied Photos

In addition to regular school sessions, there are also afternoon sessions where children from the Eco-Rangers Club can participate in various gardening projects. This is a great opportunity for them to develop their environmental awareness and improve their school's curriculum. The program's goal is to instill in the children a sense of wonder about the world around them and encourage them to live a more eco-friendly lifestyle.

The school values and respects the natural world. In addition to regular classroom activities, the school also focuses on teaching and learning about the environment. Tree Tops was able to join the Eco-Schools program in 2011. Through this initiative, the school develops their commitment to the environment further.

By completing projects the school gains "Green Flag Status." These flags displayed at the school entrance are something the children can be proud of. The WESSA introduced the Eco-Schools program in South Africa in 2003. Since then, over a

hundred schools have been registered with the program. Being part of the program ensures that the environmental initiatives that are carried out are sustainable. Environmental projects are frequently used as teaching tools and are linked to the curriculum. The teachers of Tree Tops are also blessed with outdoor classrooms that can provide them with exciting lessons, which include, activities around the vegetable and indigenous gardens. The themes and values in the program are illustrated in [Figure 36] and [Figure 37]

WESSA Eco-Schools

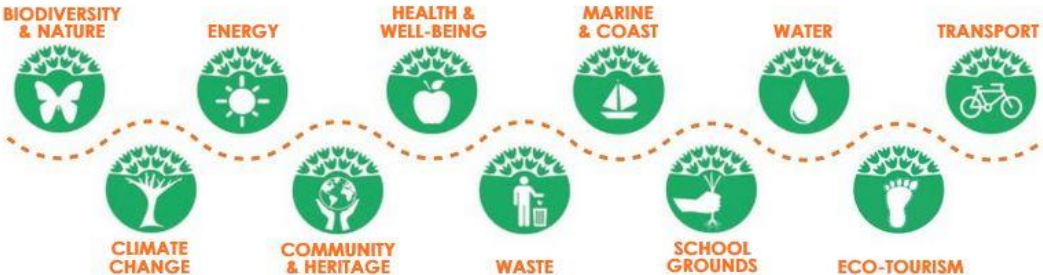


Figure 36: Themes covered with eco schools (2018)
 Source: <https://cld.bz/x8Jmzyo/2/>



Figure 37: Values with Eco-Schools (2018)
 Source: <https://cld.bz/x8Jmzyo/2/>

Recycling

This school values the importance of recycling, which is a vital component of everyday living. All the paper, plastic, and glass containers used in the school are recycled. Every Thursday, children are invited to bring in their unwanted materials to be recycled. This ensures that the school is doing its part to keep the environment clean.

Through a program known as Bread Tags for Wheelchairs, the school collects bread tags and sells them to recycling facilities, using the proceeds to buy a mobility device for a needy individual. The children participate in a program that involves collecting food and beverage cans. This is a way for them to earn while supporting the environment and their school. The students are conscious of their surroundings by recycling all of the paper and plastic materials they use in the institution. They can also rinse their yoghurt containers after each snack, which they put in recycling bins.

The school's three campuses have worm farms where the pupils collect fruits and vegetables. They then put these in bins. To maintain the gardens' appearance, the pupils use water tanks. Grey water is used to water the vegetables after they're rinsed.

4.1.3 CONCLUSION

The case study was carried out at Tree Tops School, which is situated in a suburb of Kwa-Zulu Natal. Although it's located at an intersection, the school's setting provides a tranquil environment that lets one focus on their tasks and avoids distractions. The information presented in the case study highlighted the school's positive biophilic environment. It indicates that it promotes a healthy lifestyle for its students. The case study provided an in-depth look into the school's setting. Interviews were conducted with the school's principal and grade R Mentor. They provided their unique perspectives on the school and its environment which are listed in the results section and later studied in the Analysis and Discussion Chapter.

CHAPTER FIVE
ANALYSIS AND DISCUSSION

5.1 INTRODUCTION AND METHODOLOGY

The lack of proper education at the primary level contributes to South Africa's education challenges. In addition, the high dropout rate and poor literacy skills among children are also partly attributed to the absence of programs that are geared toward education at the home and community levels. (Mabugu & Rakabe 2015) The study aimed to explore and investigate Early Childhood Development and how Biophilic Architecture can be integrated into ECD-focused typologies. It was also aimed at developing a strategy that will allow the design of appropriate learning environments that are both functional and beautiful.

Through qualitative research, the study focused on analysing reality and can therefore drive innovative projects. Understanding the various individual perspectives will allow designers to develop plans and projects to improve social interaction within a space. (Cruz & Sarmiento 2022) The data collected boasts both primary data and secondary data.

A case study of the school was carried out by performing an observation of the spaces using an observation schedule as well as using semi-structured interviews with the caregivers, which were carried out to gain a deeper understanding of the children's daily schedule and the use of the spaces within the ECD facility.

Participating schools were selected based on age group and location within the Sherwood and surrounding areas in eThekweni. Two schools acknowledged and approved participation in the study, however, due to time constraints and the school's busy schedule only one school features and has committed to the process.

A case study of the school was carried out by performing an observation of the spaces using an observation schedule as well as using semi-structured interviews with the caregivers, which were carried out to gain a deeper understanding of the children's daily programme and the use of the spaces within the ECD facility. The study conducted interviews while touring the Early Childhood Development facility and also held a sit-down discussion. The sessions were conducted over two days one week apart at two different campuses which are separated into different age groups. Participants engaged in discussions that lasted for about two hours in total. The

dialogue was recorded on a notepad. Observations were not influenced by the presence of children in the facility. This was due to the school's unwillingness to engage with the parents and the children regarding the inclusion of children as they state that they are POPIA compliant.

I selected a traditional approach to analyse the qualitative data by choosing themes that represent the most significant data points. This helped me compare and identify instances across the data set. (Wright 2015) Deductive techniques were used to create the themes. My theoretical framework helped me identify the types of themes that I could find in the data, although there was also an inductive technique used based on the semi-structured interview and any other new information that is gained that doesn't necessarily fit into any of the pre-written themes.

5.2 RESEARCH RESULTS / FINDINGS

The primary research findings are based on one ECD centre within the eThekweni area. It is a fee-paying school that is known as a magnet school, whereby children are not from one specific area, but rather travel from different neighbourhoods for this specific school. Information was gathered from the principal and the grade R mentor through discussions while touring and observing the spaces of both campuses, each accommodating different age groups. A sit-down open-ended interview with the centre's principal was done after having a tour of the campuses and completing the observational studies. The informants were very bold about their discussions and their views were based on experience within their field.

The findings presented in the results revealed that several common themes emerged among the participants. These included Architectural Preference, Biophilia, The Effects of Covid19 and Early Childhood Development, which broke down into further categories based on the three principles of ECD that were discussed in the Literature Review.

5.2.1 ARCHITECTURAL PREFERENCE

Participants were allowed to elaborate on the architectural details they would like to see in the ECD environment. The goal was to create a vision for the future of the building that reflects their values and aspirations.

- “...the home feel may work better than a designed school, It’s very ‘Homey’, even for parents, it doesn’t need modernity.” (Principal 2022)
- The principal said that the worst mistake architects make is to design classrooms where children can look out into play spaces; she would rather have glazed sections that are above children’s eye level that can still let light in. The glazed sections of the classrooms that were below eye level were sandblasted so there were no visual connections with the activities that were taking place outside.
- The grade R mentor suggested that the floor coverings be washable to accommodate any messy spills. Vinyl floor coverings are used in the classrooms, while the children use large rugs when sitting at floor level for discussions, therefore it's easily washable.
- The principal pointed out that warmer floor covering would be great, something like timber floors, not laminate as it’s too noisy. There were also discussions about seamless floors and she mentioned cork flooring.
- Toilet floorings need to be seamless to cater for accidents, something that is easy to clean and maintain. Epoxy paints were favoured.
- Storage is a huge need, large storage spaces are required to keep the school's vast array of equipment, and each class needs their own storage spaces.
- Classrooms need larger areas, at least 1m extra in each direction.
- The need for cosier spaces, like a cosy book corner.
- She also suggested that swings be made from rubber rather than harder wood alternatives to soften any accidents. The swings at this site were made of repurposed, old rubber tires.

- The school uses Astro-turf in busy areas because “Natural grass doesn’t do well under busy feet,” (Principal 2022)
- The school has gated access where the children at the Bellevue campus are collected by a person identifiable by the child’s teacher. The child goes from one hand to another. At the Silverton campus, the teacher identifies an adult in the car and hands the child to that person.
- The children easily find their way around the school, which takes around 6 weeks.

5.2.2 EARLY CHILDHOOD DEVELOPMENT

Early childhood development was a major topic of discussion among participants. As professionals in the field, the discussion about this topic was very comfortable for them. It was a great opportunity to share their ideas and concerns about how to best support young children.

5.2.2.1 Strengthening Relationships

- The school's positive relationships with its parents, pupils, and staff members contribute to a sense of community and achievement.
- There is no interaction between different age groups as the play times are staggered due to the spaces being small for larger groups, so there are fewer accidents. Teachers are on duty to supervise and guide the children through constructed play during this time.

5.2.2.2 Building Core Skills

- The school is not built on a specific teaching method; they believe that they have created their own way which rests on their mission statement. (Appendix 9: Tree Tops School Mission Statement)
- It is a secular school; therefore, no religious programs are included. They structure their teaching around commonalities. There is creative and constructive play within the structure and isiZulu is introduced as a secondary language at age three.

- Children are drawn to all parts of the school equally because the children have an even spread of interests.
- There is no interaction between different age groups as the play times are staggered due to the spaces being a little small for larger groups and so there are fewer accidents. Teachers are on duty during this time to supervise and guide the children through constructed play.

5.2.2.3 Reducing Sources of Stress

Children tend to absorb adult stress:

- Separation Anxiety
- Children are often rushed in the morning as they prepare for their school drop-off because both their parents work.
- Parents are stressed financially

How does the school deal with Stress?

- The school forms an Oasis where it creates a fun and relaxing space.
- The school is designed to make the children feel safe and secure.
- Children are not made to feel like they need to rush. There is no use of a bell or buzzer to signal the beginning or end of periods as this is a way of causing alarm or concern. The only time a sound is used to signify something is when the fire drill is sounded.
- The school focuses on teaching self-responsibility to every child through rules. These rules are to behave, be kind and respect people and the environment. This method keeps children away from being stressed out by each other

5.2.3 BIOPHILIC DESIGN

During the tour, the participants had the opportunity to discuss how the children interact with their natural surroundings. Understanding the process was an informative and interesting experience.

- Indigenous gardens where there are small walking trails for the children to engage with nature.
- Herb and Veggie gardens that the children help upkeep and harvest. The children are encouraged to taste the harvested food while there are discussions around the topic. The rest of the produce is given to the general staff as there isn't enough to make meals for everybody
- There are reptile water bowls within the gardens for lizards and insects which helps children learn to be compassionate and caring for their natural environments.
- The outdoor decks and the patch of grass at the entrance are used for snack time, depending on the weather

5.2.4 EFFECTS OF COVID19

The study was conducted during a period of unprecedented public health awareness. The pandemic brought about a shift in the way we live and interact with the world around us, presenting new challenges and opportunities.

- Students are experiencing various difficulties post-Covid19, such as reduced gross motor and academic skills due to their dependence on television, gadgets and the internet that they have become accustomed to using during “lockdown” and rotational attendance.
- It's been stressful for the children because they were now given the responsibility of keeping everyone safe, which meant that there was less time to play freely. Children were now expected to be responsible for keeping their families and grandparents safe from the Covid19 virus.

5.3 DISCUSSIONS

This study aims to explore the effects of the built environment on the development of children's lives. The research further aimed to find out how designers can help children connect with the natural world around them and design educational facilities that will give them a stronger foundation in their development.

5.3.1 MEETING THE OBJECTIVES



Figure 38: Objectives of this Study (2022)

Source: By Author

5.3.1.1 Understanding early childhood development

Early Childhood Development is more than just academic growth. Quality childcare, nutritious food, community engagement, and adequate healthcare are all considered necessities for the developing child.

Strengthening Relationships

The positive relationships that the Tree Tops School has with its staff members, pupils, and parents can contribute to developing a sense of achievement and community. Having strong connections with teachers can also help parents become more involved with their child's education. They will be able to provide a more supportive environment and increase their responsiveness to their child's emotional and social needs. (Wood n.d) According to Bowlby (1969), the concept of attachment is about the importance of establishing a firm attachment between a child and a caregiver. Ainsworth (1963) noted that the kids who exhibited the least separation anxiety were those who had experienced the most warmth and comfort. They exhibited the bond's strength by using the individual to expand their perspective and explore the world around them.

Building Core Skills

Tree Tops School does not utilise a particular teaching technique. It asserts that it formulates its method according to its mission statement. (Appendix 9) The school's approach to learning involves creative and constructive play, which is about developing social engagement in outdoor settings. Children's core skills are developed by interacting with others and experiencing the world around them. (Centre on the developing child at Harvard University 2019) The school's environment is also conducive to the development of children's diverse talents. They are drawn to the various parts of the school due to the wide variety of interests they have.

Children from different age groups don't interact with one another at Tree Tops School due to the play times being staggered. This ensures fewer accidents as the spaces are small. The teachers are present during play time to guide and supervise the kids. According to Gray (2007), young kids learn by imitating the actions of older kids while older kids become kinder by interacting with their younger counterparts. This makes me think of my son, Mikaeel that has managed to overcome his fear of rolling freely on his 2 wheel scooter down driveways by emulating the older neighbourhood friends that he interacts with, a fear his parents couldn't help him overcome, was simply overcome in one play session with older friends.

Reducing Sources of Stress

Stress is a common aspect of childhood. It can lead to various psychological issues, such as anxiety, depression, and even bullying. It can also affect a child's academic performance and make them feel less secure. Mincemoyer (2019) noted that childcare centres can help reduce stress levels and provide kids with a variety of activities. The Tree Tops School creates an oasis of relaxation and fun by providing various activities and fun within a natural environment.

The goal of the school is to provide the children with a secure and safe environment. Reducing stress levels can be done through the establishment of safe and secure spaces.

Rather than creating a feeling of urgency, the school refrains from using bells or buzzers to signal the start or end of a period as this can cause concern or alarm. The only time these sounds are used is during a fire drill.

Through rules, the school instils responsibility in every student. These include behaving appropriately, respecting the environment, and being kind to one another. This approach seeks to keep children from getting stressed out by their peers.

5.3.1.2 To evaluate early childhood development strategies in South Africa.

One of the main features that set ECD programs in South Africa apart from other countries is the need to address the issue of social transformation. This is because the country has a long history of apartheid inequalities, and the need to professionalize its workforce. (Department of basic education 2015) Early learning and development areas feature a dozen guidelines and three main themes. These allow adults to assist children in their development. (Department of basic education 2015) Appendix 9, shows how the National Early Learning Standards (NELDs) framework is built from the ELDA's to get children prepared for the Curriculum Assessment and Policy Statement (CAPS) curriculum in the foundation stage.

The Tree Tops School was established without a particular teaching technique, as it believes that it has created one of its own using the mission statement, (Appendix 9: Tree Tops School Mission Statement) which is built on the framework of WESSA eco-schools however they have adapted it to be in line with the government curriculum from grade R. The structure of the school is conducive to fostering creative and constructive play among the children.

Although the concept of playing with kids across the same age is relatively new, the separation policy enforced by the educational system has encouraged it. (Gallo 2020) The small spaces at Tree Tops School affected the kid's abilities to engage with kids in different age groups. Children's moral reasoning skills can be improved through mixed-age games, and it can also help them develop their understanding of concepts that they may have never thought of before. (Gray 2007)

5.3.1.3 Understanding the relationship between early childhood development and biophilia.

This objective was presented in the literature review as part of the ongoing effort to understand the relationship between ECD and biophilia. The review highlighted various aspects of the topic and provided valuable input.

Children grow up having a wide range of rewarding opportunities due to their exposure to nature which helps develop their physical and social skills. (Kellert 2002, Taylor 2002, Dymont & Bell 2006, Bowen 2015, Kaushik 2023)

Children develop their intellectual and creative abilities through play in nature. Its therapeutic nature can help enhance their gross and fine motor skills, and their sensory and cognitive abilities. (Bowen 2015)

Studies have shown that biophilia can positively affect healthcare and stress management. The natural world can help dissipate stress (Kaushik 2023) Kuo and Taylor (2008) noted that exposure to the natural environment can also reduce the symptoms of ADHD in kids.

5.3.1.4 Understanding biophilic design

Biophilic Architecture is a creative and advanced approach to creating places where we work, live, and learn. Its design connects the natural and built environment. Through the use of Biophilic Design, architects can create environments that are both healthy and productive. (Cerini 2016) Kellert (2008,2015) introduced Biophilic Design to the wider architectural community by formulating a framework to address the various design issues affecting our built environment.

Table 3 (Pg 48) summarises the various components of the framework. The full explanation can be found in Appendix 10.

5.3.1.5 To build a framework for the design of an ECD centre, keeping in mind the connection between the natural and the built environment.

While childcare centres are focused on the future, they also need to reflect the history of our ancestors, it's also our responsibility to pass on our biophilia to future generations. The term "childcare" fails to convey the vision of the planet, community,

and childhood. The term "Early Childhood Development Centre" would be a more appropriate replacement. (Kellert 2008)

Outdoor environments must be designed to stimulate the users' interest in environmental issues, such as energy conservation and recycling. Although it can be challenging to communicate these values, both design and architecture can effectively accomplish this concept. (Citelli 2009)

The architecture of this facility is characteristically residential, and the principal feels that it provides a feeling of home to the children and their families. She says a school doesn't have to be designed from scratch, linking it to modernity, it can be adapted. The concept of home is a vital part of every person's identity. It allows them to connect with their surroundings and feel a sense of belonging. It can encompass the familiar sights, smells, and sounds associated with seasons and the setting sun. (Suval 2018) Phenomenology has been a major contributor to the understanding of this concept. It has been shown that people can develop a sense of belonging to their surroundings through interactions with them. (Pallasmaa 2011) To develop their capacities for attachment and bonding, people need to be able to feel attached to the natural world. Certain buildings and landscapes can serve as emotional sources of commitment and loyalty. (Kellert 2008) Although architecture can evoke the feeling of home, it doesn't necessarily have to be a dwelling that has been previously occupied as such. It can be a functional and aesthetically pleasing structure that can be used to enhance a person's experience.

According to the principal, architects make the mistake of designing classrooms with large fenestration therefore kids look out into play areas. Instead, she prefers classrooms with sections that are above the pupils' eye level and can still provide light. The principal also noted that the sandblasted sections of the classrooms prevented visual connections between the activities being held outside and the classroom. This seems to contradict some of the main principles of biophilia. Many studies claim that large windows provide natural light and views of the surrounding natural landscape enhance the educational experience for the children. (Kellert 2002, Taylor 2002, Dymont & Bell 2006, Bowen 2015, Kaushik 2023) This is a commonly used design feature in educational facilities.

When it comes to space remodelling, the principal's ideal solution was to have large classrooms with more storage. This will allow children to participate in indoor activities more efficiently and effectively and to easily organize and store their various items. Building a facility from scratch can be very beneficial as it allows the designer to work with the client to develop a solution that fits their needs. Another advantage of this approach is that it allows the client to have their desired design come to life. The space can be modified to suit their needs.

The grade R mentor suggested that floor coverings be easy to clean in case of spills. Kids use large rugs when they're sitting at the floor level, ones that can be removed for cleaning. Vinyl is easy to clean. The principal said that a warm floor covering, such as timber, would be ideal, as it's not too noisy. They also talked about seamless floors and cork flooring. The seamless design of toilet floors is needed to prevent accidents. They preferred the use of epoxy paints. The concept of biophilic architecture can be accomplished by using natural building surfaces and materials. (Kellert 2008)

The principal noted that there is a need for cosier spaces, such as a book corner. This concept aligns with biophilic architecture, a part of the "Evolved Human-Nature" framework. The concept of refuge denotes the ability of a structure or environment to offer a secure and sheltered setting. (Kellert 2008) The design of landscapes and interior spaces that are made to nurture and comfort can accomplish this. For example, one can utilise reading chairs and window seats to create a more intimate setting within a larger area. An enveloping chair or a canopy bed can also be utilised to provide additional refuge. (Anooi Studio 2018)

The principal suggested that swings should be made out of rubber instead of hardwood materials to prevent injuries. The ones at the site were made from repurposed tires.

According to the principal, Astro-turf is commonly used in busy areas due to how natural grass doesn't perform well under foot traffic. However, people still prefer natural products over those made from artificial materials even if they look similar due to artificial materials not being able to fully exhibit the organic processes that make up natural substances. (Kellert 2008) Artificial grass can cause air and surface temperatures to rise, increasing the risk of injury and illness among individuals who use

them during intense heat waves. This type of surface can also contribute to the development of stormwater run-off. (Macfarlane, Carrasco, Alam, & Archbold 2015) There are grasses which are known to have a high resistance when it comes to being stepped on, those used on sports fields. In South Africa, Kikuyu is a resilient grass type that can handle the effects of foot traffic and quickly recover from damage. Maintaining the grass regularly is important to ensure that it can grow and thrive. One simple way to do this is by regularly trimming it. (Ruger n.d)

The school's design should also be conducive to free flow and easy access. This will help ease the traffic jams that occur during peak hour rush times. Unfortunately, The Tree Tops School doesn't have a drop-off area. Its campuses are maintained through pedestrian-gated access, as it outgrew its original site and subsequently acquired other properties that transformed into schools. The school purchased these properties from a previously residential area, which limited their available space. The organization handles the drop-off process between parents and teachers through a personal touch.

Tree Tops school, as shown in the case study chapter, has been built with a simple structure that allows the children to navigate through the halls and around the campus.

5.4 SUMMARY

The chapter explores the contributions of the participants and the architecture's response to the needs of children within Early Childhood Development. Most of the responses are in line with the theoretical framework and the literature review's findings. The results that did not meet the expectations of the researcher through the concepts and theories discussed in the literature review have been discussed further and now fall in line with secondary research.

The study was able to attain its objectives due to the findings reinforcing the notion that early child development and biophilic architecture form a positive relationship.

CHAPTER SIX
LIMITATIONS AND RECOMMENDATIONS

6.1 LIMITATIONS OF THE STUDY

6.1.1 THE COVID PANDEMIC AND ITS EFFECT ON ECD AND RESEARCH

In 2020, the WHO declared COVID-19 a global pandemic. South Africa's approach is best suited to this context as the country has an underdeveloped early childhood development that is vulnerable to changes. All Early Childhood Development (ECD) centres in South Africa were temporarily closed in March of that year. Since then, it has been widely believed that the physical distancing of children will need to be maintained in the 2020-2021 school year. To address this issue, the education department shifted the focus to online learning. The complexity of the early childhood development system, which involves play and inquiry-based learning, made the shift to remote learning very challenging for teachers, parents and most importantly children.

Several countries around the world implemented various measures to address the coronavirus pandemic. Some of these include restricting public transportation, closing schools and workplaces, and cancelling public events. The adjustments made fieldwork towards this study impossible, and when the restrictions were lightened, institutions still experienced the effects of the pandemic and opted to keep their students and their staff members safe by providing minimal contact. This reduced the number of ECD Centres that were willing to take part in the study; therefore selection for institutions that best fit the research was almost non-existent. The centres that were open for research to continue, allowed for limited participants towards the interviews, as a result, the research findings may be biased.

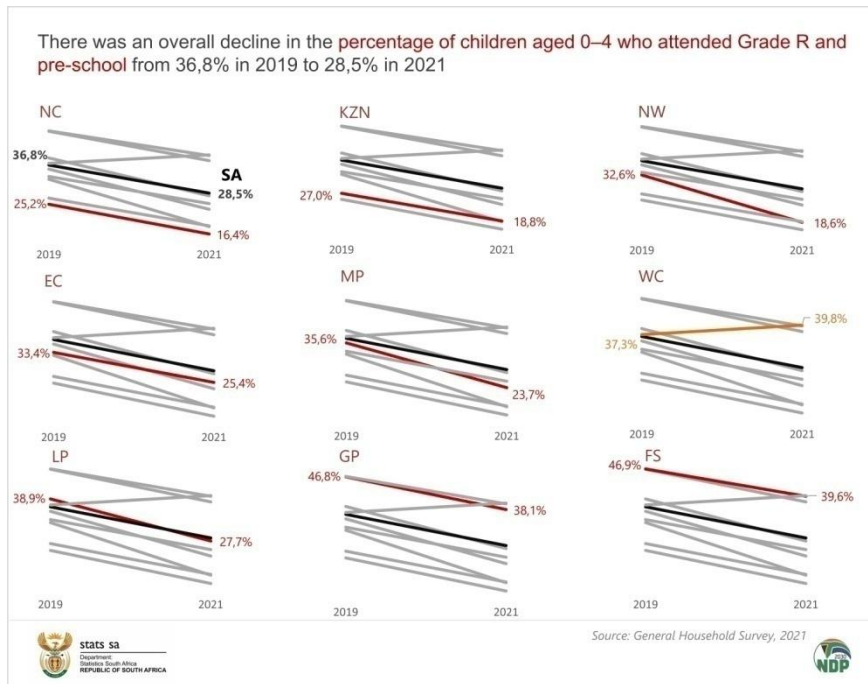


Figure 40: Pre-school and Grade R Attendance 2019

Source: <https://www.statssa.gov.za/wp-content/uploads/2022/06/Gr-r-and-pre-school-final.jpg>

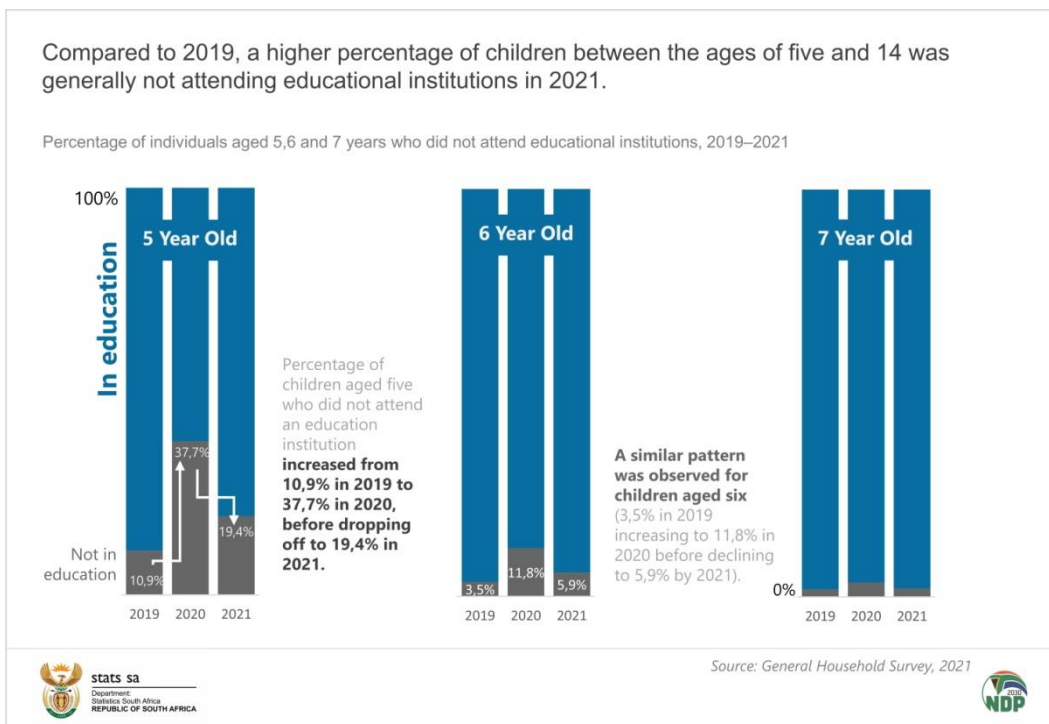


Figure 39: Effect Covid had on education institutions

Source: <https://www.statssa.gov.za/wp-content/uploads/2022/06/Did-not-attend-final.jpg>

6.1.3 SENSITIVITY REGARDING MINORS

Various research institutions are currently conducting important studies on children. To ensure that they are participating in the study, minors are required to be supported by their parents or guardian. Various factors, such as doing observations and taking photographs used to gather information necessitate parental consent.

There should be no barriers to learning; however, obtaining parental consent is one of the most common barriers to researching children. This is because it can be hard to send home the permission slips and make sure that everyone has signed and returned the forms. Concerning this particular study, one school decided against it while the other school found it difficult to get the forms returned.

6.3 RECOMMENDATIONS

Many recommendations can be given to design a quality early childhood development centre using the theories and concepts discussed in this study. They can help improve the quality of life for children and their families.

6.3.1 Practical Application of Findings

6.3.1.1 Designing an experience for children (phenomenology)

[Figure 41] While children live in an unchanging material reality, they also live in an imaginary world with different moods and geographies. This concept allows them to create environments that are both big and small, such as single rooms and gardens. (Day and Midbjer, 2007) Walls and railings are not designed to prevent people from entering a building, but to bounce balls or rattle sticks. (Day and Midbjer, 2007) Rooms are categorised into single-mood areas such as living rooms, bedrooms, kitchens, and classrooms. [Figure 42] For kids, one room can have five distinct features, including a centre and four corners. (Day and Midbjer, 2007)

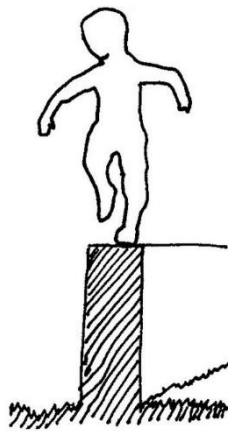


Figure 41: Walls are for walking along (2007)
(Day and Midbjer, 2007)

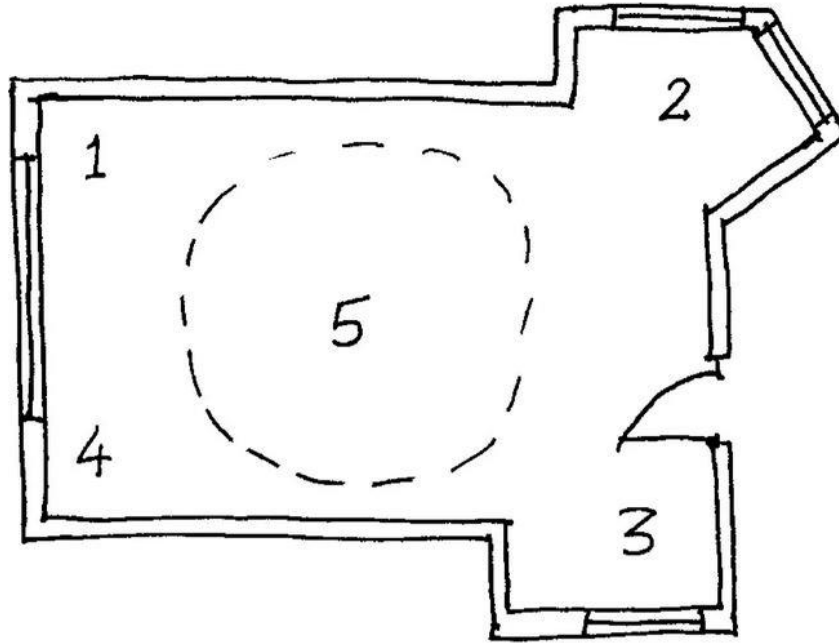


Figure 42: Room through a Child's Perspective (2007)
(Day and Midbjer, 2007)

6.3.1.2 Early Childhood Development

Building a Strong Foundation through Play

Children develop their physical and intellectual skills through play. This is done through various activities such as walking, running, and crawling. It helps them prepare for more complex activities, such as travelling through an airport or navigating a road. (Dudek 2012) According to Dudek (2012) among the principles that enable kids to customise playthings to their specifications are multi-functional functions, colour variations, and moving components.

A multi-functional play activity is something that provides a range of possibilities for children, and it can be used in various ways. (Dudek 2012) The design needs of children are those that are less obvious and more abstract. They should have materials and shapes that are both flexible and can be interpreted by the children themselves, as well as a variety of ideas. Kids are always experimenting with new things, and this is their natural behaviour. (Dudek 2012) The abstract forms of the playground by Studio Ossidiana in The Netherlands are illustrated in [Figure 43]



Figure 43: Abstract forms of a playground create multi-functional play (2020)

Source: <https://www.domusweb.it/en/architecture/gallery/2020/10/01/colourful-concrete-playground-stimulating-freedom-of-play.html>

A colour variation involves intentionally adding varying colours to a piece of equipment, which is done to provide a particular effect as illustrated in [Figure 44]. Children often reach an agreement on a rule that says that a certain colour is a crucial factor in their game, and it can serve as a catalyst for their play. (Dudek 2012)



Figure 44: Geo Dome Climber with various color connectors (2022)
Source: <https://www.americanparkscompany.com/geo-dome-climber.html>



Figure 45: Building Blocks (2022)
Source: <https://www.churcherscollege.com/nursery-3-4-/our-facilities>

Products that can move are made transformable. This allows children to modify the equipment and develop their own play patterns. It supports their instincts and makes the activity one of the best kinds of childhood entertainment. Kids can also decide how high they want to sit or if they want to go up. It promotes a sense of ownership. (Dudek 2012) Illustrated in [Figure 45] are children using building blocks to build their fantasy set.

Anthropometrics and Ergonomics

Anthropometry is a scientific method utilised by architects to measure the sizes and shapes of humans. They use this data to design spaces that are appropriate for their users known as Ergonomics. Child-scaled environments, illustrated in [Figure 46] encourage children to be independent. (Kishigami 1988)

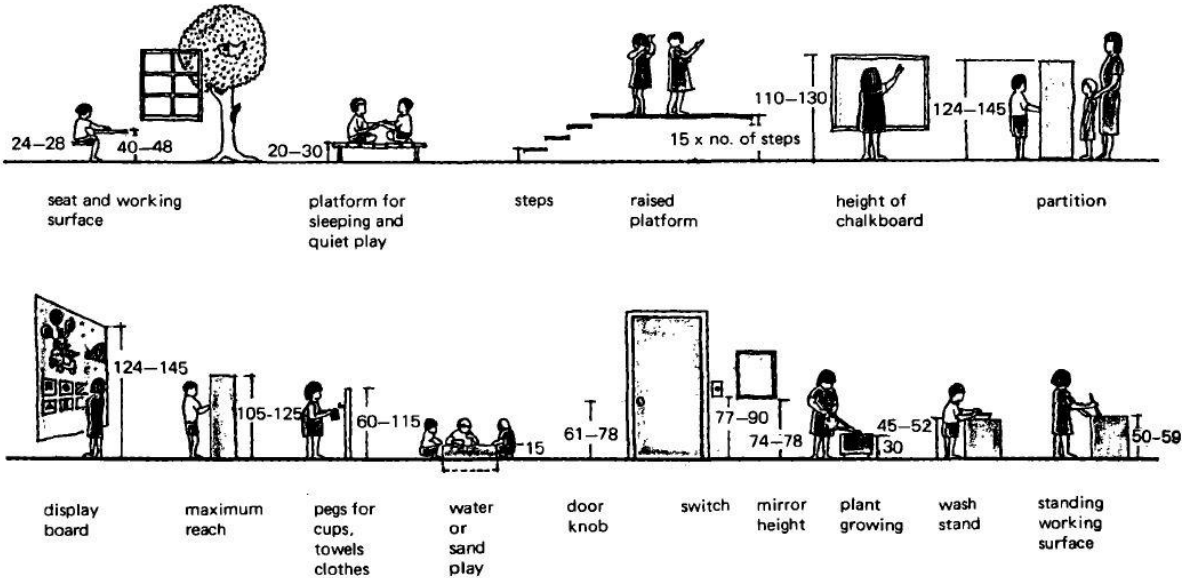


Figure 46: Child Scaled Environments (1988)
Source: Kishigami 1988

6.3.1.3 Biophilic Design

Biophilic design has a framework that designers use as a guide to include biophilia into their projects, this framework will form part of my recommendations for this study. Kellert's (2008) framework is attached as: [Appendix 10]

Environmental features



Figure 47: Indigenous South African Garden (2023)

Source: <https://www.theindigenousgardener.co.za/pathways?lightbox=dataltm-jmc3d8qs1>

The cultivation of indigenous plants is a vital part of the world's ecosystem and contributes significantly to the development and maintenance of a healthy and sustainable environment. Non-native plants can negatively affect the biodiversity of local fauna and flora. This can lead to the reduction of insect populations and bird and animal diversity. (Day and Midbjør, 2007)

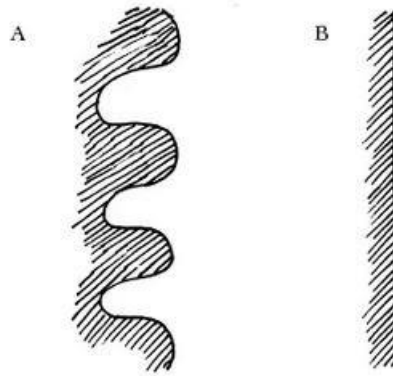


Figure 48: Shaping Edges (2007)
(Day and Midbjer, 2007)

“Life is most fertile at the meeting of different elemental qualities. Shaping woodland or waterside edges increases meeting zones, hence life. A has twice as much edge as B.” (Day and Midbjer, 2007)

Life forms are most vigorous when they meet the elements' attributes. The meeting of surfaces or elements at the edge can maximize this interaction. The water and the surface of the land meet at the edge, or the smooth surface of the land encounters rough terrain. (Day and Midbjer, 2007)

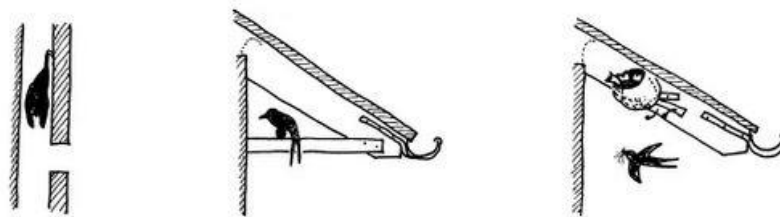
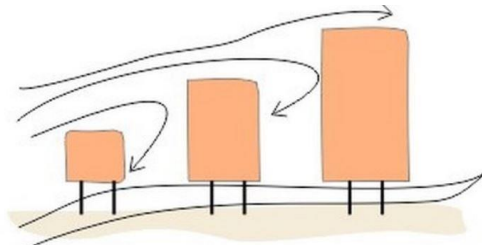


Figure 49: Habitat for insect controllers (2007)
(Day and Midbjer, 2007)

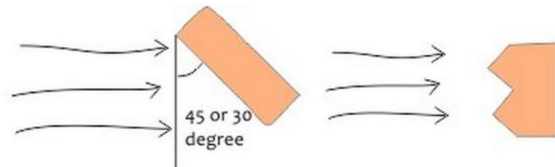
Some habitats can support only small populations that can survive harsh weather conditions, such as cats and cold winters. These habitats also restrict the breeding gene pool. On the other hand, if linked to DMOSS, reserve habitats are more resilient. Leaf-level continuity can help protect birds from predators and provide them with food. (Day and Midbjer, 2007) We can also design various nesting opportunities in these habitats, such as under eaves, where birds can eat the mosquitos and insects. Small

cavities designed into buildings, which are often warm during the day, can encourage bats to hunt. (Day and Midbjør, 2007)

Orientation Light and Ventilation



if a site has multiple buildings, they should be arranged in ascending order of their heights and be built on stilts to allow ventilation



Place buildings at a 30 or 45 degree angle to the direction of wind for enhanced ventilation. Form can be staggered in the wind facing direction also to achieve the same result.

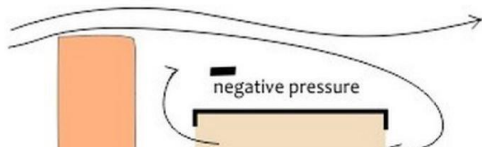
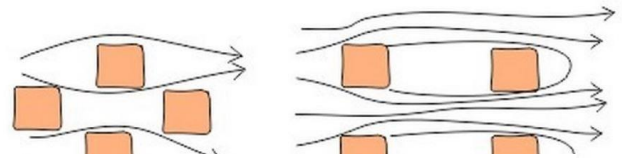


Figure 51: Clerestory light-shaft doubling as thermal chimney (2007)
(Day and Midbjør, 2007)

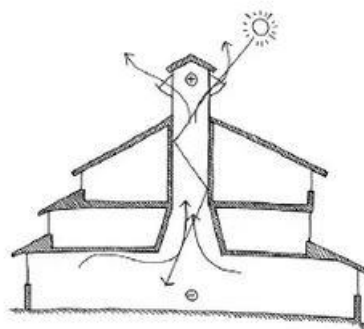
prevailing wind can alter the wind movement pattern for low lying buildings behind them



staggered layout helps in accentuating wind movement

Figure 50: Building Orientation (2022)

Source: <https://www.re-thinkingthefuture.com/rtf-fresh-perspectives/a2129-10-things-to-remember-when-designing-in-tropical-climate/>



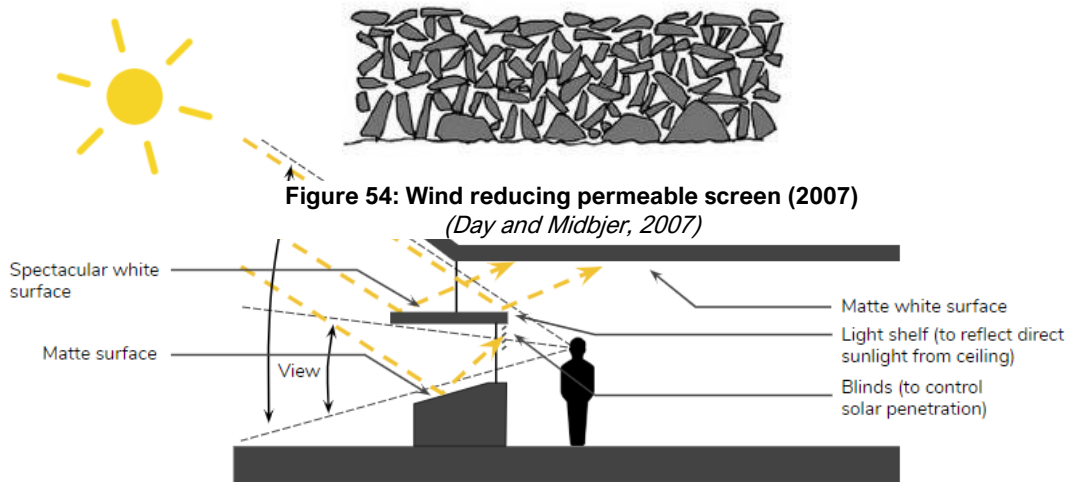
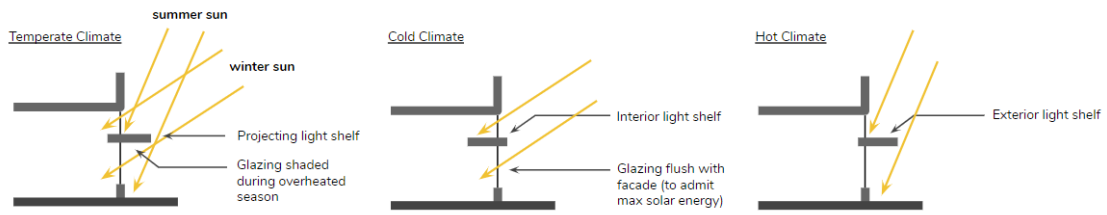


Figure 52: Natural light via a light shelf (2022)
 Source: <https://planlux.net/sunlight-shading-redirecting-devices/>

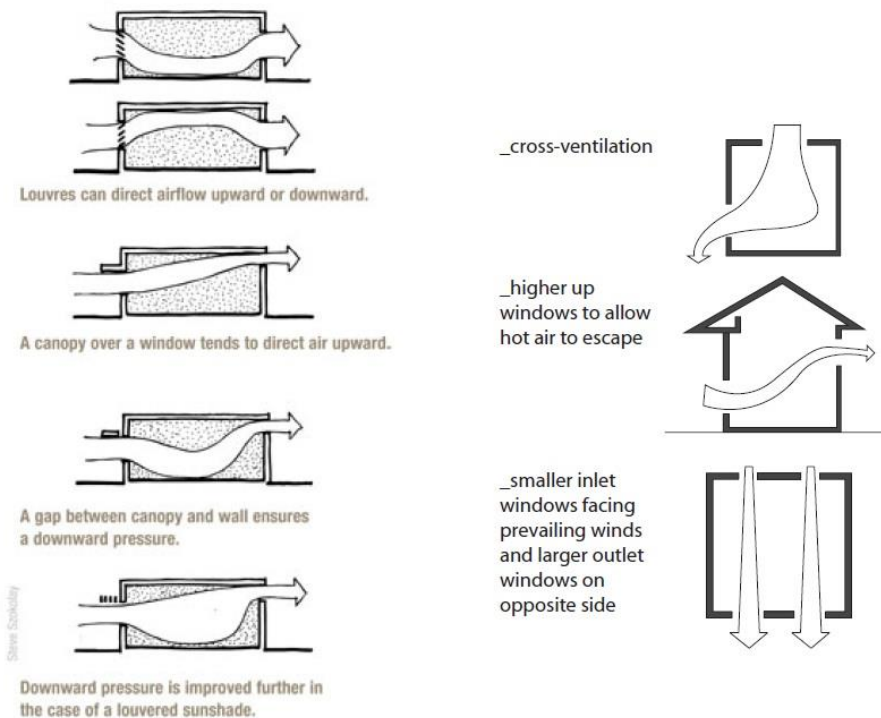


Figure 53: Natural airflow and Ventilation (2012)
 Source: <https://swazischool.files.wordpress.com/2012/09/openings.jpg>

One of the most important factors that influence a building's orientation is the amount of solar radiation that falls on its various sides at different times of the day as illustrated in [Figure 50]. This is why the building's form must be designed to encourage the utilization of shading and heat absorption. Another important factor that a designer needs to consider is the orientation of the building regarding the prevailing wind direction. This will help maintain the building's cooling and cross-ventilation. (Mour 2022)

According to Light Journey (2019), Humans have been using the sun's rays to regulate their bodies for thousands of years. Because of this, we have evolved to be healthier when working and living under the sun's daily cycle. The presence of sunlight supports the various elements that are connected to the environment, such as the interaction with animals and plants. Exposure to weather patterns and the view of nature also contribute to the development of natural designs. Due to the advancements in lighting technology, individuals are now more capable of designing for people with a human-centred perspective. [Figure 52] shows how a light shelf can be used to enhance the natural light's brightness. It also blocks out harsh light from the sun's rays.

In [Figure 53] various ventilation strategies are illustrated. The size and location of the openings are important factors that affect a building's breathability. This is because the air exchange between the exterior and interior of the building is vital. It is also important that the openings are large yet controllable and the air doesn't pass near hot surfaces on the outside. They should be able to handle the weather and other natural elements such as rain and insects. This is done through the careful placement of the openings on either side of the building and behind tree buffers in consideration of wind orientation while limiting the direct sunlight that enters the space. (Mour 2022)

Various types of screens can be used to reduce wind speed and provide a resilient and permeable environment. These include perforated walls, as shown in [Figure 54], tree shelter belts, and nets. (Day and Midbjør, 2007)

Water

A way to integrate the presence of water patterns into the landscape is through open-air rainwater management. Through the use of rainwater harvesting, reuse, and

preservation strategies, a place can enhance its human experience. These strategies can be used to emphasize the cultural or historical character of a space. A step-well or reflection pool can serve as a gathering place for people who want to reflect on their lives or learn more about nature. An engineered wetland can also enhance biodiversity and provide people with an opportunity to connect with nature. A combination of rain chains and french-drains can be used as drainage mechanisms. (Browning, Ryan & Clancy 2014). [Figures 55, 56 and 57] illustrate other creative ways of using water as design features.



Figure 55: Rainwater collection features (2023)

Source: <https://www.loveyourlandscape.org/expert-advice/water-smart-landscaping/rain-catchment-systems/do-this-not-that-when-harvesting-rainwater/>



Figure 56: Using gravity to create streams of water as a feature within the design (2011)
Source: <https://www.britannica.com/explore/savingearth/rainwater-harvesting-system>

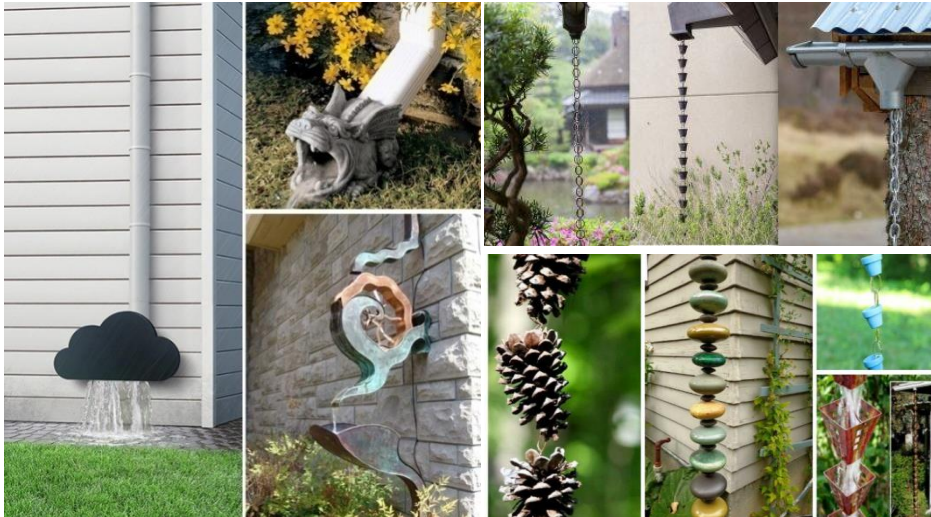


Figure 57: Rain chains and creative downspout ideas (2022)
Source: compiled by Author

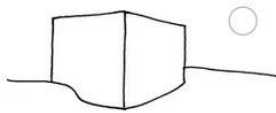
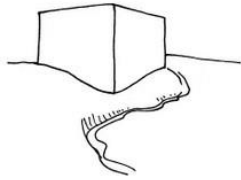
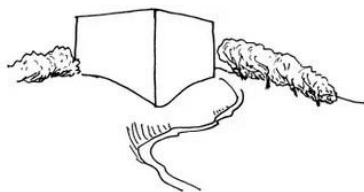


Figure 58: (top to bottom)

- a. Mineral, but not earthy.
- b. Landform moderated by water-shaping powers, also vegetation and running water.
- c. Land formed as earth would like.
- d. Vegetation – and place –shaped by the force of air.

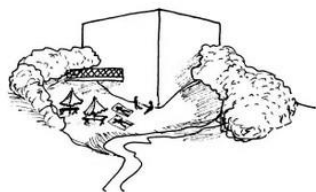


(Day and Midbjer, 2007)



Elemental Remediation

The first step in elemental remediation is to identify what was there. This can help us determine the initial form of the land and its physical properties. For instance, how did the wind and water flow through the area? What was the original structure of the landscape? (Day and Midbjer, 2007)



The ability to shape landforms to create microclimatic varieties with diverse capabilities is a key advantage of this concept. That can accommodate different age groups and activities, seasons, creatures, and birds. (Day and Midbjer, 2007)

6.4 SUGGESTIONS FOR FURTHER RESEARCH

The success of a research project depends on various factors. Some of these include funding, the quality of data it collects, and the researcher's motivation. The acceptance and availability of the selected participants are also important factors that affect the success of the project. Through these elements, the researcher can make an informed decision about the study.

Participants, in this particular study, were limited due to the limitations discussed above. It is recommended that case studies be carried out in government facilities within the South African context. This can help improve the efficiency of the research process and provide a more comprehensive view of the subject matter.

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APPENDICES

APPENDIX ONE - GATE KEEPERS LETTER - ARCHITECT



DATE:

To whom it may concern

Mrs Vaishali Zainub Khan is a Masters student in the School of Built Environment and Development Studies and formally requests permission to interview the Architect in your practice and use the data collected towards her Masters Research Project entitled:

The influence of biophilic architecture on early childhood development: towards a children's development facility in eThekweni, South Africa. The findings will be shared with the institution if requested after the study has been completed.

This interview will play an important role because of the scope of work your company has undertaken and it will be beneficial to gain insight into the thought process and theories regarding learning spaces and how the natural environment features within those learning spaces designed.

Thank you and kind regards

Architect Sign

Firm Name: _____



Business Stamp Above

Mrs Magdalena Catharina Cloete
Supervisor.

SCHOOL OF BUILT ENVIRONMENT AND DEVELOPMENT STUDIES

Email: cloete@ukzn.ac.za

Tel number: 031 260 1172

Built Environment and Development Studies, University of KwaZulu-Natal, Howard College Campus, Durban 4041

APPENDIX TWO – GATE KEEPERS LETTER - SCHOOL



DATE:

To whom it may concern

Mrs Vaishali Zainub Khan is a Masters student in the School of Built Environment and Development Studies and formally requests permission to interview staff in your institution/department. The data collected will be used in her Masters Research Project entitled: **The influence of early childhood development on biophilic architecture: towards a children's development facility in eThekweni, South Africa**, and the findings will be shared with the institution if requested after the study has been completed.

The study may be compiled in a few days, as it sets to include the following:

- Interviews will be conducted with members of staff to gain insight into their perceptions of the learning spaces and how the natural environment forms part of the learning space.
- Observations will be done to understand how the children engage with the indoor and outdoor spaces.
- Architectural survey of the buildings will include sketches and photographs to capture the architectural form and qualities of both internal and external spaces.

Thank you and Kind regards

Principal Sign Above

School Name: _____



School Stamp Above

Mrs Magdalena Catharina Cloete
Supervisor.

SCHOOL OF BUILT ENVIRONMENT AND DEVELOPMENT STUDIES

Email: cloete@ukzn.ac.za

Tel number: 031 260 1172

Built Environment and Development Studies, University of KwaZulu-Natal, Howard College Campus, Durban 4041

APPENDIX THREE - SEMI-STRUCTURED INTERVIEWS

The following is a sample of the interview that will be conducted with the participants. These interviews questions are open-ended to allow the participant flexibility in response.

Interview carried out and compiled by Vaishali Zainub Khan

Masters of Architecture Student at the University of Kwa-Zulu Natal

Student Number – 206 506 642

Date and time of Interviews will be conducted at the participant's convenience.

Interviews will be conducted remotely via video call as no face to face/ physical contact based research is to be conducted.

PART A

Name:.....

Age:.....

Date:.....

Name of School:.....

PART B

1. What is your job/role at the school?
2. How many children are registered per class?
3. What is the teacher child ratio?
4. How many classes are there per age group?
5. What are the ages of the children?
6. Are you aware of any stressors that affect the children
7. What programs have been designed to help the children cope with their stress?
8. What is the main teaching idea or method practiced in this school?
9. In your opinion, is this a good method? And Why?
10. Can you list the pros and cons to such a method?
11. What security features are there in the school?
12. Are the children able to find their way around the school?
13. Which parts of the school are the children most drawn to?
14. Can you rate the design of the school and its spaces out of 10? 1 being the lowest and 10 being the highest.
15. Could you highlight the reason for your rating?
16. What design or special adjustments would you make in the school and why?
17. What methods are used to stimulate the children and how?
18. Do the children of different age groups interact with each other?
19. Are the children encouraged to play outdoors and how?
20. Does the school focus on any sustainable efforts and are the children involved?
21. Are you aware of the impact nature has on childhood development.

APPENDIX FOUR–OBSERVATION CHECKLIST

The following is a sample of the observation checklist that will be conducted during a direct observation of spaces and how they are used. These observations are carried out to study the built environment and the observer will have no direct contact with the children that are engaging with those spaces. When using any photographs of my own, care will be taken to keep any identities anonymous by obscuring any facial features visible.

Observation carried out and compiled by Vaishali Zainub Khan
 Masters of Architecture Student at the University of Kwa-Zulu Natal
 Student Number – 206 506 642

Date and time of Observations will be conducted at the participant’s convenience.
 Observations will be conducted on site with all social distancing and other covid-19 protocols in effect..

PART A

Name:.....
 Age:.....
 Date:.....
 Name of School:.....

PART B

DESIGN GUIDELINES		YES	NO	COMMENT
General	Location distance to public transport			
	Vehicular access / drop off			
	Parking			
	Pedestrian access			
	Main/secondary road access			
	Any links to nearby public spaces?			
	Does the building feel welcoming?			
	Is the building sustainable?			
	Grey water harvesting?			
	Acoustic design?			

Early Childhood Development	Does the building promote exploration?			
	Are there stimulating colors used?			
	Do the spaces inspire creativity?			
	Does the building focus on scale?			
	Are there open spaces that the children can access?			
	Is there a playground?			
	Are there jungle gyms, sandpits and other interactive areas?			
	Indoor activities: toys, story time, screen time?			
	Is there a library?			
	Design towards a smaller scale suited to young children?			
	Nutritional program: onsite kitchen?			
	Nutritional program: dining area?			
	Nap Time: Sleeping area and furniture?			
Biophilic Architecture	Is the building facing North?			
	Does the building have access to the natural environment?			
	Is there any special connection to the natural environment?			
	Does the building receive enough natural light?			
	Does the building receive enough ventilation?			

Biophilic Architecture	Are there any views of the surrounding landscape?			
	Are there gardens?			
	Is/Are there green roof/s?			
	Is the green wall design?			
	Are there large trees that provide shaded areas?			
	Are there courtyards?			
	Are there plant pots or planters?			
	Are there food gardens?			
	Were natural materials used (wood/stone,etc)?			
	Were natural colours used?			
	Are there any water features?			
	Has biomimicry been used?			

APPENDIX FIVE – INFORMED PARENTAL CONSENT

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC) INFORMED CONSENT

Information Sheet and Consent to Participate in Research

Date: 25 August 2022

Dear Parent

My name is Vaishali Zainub Khan from the School of the Built Environment and Development Studies at the University of Kwa-Zulu Natal based at Howard College Campus, Dennis Shepstone building.

Your child is invited to consider participating in a study that involves research in Learning Spaces towards a Masters in Architecture.

The topic of the study is:

THE INFLUENCE OF EARLY CHILDHOOD DEVELOPMENT ON BIOPHILIC ARCHITECTURE: *Towards a Children's Development Facility in eThekweni, South Africa*

The aim and purpose of this research is to understand how both, children and adults use spaces in ECD centers everyday and hopefully how these spaces are experienced. These elements impact the wellbeing and development of children.

The case study includes 2 ECD facilities in the Durban area. The study is expected to include the children, teachers and child minders affiliated with a centre.

Child participation will involve a normal daily routine at school. The duration of your child's participation if you choose to enroll and remain in the study is expected to be for a day only.

The study will not involve any risks and/or discomforts. There may in some cases be no direct benefits to participants. However the broad outcome of the study is to impact on the policies governing early childhood care and development by firstly creating awareness of the impact of design of learning spaces and to also develop design guidelines for Early Childhood Development Centres.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number **HSSREC/00003801/2022**).

In the event of any problems or concerns/questions you may contact the or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

RESEARCHER INFO

Vaishali Zainub Khan

Email: vai2blue@gmail.com | [REDACTED]

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

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Please take note of the following considerations:

- Participation in this research is voluntary. Participants may withdraw participation at any point, and that in the event of refusal/withdrawal of participation the participants will not incur penalty or loss of benefit to which they are normally entitled.
- To withdraw from the study the participant are required to inform the researcher in writing of their decision providing reasons for their withdrawal. This will enable the researcher to adjust their research. The nature of the research does not pose any risk or discomfort, however as participation, voluntary withdrawal will be accepted if requested.
- There will be no costs incurred by participants as a result of participation in the study.
- Centres included in the study can choose to not be named. Participants similarly can stay anonymous. To protect confidentiality no personal information will be included in the recording and reporting of the research.
- The data collected will be used in this dissertation and all raw data will be disposed off in 5 years.

CONSENT FORM

Parent / Guardian

(To be signed by the parent/guardian before observational study is carried out)

I have read the information presented in the information letter about a project being conducted by Vaishali Zainub Khan of The School of Built Environment and Development Studies at Howard College, UKZN, under the supervision of Magdalena Cloete. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and additional details I wanted.

- I am aware that I have the option of allowing my child to be photographed to ensure accurate recordings of his / her engagement in the study.
- I was informed Photos used in the document will keep the anonymity of all individuals by either obscuring their facial features or taking images from an angle that hides their identity.
- I am aware that my child's name will remain anonymous.
- I was informed that I may withdraw my consent at any time without penalty by advising the researcher.
- I was informed that if I have any comments or concerns resulting from the participation of my child in this project, that I may contact the researcher.

With full knowledge of all foregoing, I agree, of my own free will, for my child to participate in this study.

Yes No

I agree to the use of anonymous quotations in the final research project report that comes of this research.

Yes No

I agree to allow photography during the research activities.

Yes No

Participant name

(Child): _____

Parent / Guardian name

signature

Witness name

signature

Date: _____

APPENDIX SIX – ASSENT FORM FOR CHILDREN

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE
(HSSREC)

ASSENT FORM

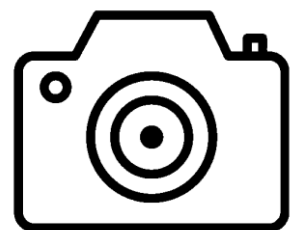
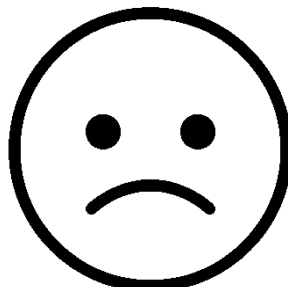
Teacher to read out loud to children:

“This is Mrs Khan. She is here today to learn about our spaces and she will be observing our classroom and our playtime. Your parents were happy for her to learn about your spaces by saying yes on the form that we sent home the other day. Now it’s your turn to let us know if you are comfortable and happy for her to stay at a distance and watch over our classroom and playground.

If you are happy to say yes please colour the HAPPY face. If you are not happy to have Mrs Khan include you in her study please colour the SAD face. Now there’s a picture of a camera below, Please colour in the camera if Mrs Khan is allowed to use a picture of you in her study. Please write your name here”

Note:

1. Only the children whose parents have given consent will complete an ASSENT FORM
2. If a parent has not allowed photography of their child, that would take precedent over the child’s consent
3. Photos used in the document will keep the anonymity of all individuals by either obscuring their facial features or taking images from an angle that hides their identity.



Name: _____

APPENDIX SEVEN – SOUTH AFRICAN GOVERNMENT REGULATIONS AND POLICIES FOR REGISTRATION OF EARLY CHILDHOOD DEVELOPMENT CENTRE’S

South African Government Regulations and Policies for Registration of Early Childhood Development Centre’s

Table 1: Staffing Requirements

Age	18-60, depends on health of person and context of centre. Combination of mature and younger persons.
Attributes and skills	Patience, loving nature, high standard of cleanliness, ability to work in a team. Understanding of, and ability to work with, young children. Supervisor should have knowledge of administration, management skills and financial skills.
Health	Staff appointed must be medically examined before being employed. Staff with infections, illness, must refrain from working with children and food (this does not necessarily mean termination of services).
Culture	Knowledge and respect of culture of children.
Training and experience	All staff should be completing or have completed a basic level training course from a recognized agency covering health, safety, nutrition, child development, administration skills including job description and crisis management. Supervisors/person in charge should have at least a standard 88 or equivalent (and have an understanding of working with adults). Staff development programs are important. In-service training is important.
Language	Mother tongue of child. Knowledge of other languages in an area to introduce to the children.
Staff/child ratios	House (mixed age groups) 1:6 House with additional structures on residential property, daycare centre or hall: 0-18 months 1:6 19 months – 3 years 1: 15 3 years 1 month – 6 years 1:25 After school centre 1 :35 Ratios assessed according space as laid out in the premises category of this document.

Table 2: Facility Requirements

Toilets	<p>The sanitation of the community in which the crèche is situated should be used as the standard. If running water is available flush toilets should be used. Use step-up and adapter seat if normal toilet. Toilets must be disinfected regularly Ratios: 1 commode/pottie : 5 children</p> <ul style="list-style-type: none"> ● 1 toilet : 20 children <p>For Babies: bucket with lid for sterilizing and soaking nappies. The nappies must be washed daily and the bucket cleaned. There should be a place to change nappies. Separate facilities for washing of potties.</p> <p>After School Facilities: separate facilities for boys and girls</p> <p>Crèches must work towards:</p> <ul style="list-style-type: none"> ● Separate facilities for all boys and girls. ● A potty per child. ● A separate staff facility.
Washbasins	<p>1 hand basin: 20 children. Use step-ups if there are fixed washbasins. Water must be changed regularly. Soap and dry cloth must be available. The drying cloth must be changed daily and be accessible to the children. A plastic bucket/container (rather only 10 per bucket) may be used but no water must be left in it after use. Disinfectant should be used in the water. A way of waste disposal is needed – French drain.</p>
Kitchen	<p>Separated from play area by at least a partition. No recommended size. No free access to children, but should be escorted when entering the kitchen. Must be kept clean, hygienic (light washable paint). Equipment should be stored in safe containers. Should be equipped with a table, sink, cooking utensils, crockery and cutlery, cleaning materials. Some means of cooking food, approved refuse removal and cooling facilities. If using gas or paraffin it should be stored outside safely. Washable floor cover. Big enough for utensils and equipment. Not a storage place for toys etc. Separate space (not room) for preparation of baby food. Facilities to boil water for sterilization.</p>
Indoor Space	<p>Indoor play area after cupboards and other furniture has been taken into account:</p> <ul style="list-style-type: none"> ● 2m² per baby ● 1.5m² per toddler
Outdoor Space	<p>Outdoor play area:</p> <ul style="list-style-type: none"> ● 1m² per child at least for the first 30 children. Children can then be divided into groups and taken outside one group at a time. Always under supervision. <p>No open fires in outdoor play area. Public parks may be used as long as it is safe for the children. If no outdoor space add 1m² per child to the indoor space.</p>
Office/staff/sickbay/isolation rooms	<p>A sickbay is a quiet space away from other children even in the same room. IF there is an office, the sickbay should be in the office. If possible a space for staff to rest should also be provided.</p>

<https://wp.wpi.edu/capetown/projects/p2013/early-childhood-development-connection/knowledge-worth-sharing/registering-requirements/>

APPENDIX EIGHT – TREE TOPS SCHOOL MISSION STATEMENT

Tree Tops School GENERAL SCHOOL POLICY

'As the bough is bent, so grows the tree.'



Tree Tops Mission Statement encapsulates all the guiding principles and belief systems that govern the functioning of the school, whether in terms of ethos, curriculum, strategic or financial planning. When decisions are being made and policies formulated, they are 'held up' against the Mission Statement to see if they are congruent.

MISSION STATEMENT

Tree Tops is an independent, co-educational school that specialises in educating young children from 'age 3 to Grade 3'. The School is a Non Profit Company (N.P.C.) which has children at the heart of its business. The size of the school lends itself to the development of personal relationships between the staff, pupils and parents, which contributes to a warm sense of community and shared endeavour. **Our core purpose is to promote and protect the rights of children in our care to a wholesome and unhurried experience of childhood, while guiding and supporting their growth and development in a happy, safe, caring and stimulating environment.**

In fulfilling Tree Tops' core purpose, we aim to ensure that our school is:

- A place of peace, happiness and security, where love and laughter are woven into the fabric of each day
- A place where daily opportunities for creative and constructive play are available for all age groups
- A place where the emphasis is on caring and sharing, and on discovering one's humanity
- A place where value systems and acceptable conduct are defined clearly and upheld consistently
- A place where each child is encouraged to 'be the best she/he can be' and where the diverse talents of all children are celebrated
- A place of natural beauty and tranquillity, where children are aware of the wonders of the world around them
- A place where commonalities are emphasised rather than cultural and religious differences
- A place where individual learning styles are recognised in the design and delivery of the curriculum
- A place where gender differences are acknowledged, but stereotypes are mediated against and are not allowed to limit the aspirations or interests of either boys or girls
- A place where pride is fostered in one's school, city, province and country

We are committed to encouraging and supporting our children to develop:

- Independence and self-discipline
- Self-respect
- Respect for others
- Respect for the environment, with special emphasis on the natural world
- An appreciation of the fragile nature of our Earth and the need to live in ways that promote environmental sustainability
- Tolerance and empathy
- A knowledge of right and wrong
- A sense of fellowship
- A sense of humour
- The confidence to take risks and try new things
- Emotional resilience when approaching challenges in both social and learning spheres

Tree Tops is a learning community, marked by collegial co-operation, which recognises learning as both an individual and collective process and creates school structures and processes to support high achievement by children in all areas of the curriculum. Teachers in our Foundation Phase (Grade R to Grade 3) are committed to assisting all pupils to meet the requirements of the National Curriculum and Assessment Policy Statements (CAPS) and to move beyond them wherever possible.

APPENDIX NINE – TABLE SHOWING EARLY LEARNING AND DEVELOPMENT AREAS (DBE 2015)

The South African National Curriculum Framework for children from Birth to Four

Early Learning and Development Areas	Relationship with the NELDS - Desired Results	Relationship with CAPS - Foundation Phase Subjects
1. Well-being	<ul style="list-style-type: none"> Children are becoming more aware of themselves as individuals, developing a positive self-image and learning how to manage their own behaviour Children are demonstrating growing awareness of diversity and the need to respect and care for others. Children are beginning to demonstrate physical and motor abilities and an understanding of a healthy lifestyle. 	Life Skills Language
2. Identity and belonging	<ul style="list-style-type: none"> Children are becoming more aware of themselves as individuals, developing a positive self-image and learning how to manage their own behaviour Children are demonstrating growing awareness of diversity and the need to respect and care for others. 	Life Skills (including historical and geographical understandings of self and family) Language
3. Communication	<ul style="list-style-type: none"> Children are learning how to think critically, solve problems and form concepts Children are learning to communicate effectively and use language confidently. Children are learning about mathematical concepts. 	Language Mathematics Life Skills
4 Exploring mathematics	<ul style="list-style-type: none"> Children are learning how to think critically, solve problems and form concepts Children are learning to communicate effectively and use language confidently. Children are learning about mathematical concepts. 	Mathematics Language Life Skills (including scientific and environmental knowledge and skills)
5. Creativity	<ul style="list-style-type: none"> Children are learning how to think critically, solve problems and form concepts Children are becoming more aware of themselves as individuals, developing a positive self-image and learning how to manage their own behaviour Children are learning to communicate effectively and use language confidently. 	Language Mathematics Life Skills
6. Knowledge and understanding of the world	<ul style="list-style-type: none"> Children are learning how to think critically, solve problems and form concepts Children are demonstrating growing awareness of diversity and the need to respect and care for others. Children are learning about (mathematical) concepts 	Life Skills (including historical, geographical knowledge, scientific and mathematical knowledge and skills) Mathematics Language

APPENDIX TEN – ELEMENTS AND ATTRIBUTES OF BIOPHILIC DESIGN (Kellert 2008)

6 Dimensions, Elements, and Attributes of Biophilic Design

aquarium. Symbolic or vicarious experience involves no actual contact with real nature, but rather the representation of the natural world through image, picture, video, metaphor, and more.

The second basic dimension of biophilic design is a *place-based or vernacular* dimension, defined as buildings and landscapes that connect to the culture and ecology of a locality or geographic area. This dimension includes what has been called a sense or, better, spirit of place, underscoring how buildings and landscapes of meaning to people become integral to their individual and collective identities, metaphorically transforming inanimate matter into something that feels lifelike and often sustains life. As René Dubos (1980, 110) argued:

People want to experience the sensory, emotional, and spiritual satisfactions that can be obtained only from an intimate interplay, indeed from an identification with the places in which [they] live. This interplay and identification generate the spirit of the place. The environment acquires the attributes of a place through the fusion of the natural and human order.

People are rarely sufficiently motivated to act as responsible stewards of the built environment unless they have a strong attachment to the culture and ecology of place. As Wendell Berry (1972, 68) remarked: "Without a complex knowledge of one's place, and without the faithfulness to one's place on which such knowledge depends, it is inevitable that the place will be used carelessly and eventually destroyed." A tendency to affiliate with place reflects the human territorial proclivity developed over evolutionary time that has proven instrumental in securing resources, attaining safety and security, and avoiding risk and danger.

Despite the modern inclination for mobility, most people retain a strong physical and psychological need for calling some place "home." This attachment to territory and place remains a major reason why people assume responsibility and long-term care for sustaining buildings and landscapes. Conversely, lacking a sense of place, humans typically behave with indifference toward the built environment. An erosion of connection to place has unfortunately become a common affliction of

modern society—what Edward Relph called "placelessness," and described in the following way (1976, 12):

If places are indeed a fundamental aspect of existence in the world, if they are sources of security and identity for individuals and for groups of people, then it is important that the means of experiencing, creating, and maintaining significant places are not lost. There are signs that these very means are disappearing and that "placelessness"—the weakening of distinct and diverse experiences and identities of places—is now a dominant force. Such a trend marks a major shift in the geographical bases of existence from a deep association with places to rootlessness.

The two basic dimensions of biophilic design can be related to six biophilic design elements:

- Environmental features
- Natural shapes and forms
- Natural patterns and processes
- Light and space
- Place-based relationships
- Evolved human-nature relationships

These six elements are then revealed in more than 70 biophilic design attributes.

The remainder of this chapter describes these elements and attributes of biophilic design. This description is necessarily brief, due to space limitations, and insufficient. Additionally, this initial formulation will be modified in the future with increasing knowledge, and some of this categorization will inevitably overlap. This classification should, therefore, be viewed as a work in progress. At the end of the chapter, all the design elements and attributes are listed in Table 1.1, and a small number of illustrations are provided.

Environmental Features

The first and most obvious of the biophilic design elements is *environmental features*, involving the use of relatively well-recognized characteristics of the natural world in the built environment. Twelve attributes are identified, including the following:

1. *Color.* Color has long been instrumental in human evolution and survival, enhancing the ability to locate food, resources, and water; identify danger; facilitate visual access; foster mobility; and more. People for good and obvious reasons are attracted to bright flowering colors, rainbows, beautiful sunsets, glistening water, blue skies, and other colorful features of the natural world. Natural colors, such as earth tones, are thus often used to good effect by designers.
2. *Water.* Water is among the most basic human needs and commonly elicits a strong response in people. The famous architectural critic John Ruskin remarked in this regard (Hildebrand 2000, 71): "As far as I can recollect, without a single exception, every Homeric landscape, intended to be beautiful, is composed of a fountain, a meadow, and a shady grove." Roger Ulrich similarly observed (1993) based on a review of many studies: "Water features constantly elicit especially high levels of liking or preference." The effective use of water as a design feature is complex, well described in the chapter by Mador, and often contingent on such considerations as perceptions of quality, quantity, movement, clarity, and other characteristics.
3. *Air.* People prefer natural ventilation over processed and stagnant air. Important conditions include quality, movement, flow, stimulation of other senses such as feel and smell, and visual appeal despite the seeming invisibility of the atmosphere.
4. *Sunlight.* Daylight is consistently identified as an important and preferred feature by most people in the built environment. The simple use of natural rather than artificial light can improve morale, comfort, and health and productivity. This preference reflects the fact that humans are a largely diurnal animal, heavily reliant on sight for securing resources and avoiding hazard and danger. People depend on visual acuity to satisfy various physical, emotional, and intellectual needs. Additional consideration of the importance of light is addressed in a later section on the more general biophilic design element of light and space.
5. *Plants.* Plants are fundamental to human existence as sources of food, fiber, fodder, and other aspects of sustenance and security. The mere insertion of plants into the built environment can enhance comfort, satisfaction, well-being, and performance.
6. *Animals.* Animals are similarly basic to human existence as sources of food, resources, protection, and companionship, and occasionally as precipitators of fear and danger. Designing animal life into the built environment can be difficult and problematic, although sometimes effective in aviaries, aquaria, and even the presence of free-roaming creatures associated with certain designs like green roofs. Animals in building interiors typically occur in representational rather than literal form, many through the use of ornament, decoration, art, and in stylized and highly metaphorical disguise. The presence of animal forms, nonetheless, often provokes satisfaction, pleasure, stimulation, and emotional interest.
7. *Natural materials.* People generally prefer natural over artificial materials, even when the artificial forms are close or seeming exact copies of natural products. Part of the aversion is likely due to the inability of artificial materials to reveal the organic processes of aging, weathering, and other dynamic features of natural materials, even inorganic forms like stone. The patina of time may provoke an intuitive understanding among some people of the benefits flowing from the movement of nutrients and energies through natural systems.
8. *Views and vistas.* People express a strong and consistent preference for exterior views, especially when the vistas contain natural features and vegetation. These views are often most satisfying when the scale is compatible with human experience—for example, not overly restricted or confined, unfamiliar, or out of scale or proportion (e.g., too large or too high).
9. *Facade greening.* Buildings with vegetative façades, such as ivy walls or green roofs, often provoke interest and satisfaction. This likely reflects the historic benefits associated with organic materials as sources of insulation, camouflaging protection, or even food. Plants on buildings and constructed landscapes can also evoke a powerful vernacular, such as the thatched or vegetative roofs of many cultures.

10. *Geology and landscape.* The compatible connection of buildings to prominent geological features is often an effective design strategy. These structures are sometimes described as rooted or grounded. Frank Lloyd Wright achieved particular success with his Prairie-style architecture in part by creating structures that worked in strong parallel relation to rather than dominating their savanna-type landscape.
11. *Habitats and ecosystems.* Buildings and landscapes that possess a close and compatible relationship to local habitats and ecosystems also tend to be highly effective and preferred. Important ecosystems in this regard are often wetlands, forests, grasslands, and watersheds.
12. *Fire.* Fire in the built environment, while a complicated and difficult design challenge, is often a preferred feature, generally associated with the benefits of heating and cooking. The manipulated experience of fire within building interiors has long been celebrated as a sign of comfort and civilization, providing pleasing qualities of color, warmth, and movement.

Natural Shapes and Forms

The second biophilic design element is *natural shapes and forms*. This element includes representations and simulations of the natural world often found on building façades and within interiors. Eleven attributes are associated with this design element:

1. *Botanical motifs.* The shapes, forms, and patterns of plants and other vegetative matter are a frequent and often important design element of the built environment (Hersey 1999). These representations often mimic or simulate plant forms such as foliage, ferns, cones, shrubs, and bushes, both literally and metaphorically.
2. *Tree and columnar supports.* Trees have also played a vital role in human affairs as sources of food, building material, paper products, heating supply, and other uses. The appearance or simulation of tree-like shapes, especially columnar supports, is a common and often coveted design feature in the built environment. Some of our most appealing structures contain tree forms and shapes that frequently include leaf capitals. When revealed in multiples, they can sometimes suggest a forested setting.
3. *Animal (mainly vertebrate) motifs.* The simulation of animal life is widespread in building interiors and facades, although to a less extent than with plants. The appearance of animal parts is often encountered, such as claws or heads, rather than entire creatures. Animal forms are frequently revealed in highly stylized, fictionalized, and sometime contorted shapes and forms.
4. *Shells and spirals.* Simulations and depictions of invertebrate creatures are widespread design features in the built environment, particularly shell and spiral forms of actual and imagined mollusks. The shapes and forms of bees (and their hives), flies, butterflies, moths, and other insects, as well as spiders (and their webs) and other invertebrates, are also common. Some building designs mimic invertebrate processes, such as the bioclimatic controls of termite mounds, the structural strength of seashells and hives, and the patterns of webs, a subject considered at the end of this section under the topic of "biomimicry," and in the chapter by Benyus.
5. *Egg, oval, and tubular forms.* Egglike and tubular forms are also design elements in some building interiors, facades, and exterior landscapes such as gardens and fountains. These shapes often occur literally and metaphorically, both important expressions of ornament and sometimes for structural purposes.
6. *Arches, vaults, domes.* Arches, vaults, and domes in the built environment resemble or copy forms found in nature, including beehives, nest-like structures, shell forms, and cliffs. These forms can be used for both decorative and functional purposes.
7. *Shapes resisting straight lines and right angles.* Natural shapes and forms are often sinuous, flowing, and adaptive in responding to forces and pressures found in nature. Natural features are thus rarely revealed as straight lines and right angles characteristic of human engineering and manufactured products and structures. The large-scale modern built environment has often been characterized by

standardized and rigid shapes. People nonetheless generally prefer designs that resemble the tendency of organic forms to resist hard mechanical edges, straight lines and angles.

8. *Simulation of natural features.* This attribute reaffirms the tendency to simulate rather than replicate actual natural forms in the built environment. Ornamentation and decoration especially employ imagined forms only vaguely reminiscent of those found in the natural world. These designs are often most successful when they possess a logic that intimates functional features occurring in nature, such as shapes, patterns and processes that suggest structural integrity and adaptive advantage in response to environmental pressures rather than mere superficial decoration.
9. *Biomorphy.* Some interesting architectural forms bear very little resemblance to life forms encountered in nature, yet are clearly viewed as organic. These resemblances to living forms are usually unconscious products of design, sometimes called "biomorphy" (Feuerstein 2002). Powerful examples of biomorphic architecture that provoke observers to impute known animal and plant labels even when the designer did not deliberately create these life-forms include the birdlike shape of Jörn Utzon's Sydney Opera House and the fernlike or less reverently labeled "pregnant whale" of Eero Saarinen's Yale University hockey rink.
10. *Geomorphology.* Some building designs mimic or metaphorically embrace landscape and geology in relative proximity to the structure. This relationship to the ground can lend the appearance of solidity to the built environment, making structures appear integral rather than separate from their geological context.
11. *Biomimicry.* Some successful designs borrow from adaptations functionally found in nature, particularly among other species. Examples include the structural strength and bioclimatic properties of shells, crystals, webs, mounds, and hives, effectively incorporated into the built environment. This tendency has been called "biomimicry" by Janine Benyus, elucidated in her book of this title (Benyus 1997) and connected to biophilic design in a later

chapter in this volume. The knowledge of biomimetic properties is growing rapidly and will likely result in a revolution of product development with enormous biophilic design implications.

Natural Patterns and Processes

A third biophilic design element is *natural patterns and processes*. This element emphasizes the incorporation of properties found in nature into the built environment, rather than the representation or simulation of environmental shapes and forms. Fifteen attributes have been identified and are described below, although this complex element is likely to be altered in the future with additional understanding.

1. *Sensory variability.* Human fitness and survival has always required coping with a highly sensuous and variable natural environment, particularly responding to light, sound, touch, smell, and other sensory environmental conditions. Human satisfaction and well-being continue to be reliant on perceiving and responding to sensory variability, especially when this occurs in structured and organized ways within the built environment.
2. *Information richness.* The cognitive richness of the natural world reflects its likely being the most intellectually challenging environment people will ever encounter even in our modern information age. This quality constitutes one of its most beguiling features, and when effectively incorporated into the built environment in actual or metaphorical form can stimulate curiosity, imagination, exploration, discovery, and problem-solving. Most people, therefore, respond positively to buildings and landscapes that possess information richness, variety, texture, and detail that mimic natural patterns when coherently revealed.
3. *Age, change, and the patina of time.* A fundamental feature of the natural world is aging through time, particularly organic forms. This dynamic progression evokes a sense of familiarity and satisfaction among people, despite the eventual occurrence of senescence, death, and decay. A patina of time is characteristic of natural materials, even inorganic ones, and is one reason, as noted above, that artificial

- products rarely evoke sustained positive response even when they are exact copies.
4. *Growth and efflorescence.* Growth and development are specific expressions of aging that when found in the built environment typically provoke pleasure and satisfaction. Efflorescence marks the progressive unfolding of a maturational process that when encountered in buildings and landscapes, especially through ornamentation, is often highly appealing (Bloomer 2000). These temporal and transitional attributes often lend a dynamic quasi-living character to the built environment despite its immutable character.
 5. *Central focal point.* The navigability of natural landscapes is often enhanced by the presence of a centrally perceived focal point. This point of reference frequently transforms what otherwise is a chaotic setting into an organized one that facilitates passage and way-finding. As the poet Wallace Stevens described (1955): "I placed a jar in Tennessee/ And round it was, upon a hill./ It made a slovenly wilderness/ surround that hill." Many successful buildings and constructed landscapes similarly achieve coherence despite complexity and large scale when a centrally organized reference point has been effectively incorporated.
 6. *Patterned wholes.* People respond positively to natural and built environments when variability has been united by integrated and patterned wholes. What may have previously been experienced as inchoate becomes structured in a manner that fosters understanding and often feelings of mastery and control.
 7. *Bounded spaces.* Humans have a strong proclivity for bounded spaces. This territorial tendency, over evolutionary time, likely fostered resource exploitation and security. People also value delineated spaces within the built environment, which enhance the recognition of clear and consistent boundaries and place demarcations.
 8. *Transitional spaces.* Transitional spaces within and between built and natural environments often foster comfort by providing access from one area to another. Important passageways in the built environment include thresholds, portals, doors, bridges, and fenestration.
 9. *Linked series and chains.* Clear physical and temporal movement in both natural and built environments is often facilitated by linked spaces, especially when occurring in connected chains. These relational spaces convey meaning and organization, as well as sometimes a sense of mystery that both stimulates and entices.
 10. *Integration of parts to wholes.* People prefer in natural and built environments the feeling that discrete parts comprise an overall whole, particularly when the whole is an emergent property consisting of more than the sum of the individual parts. This integrative quality fosters a feeling of structural integrity, even in complexes of considerable size and detail.
 11. *Complementary contrasts.* Meaning and intelligibility, as well as interest and stimulation, in natural and constructed settings often reveal the blending of contrasting features in complementary fashion. This can occur through the compatible rendering of seeming opposites, such as light and dark, high and low, and open and closed.
 12. *Dynamic balance and tension.* The dynamic balancing of different and sometimes contrasting forms often fosters a sense of strength and durability in both natural and built environments. This blending of varying forces often produces a quality of creative tension that transforms static forms into organic-like entities.
 13. *Fractals.* Elements in nature are rarely if ever exact copies of one another, even among highly related entities. Snowflakes or leaves of a single species or tree may be highly similar but never the same. Orderly variation on a basic pattern is the norm, whether it be thematic diversity based on size, or spatial or temporal scale. Related and similar forms are often called "fractals," and these patterns are found in some of our most successful buildings and landscapes. These structures frequently include repeated but varying patterns of a basic design, such as ornamentation in parallel or closely linked rows that differ slightly from one another.
 14. *Hierarchically organized ratios and scales.* Successful natural and built forms often occur in hierarchically connected ways, sometimes arithmetically or geometrically related. This thematic congruence

can facilitate the assimilation of highly complex patterns that otherwise might be experienced as overwhelmingly detailed or even chaotic. Arithmetic and geometric expressions of this tendency in both natural and built settings include the golden proportion and the Fibonacci ratio (Portoghesi 2000).

Light and Space

A fourth biophilic design element is *light and space*. Twelve design attributes of this element follow, seven focusing on qualities of light and five focusing on spatial relationships:

1. *Natural light*. This attribute includes the effects of daylighting as previously described, as well as inclusion of the full color spectrum of natural light. Chapters by Loftness and Frumkin note studies showing that natural light is both physically and psychologically rewarding to people, frequently contributing to their health, productivity, and well-being in the built environment.
2. *Filtered and diffused light*. The benefits of natural light are often enhanced by modulating daylight, particularly by mitigating the effects of glare. Filtered or diffused sunlight can also stimulate observation and feelings of connection by providing a variable and mediated connection between spaces, particularly inside and outside areas such as described in the chapter by Bloomer.
3. *Light and shadow*. The complementary contrast of light and dark spaces can produce significant satisfaction in both buildings and landscapes. The creative manipulation of light and shadow can foster curiosity, mystery, and stimulation. This attribute likely evolutionarily enhanced human movement and the ability to discern objects over long distances, particularly from a protected refuge.
4. *Reflected light*. Lighting designs are frequently enhanced by light reflecting off surfaces such as light-colored walls, ceilings, and reflective bodies like water. Functional benefits include mitigation of glare, enhanced penetration of light into interior spaces, and spying resources at a distance.
5. *Light pools*. People are often drawn into and through interior spaces by the presence of pools of connected light. Light pools can assist movement and way-finding by providing lighted patches across shadowed or obscured areas such as a forest or darkened halls and passageways. Light pools can also foster feelings of security and protection, such as a lighted hearth.
6. *Warm light*. The perception of warmly lit areas, often islands of modulated sunlight surrounded by darker spaces, can enhance the feeling of a nested, secure, and inviting interior.
7. *Light as shape and form*. The manipulation of natural light can create stimulating, dynamic, and sculptural forms. Beyond the aesthetic pleasure, these shapes facilitate mobility, curiosity, imagination, exploration, and discovery.
8. *Spaciousness*. People prefer feelings of openness in natural and built environments, especially when it occurs in complementary relation to sheltered protected refuges at the surrounding edges. Effective designs often include spacious settings in close alliance with smaller spaces, which in contemporary architecture can often be encountered in airports, train stations, and some commercial and educational buildings.
9. *Spatial variability*. Spatial variability fosters emotional and intellectual stimulation. Spatial diversity is often most effective when in complementary relation to organized and united spaces.
10. *Space as shape and form*. Space can be creatively manipulated to convey shapes and forms. This effect can add beauty to the built environment, which stimulates interest, curiosity, exploration, and discovery.
11. *Spatial harmony*. The manipulation of space in the built environment tends to be most effective when it blends light, mass, and scale within a bounded context. This achievement evokes a sense of harmony, which fosters a sense of security and facilitates movement within diverse settings.
12. *Inside-outside spaces*. Appealing interior spaces in the built environment often appear connected to the outside environment. These areas also mark the transition of nature with culture. Important design forms in the built environment that evoke this quality include colonnades, porches, foyers, atriums, and interior gardens.

Place-Based Relationships

A fifth biophilic design element is *place-based relationships*. This element refers to the successful marriage of culture with ecology in a geographical context. The connection of people to places reflects an inherent human need to establish territorial control, which during the long course of our species' evolution facilitated control over resources, attaining safety, and achieving security. Locational familiarity—the yearning for home—remains a deeply held need for most people. Eleven attributes of place-based relationships are described, the last (placelessness) being the antithesis of the others rather than a stand-alone attribute.

1. *Geographic connection to place.* Secure feelings of connection to the geography of an area often foster feelings of familiarity and predictability. This can be achieved by emphasizing prominent geological features associated with the siting, orientation, and views of buildings and landscapes.
2. *Historic connection to place.* Meaningful relation to place often marks the passage of time, which fosters a sense of participation and awareness of an area's culture and collective memory. Buildings and landscapes that elicit this continuity with the past encourage the belief that the present and future are meaningfully linked to the history of a place.
3. *Ecological connection to place.* Places are sustained by an affirmative connection to ecology, particularly prominent ecosystems such as watersheds and dominant biogeographical features (e.g., mountains, deserts, estuaries, rivers, and oceans). The design of the built environment inevitably refashions nature, but this can occur in ways that do not diminish the overall biological productivity (e.g., nutrient flux), biodiversity, and ecological integrity of proximate ecological communities. Humans, like any ecologically transformative organism (e.g., elephants on the savanna, sea otters in a kelp bed), can add as well as subtract value from their natural systems. The design of the built environment can, therefore, aspire to achieve net ecological productivity.
4. *Cultural connection to place.* Cultural connection to place integrates the history, geography, and ecology of an area, becoming an integral component of individual and collective identity. The need for culture is a universal human need, sustained over time by repetition, normative events, and the architectural heritage of a people, particularly its treasured and distinctive vernacular forms.
5. *Indigenous materials.* A positive relation to place is generally enhanced by the utilization of local and indigenous materials. Native resources can provide a vivid and resonant reminder of local culture and environment, as well as require less energy for manufacture and transport.
6. *Landscape orientation.* Buildings and landscapes that compatibly connect to the local environment contribute to a sense of place. These constructions typically emphasize landscape features such as slope, aspect, sunlight, wind direction, and others that take advantage of prevailing biometeorological conditions. This orientation to landscape frequently evokes a sense of being a part of and embedded within local settings, rather than being separated from them.
7. *Landscape features that define building form.* Landscape features can embellish and distinguish building form, particularly prominent geological features, natural objects, and water. The built environment can, therefore, integrate with rather than be isolated from its biophysical context. When this fails to occur, even extraordinary buildings can be perceived as standing apart, perhaps impressive products of human engineering but largely abstract forms divorced from context and barren.
8. *Landscape ecology.* Effective place-based designs reinforce landscape ecology over the long term. This can be achieved through design that considers landscape structure, pattern, and process such as ecological connectivity, biological corridors, resource flows, biodiversity, optimal scale and size, ecological boundaries, and other parameters of functioning natural systems (Dramstad et al. 1996).
9. *Integration of culture and ecology.* The fusion of culture with ecology fosters long-term sustainability. The result marks the point where nature and humanity are positively transformed and mutually enriched by their association. When this occurs, buildings and landscapes often provoke considerable

- loyalty, responsibility, and stewardship among the people who reside nearby.
10. *Spirit of place.* The spirit of a place signifies a level of commitment and meaning that people extend to both natural and built environments when they become cherished components of individual and collective identity, more than simply inanimate matter. The spirit of a place metaphorically signifies the built environment having become life-like and serving as the motivational basis for long-term stewardship and responsibility. While not technically alive, these structures and places give rise to and sustain human culture and ecology over time.
 11. *Avoiding placelessness.* "Placelessness" is the antithesis of place-based design, to be avoided whenever possible. One of the insidious and damaging effects of much modern architecture has unfortunately been the divorce of design from connection to the culture or ecology of place. This corrosive separation of the built environment from its biocultural context has resulted in the decline of human-nature relationships and environmental sustainability.

Evolved Human-Nature Relationships

The sixth and final biophilic design element is *evolved human-nature relationships*. The term is somewhat misleading, as all the described biophilic design elements presumably reflect biologically based human affinities for the natural environment. The attributes described in this section, however, more specifically focus on fundamental aspects of the inherent human relationship to nature. Twelve attributes are described, the last eight of which are derived from a typology of environmental values developed by the author and described elsewhere (Kellert 1996, 1997):

1. *Prospect and refuge.* Refuge reflects a structure or natural environment's ability to provide a secure and protected setting. In the built environment, this often occurs through the design of comfortable and nurturing building interiors and secreted landscape places. Prospect, on the other hand, emphasizes discerning distant objects, habitats and horizons, evolutionarily instrumental in locating resources, facilitating movement, and identifying sources of danger. Some of our most satisfying buildings and landscapes capture the complementary relation of prospect with refuge (Hildebrand 2000, Appleton 1975).
2. *Order and complexity.* Order is achieved in the built or natural environment by imposing structure and organization. Extreme order often results in repetition, monotony, and boredom. By contrast, complexity reflects the occurrence of detail and variability. Excessive complexity can also be troublesome, making it difficult to assimilate detail and sometimes leading to a sense of chaos. Designs that effectively meld order with complexity tend to be successful, stimulating the desire for variety but in ways that seem controlled and comprehensible.
3. *Curiosity and enticement.* Curiosity reflects the human need for exploration, discovery, mystery, and creativity, all instrumental in problem solving (Kaplan et al. 1998). Enticement fosters curiosity. These complementary tendencies can engage the flywheel of human intellect and imagination. Some of our most effective buildings and landscapes foster curiosity, exploration, and discovery of natural process and diversity.
4. *Change and metamorphosis.* Change is a constant in both natural and human systems, reflected in the processes of growth, maturation, and metamorphosis (Bloomer 2000). Many powerful designs capture this dynamic and developmental quality, where one form or state appears to flow into another in a quasi-evolutionary sequence.
5. *Security and protection.* A fundamental objective of the built environment is ensuring protection from threatening forces in nature. Yet, the most successful designs over the long run never accomplish this need at the expense of other equally legitimate environmental values. Security in the built environment must not excessively insulate or isolate people from the natural world.
6. *Mastery and control.* Buildings and constructed landscapes reflect the human desire for mastery and control over nature. When accomplished with moderation and respect, mastering nature facilitates the satisfactory expression of human ingenuity and

cleverness that fosters self-confidence and self-esteem.

7. *Affection and attachment.* Affection for the natural world has been a critical component in engendering the human capacities for bonding and attachment, important in a largely social creature. Buildings and landscapes that elicit strong emotional affinities for nature are typically recipients of lasting loyalty and commitment.
8. *Attraction and beauty.* The aesthetic attraction to nature is one of the strongest inclinations of the human species. This biologically encoded tendency has been instrumental in fostering the capacities for curiosity, imagination, creativity, exploration, and problem solving. Some of our most successful buildings and landscapes foster an aesthetic appreciation for natural process and form.
9. *Exploration and discovery.* Nature is the most information-rich and intellectually stimulating environment that people ever encounter. Buildings and constructed landscapes that facilitate opportunities for exploration and discovery of natural process elicit considerable interest and appreciation, even when these environmental features are largely revealed in representational ways.
10. *Information and cognition.* Intellectual satisfaction and cognitive prowess can be fostered through designs that emphasize the complexity of natural shapes and forms. This can be achieved through the direct and indirect experience of nature, as well as by the creative use of ornamentation in the built environment that fosters critical thinking and problem solving.
11. *Fear and awe.* It may seem odd to emphasize negative and unwanted feelings such as fear and aversion of nature as components of biophilic design. Yet, protecting ourselves from threatening elements of the natural world has always been a primary objective of the built environment. Fear of nature can also be a motivational basis for designing peril and adventure into the built environment, such as overhanging precipices or proximity to fearsome forces like rushing water. Feelings of awe

for the natural world can further combine reverence with fear, and some of our most celebrated structures achieve this effect through extolling majestic natural features that engender an appreciation for powers greater than ourselves.

12. *Reverence and spirituality.* Some of our most cherished buildings similarly affirm the human need for establishing meaningful relation to creation. These designs provoke feelings of transcendence and enduring connection that defy the aloneness of a single person isolated in space and time. Structures that achieve this reverential feeling of connection are also typically sustained generation after generation.

CONCLUSION

Six biophilic design elements and roughly 70 attributes have been described, and are summarily listed in Table 1-1. A small number of illustrations are provided at the chapter's conclusion depicting some of these design features. This categorization is a work in progress, which inevitably will be modified and improved over time.

All design of the built environment, including the biophilic desire to harmonize with nature, reflects what René Dubos called the active "wooing of the earth" (Dubos 1980). This objective, in other words, results in some degree of deliberate refashioning of nature to satisfy human needs, but in ways that celebrate the integrity and utility of the natural world. Thus, human intervention, if practiced with restraint and respect, can avoid arrogance and environmental degradation. With humility and understanding, effective biophilic design can potentially enrich both nature and humanity. As Dubos remarked (1980, 68):

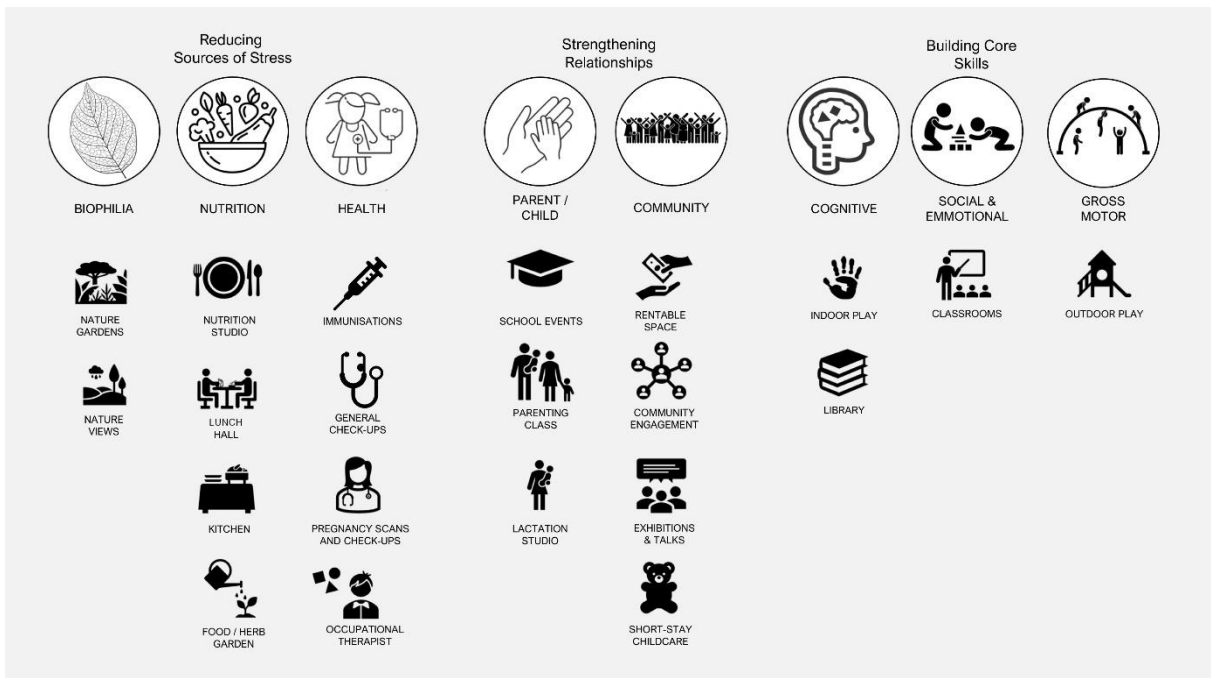
Wooing of the earth suggests the relationship between humankind and nature [can] be one of respect and love rather than domination. The outcome of this wooing can be rich, satisfying, and lastingly successful if both partners are modified by their association so as to become better adapted to each other.

PART 2
DESIGN DEVELOPMENT

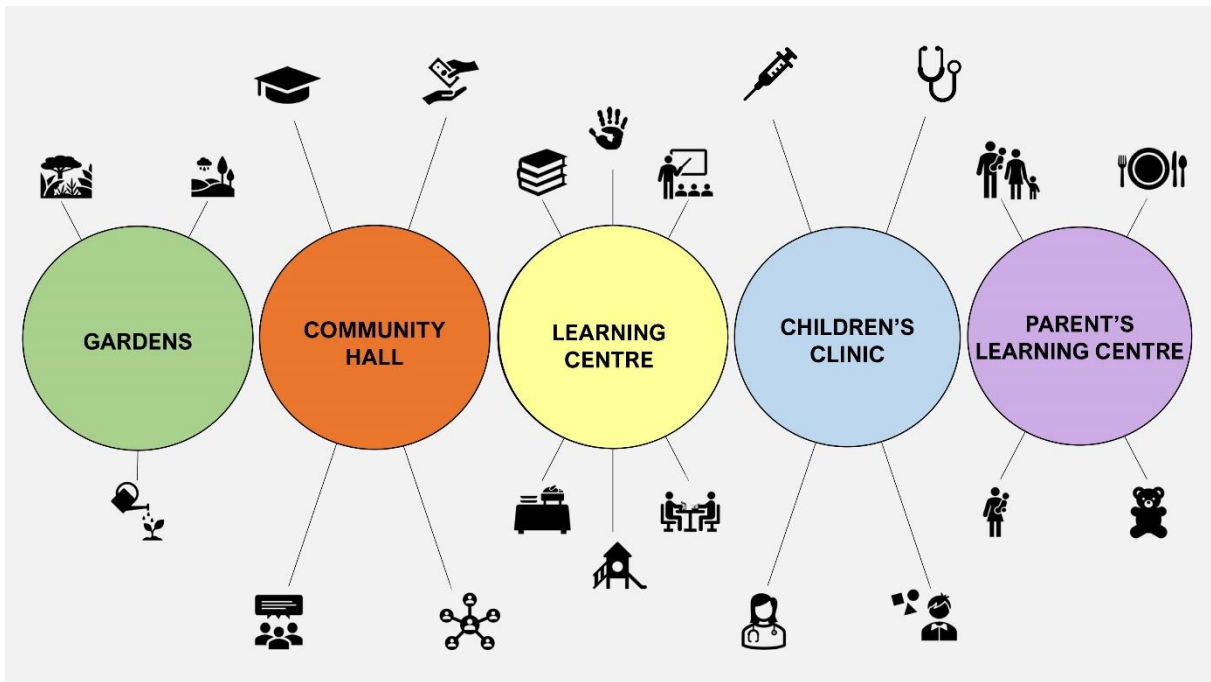
Typology



Based on Harvard's 3 core principals, I was able to gain a profound understanding of typography.



These principles require various activities to support their implementation.

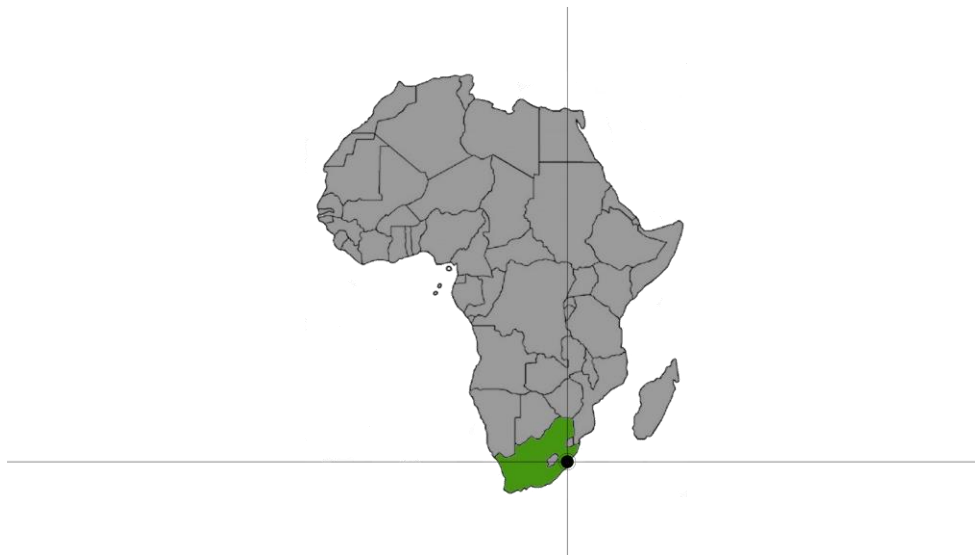


Besides a children’s learning centre, other facilities such as a community hall, a parenting centre, an outdoor area, and a clinic are also required to cater to those activities.

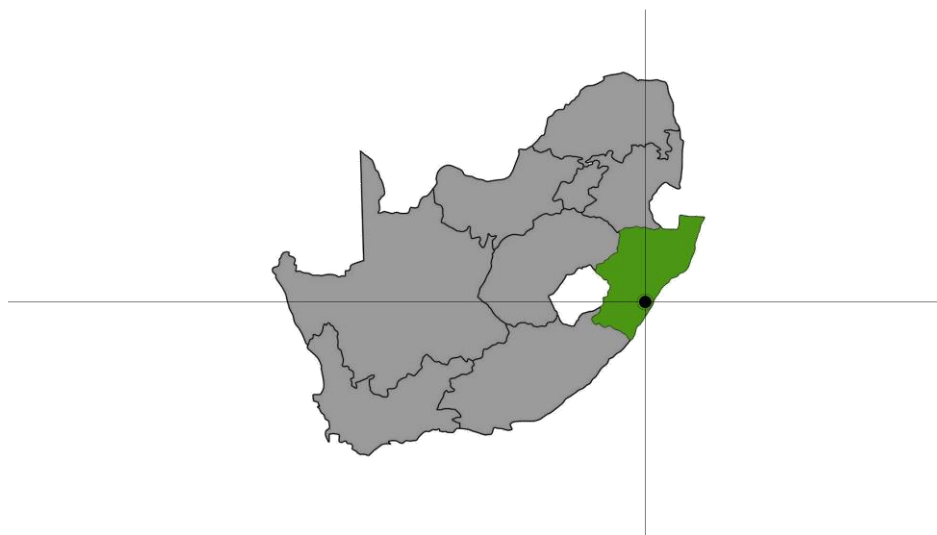
Location



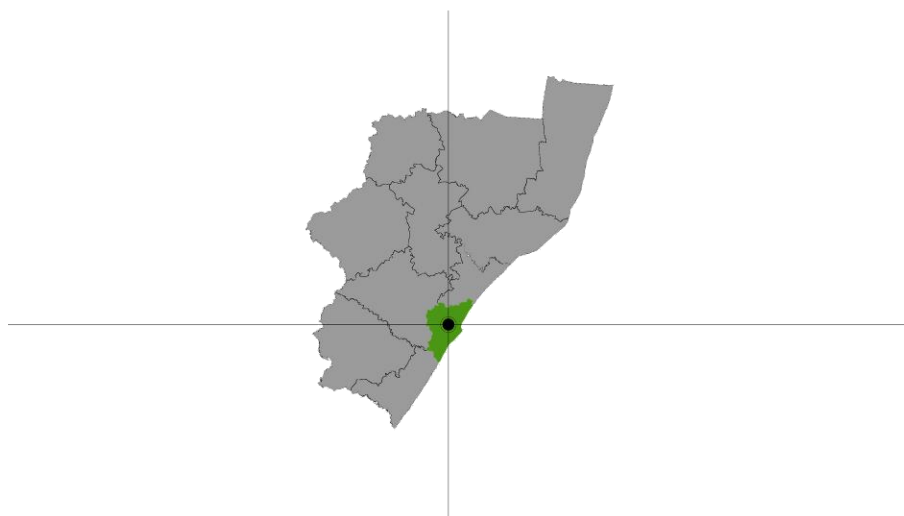
Africa



South Africa



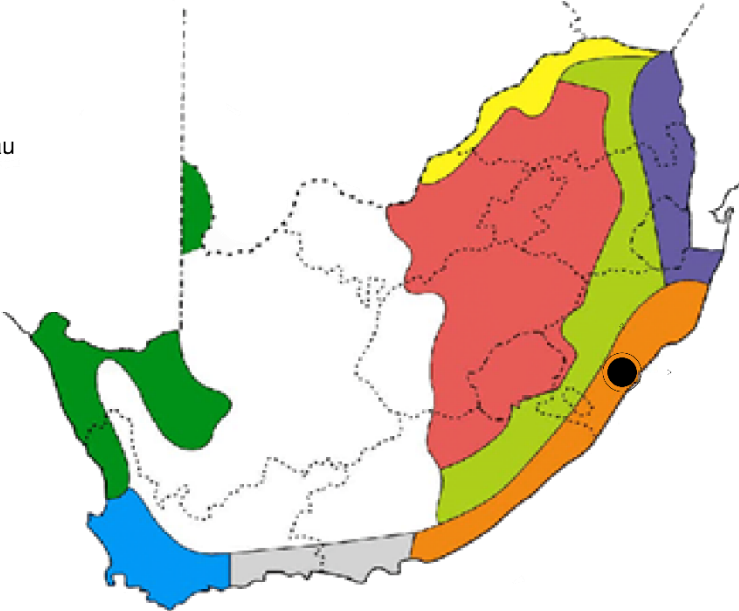
Kwa-Zulu Natal



eThekweni

Climate

- Subtropical Plateau
- Desert
- Mediterranean
- Semi Arid Pllateau
- Moderate Coast
- Moderate Eastern Plateau
- Subtropical Coast
- Escrpment
- Subtropical Lowveld



Site Selection



SITE SELECTION CRITERIA



ACCESS & TRANSPORTATION

Site A has access from a Metropolitan road where-as Site B has access from a Residential Road. The traffic flow on site B is more congested due to there being other schools within the vicinity.



SAFETY & SECURITY

Safety within both sites we equal, however Site A is neighbouring a busy plant nursery, which increases the feeling of being safe and secure.



ZONING

The zoning for Site A being commercial within close proximity to other schools and community spaces is more favourable than Site B which is found to be a part of the D'MOSS area and would be disadvantageous if built on.



SUNLIGHT ACCESS

Buildings neighbouring both sites don't pose a disadvantage. They don't cast much shadows onto the sites, however both sites have very tall trees.



FLAT LANDSCAPING

Both sites have natural almost flat landscaping. Site A has 2 stepped flat portions that would help separate the learning section from the more public spaces.



QUALITY OF NATURAL ENVIRONMENT

Both sites include natural environments with trees and animals, but the quality of site A is far superior with more plant species attracting more forms of life.

SITE RATING ANALYSIS	A	B
ACCESS & TRANSPORT	8	6
SAFETY & SECURITY	6	5
ZONING	8	4
SUNLIGHT ACCESS	6	8
FLAT LANDSCAPING	7	8
QUALITY OF NATURAL ENVIRONMENT	10	7
TOTAL	45	38

Site Analysis



Figure Ground Diagram

This figure-ground study shows that the site is located in an area where the buildings are more dense. The architecture will merge better with its environment becoming a part of the built environment.



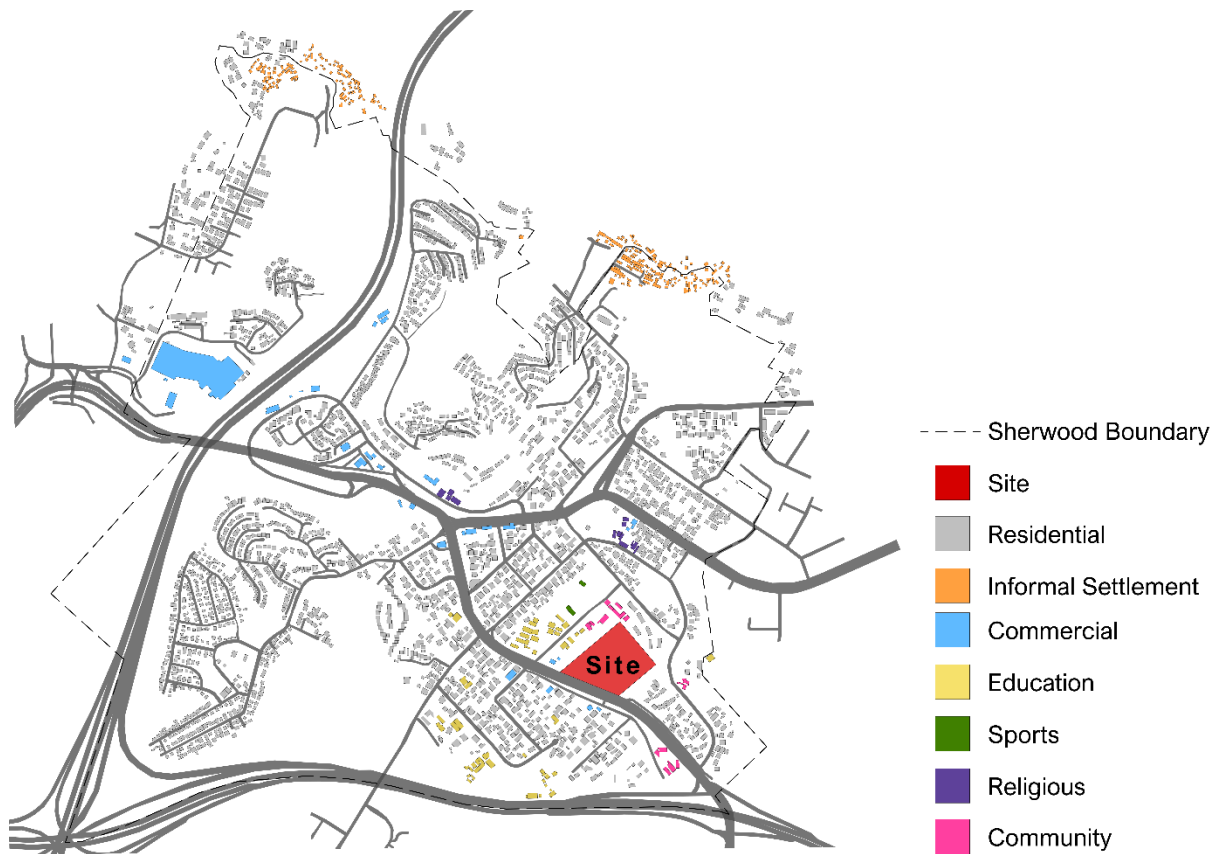
Open Space Network

Selecting a site within the built environment, allows for better access to the site so that the project can work well for its community. Design opportunities within the actual site and the surrounding infrastructure will help build communities. In addition the open network diagram shows road access to the site.



Street Pattern Hierarchy

Selecting a site within the built environment, allows for better access to the site so that the project can work well for its community. Design opportunities within the actual site and the surrounding infrastructure will help build communities. In addition the open network diagram shows road access to the site which is off a metropolitan road (m19)



Land-Use Density

The site is in close proximity to neighbouring schools and within the residential area. Some small businesses flank the main road that accesses the site. There is also a childrens ophanage that neighbours the north of the site, and the ecd center could be beneficial to them.



Green Space Network

D'moss or Durban metropolitan open space system is a network of green corridors in the city of Durban. These areas take into account conservation assessments and, dealing with vegetation types and rare species. By connecting the open spaces there is allowance for movement of species, genetic material, energy, water, sediments and nutrients. The site is set in the middle of the most built up area of the suburb and by designing with biophilia in mind it helps create a green center with its connection to the neighbouring nursery.

MICRO ANALYSIS

Site History



The Site set on 814 Jan Smuts hiway, was previously known as the Jungle Garden Nursery which has closed.



It left behind a neglected, derelict site that has become an eyesore in the community.



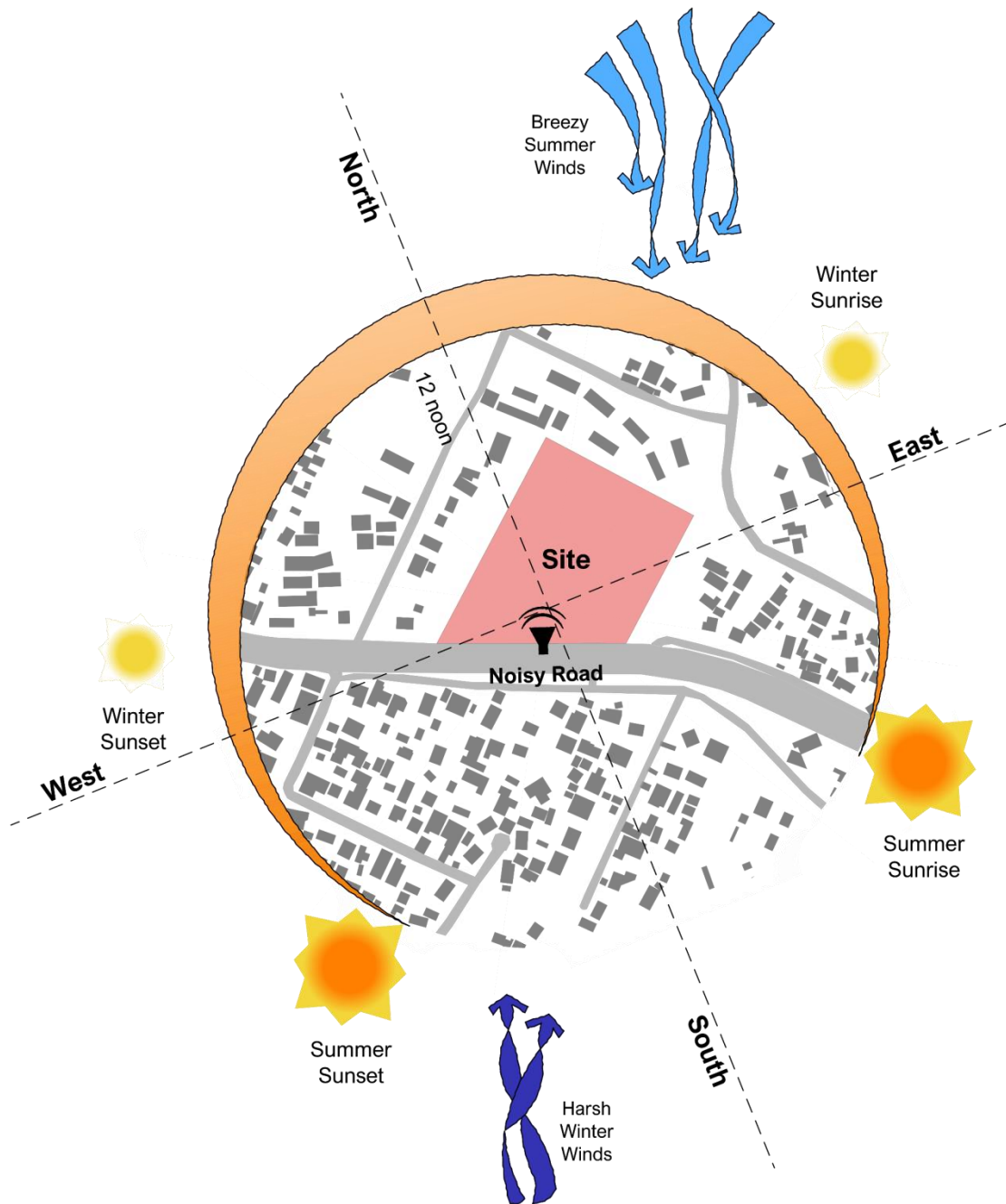
This was a place that people enjoyed, they found it to be a wonderful way to release stress and enjoy socialising at the restaurant on site.



The Koi at jungle is all that is left, however they have relocated across the road into a previously residential property.

MICRO ANALYSIS

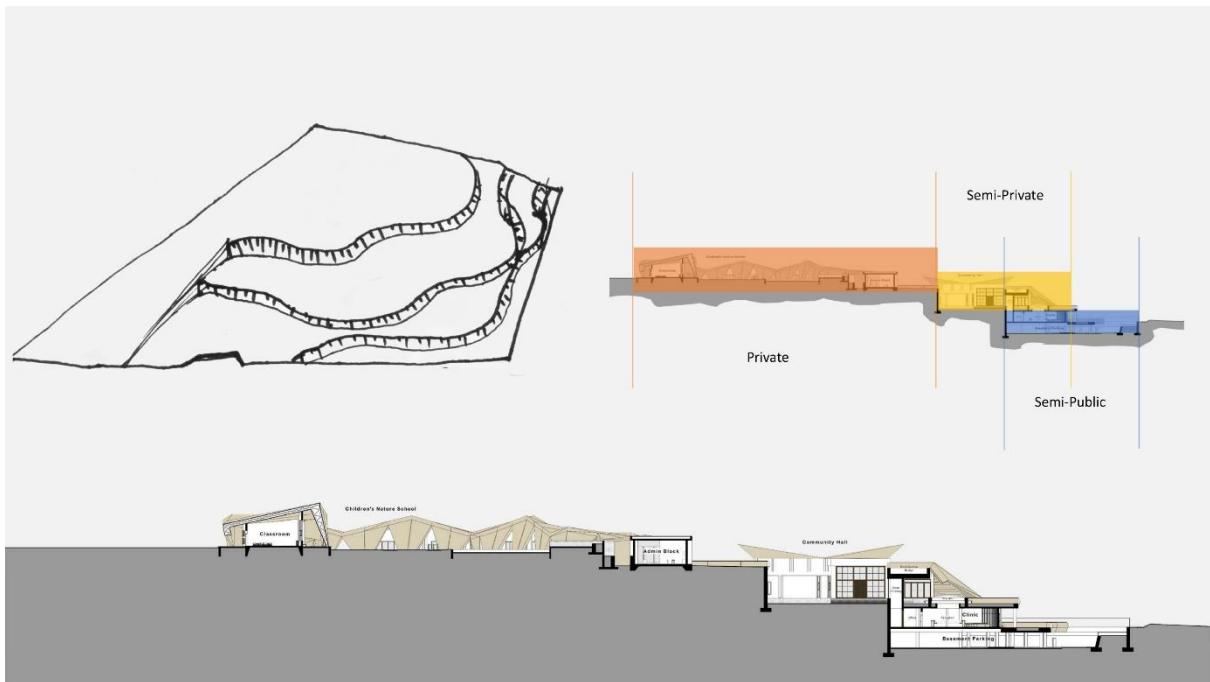
Site Analysis



The upper end of the has the best natural light and ventilation for optimal design while the lower road facing edge of the of the site is accustomed to harsh winds and light which the trees are able to buffer out, as well as the noisy main road.

ENVIRONMENTAL FEATURES

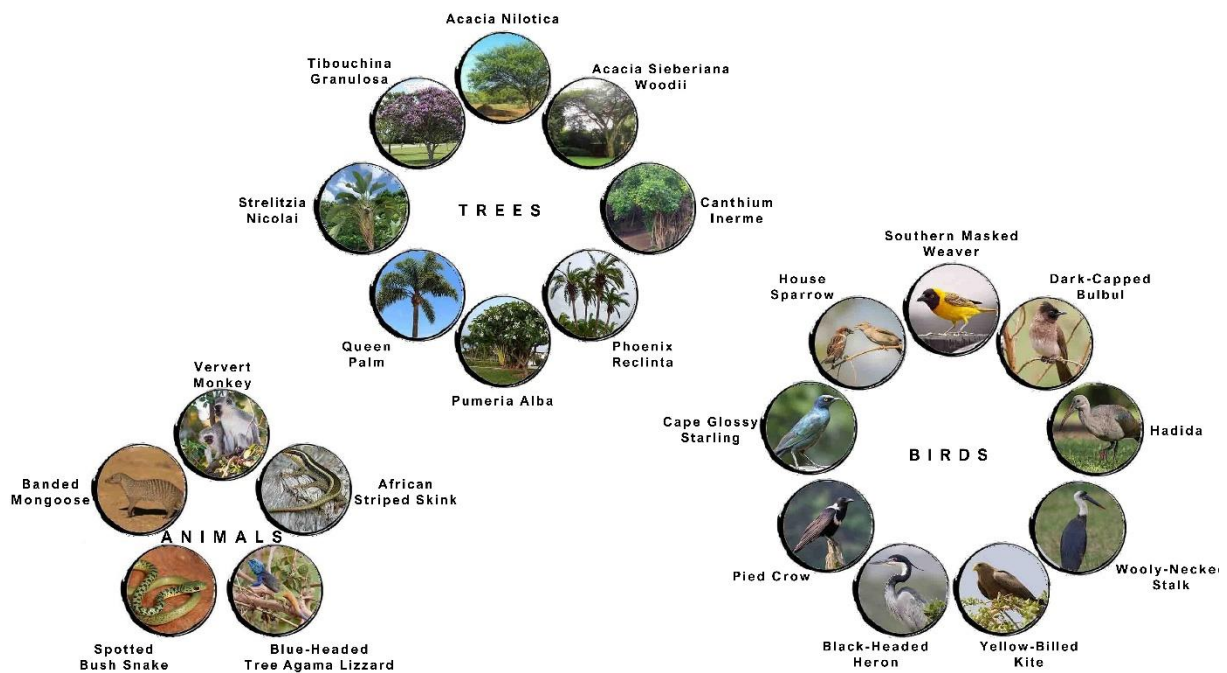
Geology + Landscaping



The first step in elemental remediation is to identify what was there. This can help us determine the initial form of the land and its physical properties. The current site has platforms cut into the site. I chose to look at the original structure of the landscape so that the concepts with the buildings mimic the natural contours and by using green roofs on the lower 2 levels the structure etches itself under the natural features camouflaging itself into the landscape. These terraces create a means for separating the semi-public from the public from the private spaces.

ENVIRONMENTAL FEATURES

Biodiversity



The importance of biodiversity in biophilic design cannot be overstated. It can help create environments that are both sustainable and beneficial to humans. Native plants are a vital part of ecosystems and need to be a part of the landscaping design strategies. Unfortunately, non-native species can negatively affect flora and fauna populations. This can result in the reduction of animal and bird diversity and the loss of insect populations.

ENVIRONMENTAL FEATURES

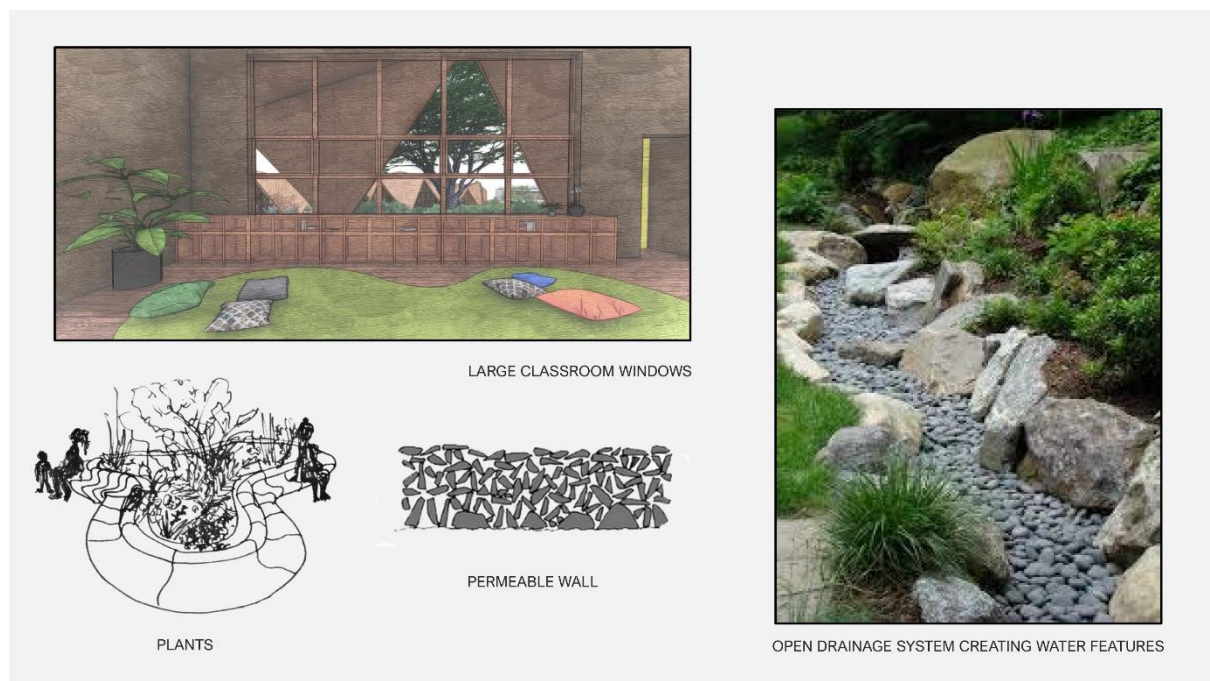
Views + Vistas + Façade Greening



People are drawn to buildings that are designed to work harmoniously with the surrounding natural features. For instance, structures with plant-covered walls are often well-received. We need the views into natural spaces to feel at ease

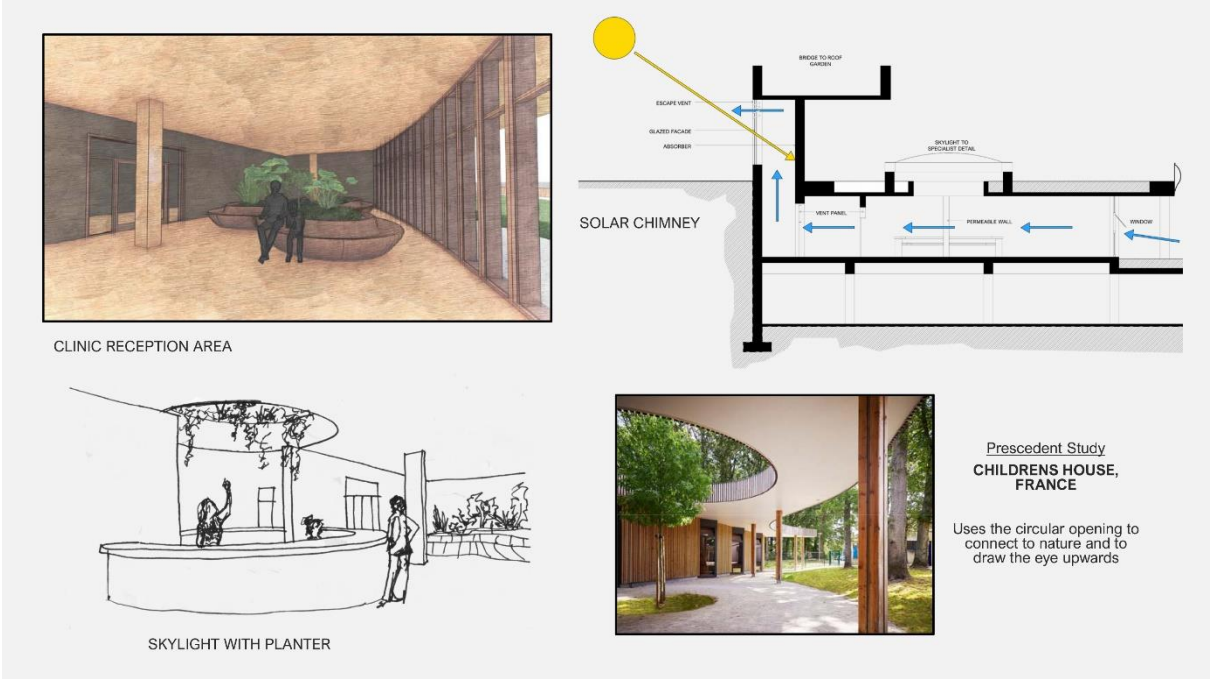
ENVIRONMENTAL FEATURES

Light + Air + Water



Besides being able to create a sense of connection with nature, a naturally lit and a well-ventilated environment can also help promote well-being. Biophilic lighting needs to follow your natural Circadian rhythm. Windows are kept large to let in lots of natural light. The main structure acts as solar shading similar to that of the KZN verandah house which keeps out harsh direct summer light. Plants don't just create quality air, in spaces that are prone to south westerly harsh winds, plants are able to act as a buffer, similar to a permeable wall. An system where the roof drainage runs of into an open drainage system is to be adopted to create an interesting water feature when the weather permits.

LIGHT + SPACE
Natural Light + Ventilation



Due to the semi basement spaces created on the clinic floor, Lighting and ventilation would be a problem at the back of the site therefore a solar chimney features in the design where the north glazed façade will help draw out hot air, ventilating the spaces below. This chimney will also act as a lightwell into the back rooms. Air is drawn through the south facing windows, through permeable walls and pulled through louvres at the top of the solar chimney to ventilate the spaces. A skylight with planter is designed into the reception area to create a focal point and enhance the environmental features within the design.

NATURAL PATTERNS AND PROCESSES

Materials



Materials used include **stonework**, **timber**, and **rammed earth**, which all assist in shaping a biophilic design by using natural colours and textures.

NATURAL PATTERNS AND PROCESSES

Age + Change + The Patina of Time



These natural materials age with time and their facades change showing wear and growth, just as plants grow and change our landscapes, so can buildings.

PLACED-BASED RELATIONSHIPS
Historic Connection to Place



CAFÉ JUNGLE RENDEZVOUS
(OLD SITE)

JUNGLE WOOD CAFÉ AND HEALTH BAR
(OLD SITE)



One of the most remembered parts of the old site according to the community at the time was the well known café that they would frequent. Although the site has been derelict for a number of years I wanted to bring back the social connection that previously existed.

PLACED-BASED RELATIONSHIPS
Cultural Connection to Place



ZULU PATTERNS

The traditional attire of the Zulu people is a prominent part of their culture, and this project's design features their elements. The main shape of their beads is the triangle, and the three corners represent the Father, Mother and Child. The architectural element is draped over the structure providing shade and a defined space for people to gather.

PLACED-BASED RELATIONSHIPS

Gathering + Engagement



Shaping edges by inside curving edges expand and contract creating an organic assortment of spaces of gathering and engagement. Such spaces are found on the playground. These spaces help separate the large playground into different areas which cater to small and large groups of children. Although it is great for children to be around other children of different ages during play, some of the spaces need to cater to outdoor learning engagements as well.

PLACED-BASED RELATIONSHIPS

Gathering + Engagement



This feature runs through the site and the clinic level as we see here uses this technique to create the outdoor social space. The cladded structure above gives the user a feeling of being nestled into the space and free to enjoy their company.

EVOLVED HUMAN-NATURE RELATIONSHIPS

Prospect + Refuge



For most people, the desire to seek out places that offer the prospect of looking for something without being detected is an innate component of their nature. This is called Prospect and Refuge. It suggests that our evolutionary need to survive has a significant influence on our aesthetic experience. These spaces are created both indoors and outdoors. Here we see the act of peering over the playground from the bridge above.

EVOLVED HUMAN-NATURE RELATIONSHIPS

Prospect + Refuge



These images show the window seats nestled in as refuge areas, having views throughout the library. Similar spaces are designed into classrooms for children that may need a time away. Instead of a naughty corner, rather a space for them to gather their thoughts and emotions, teaching them how to overcome big feelings.

JUNGLE-WOOD

Children's Development Centre

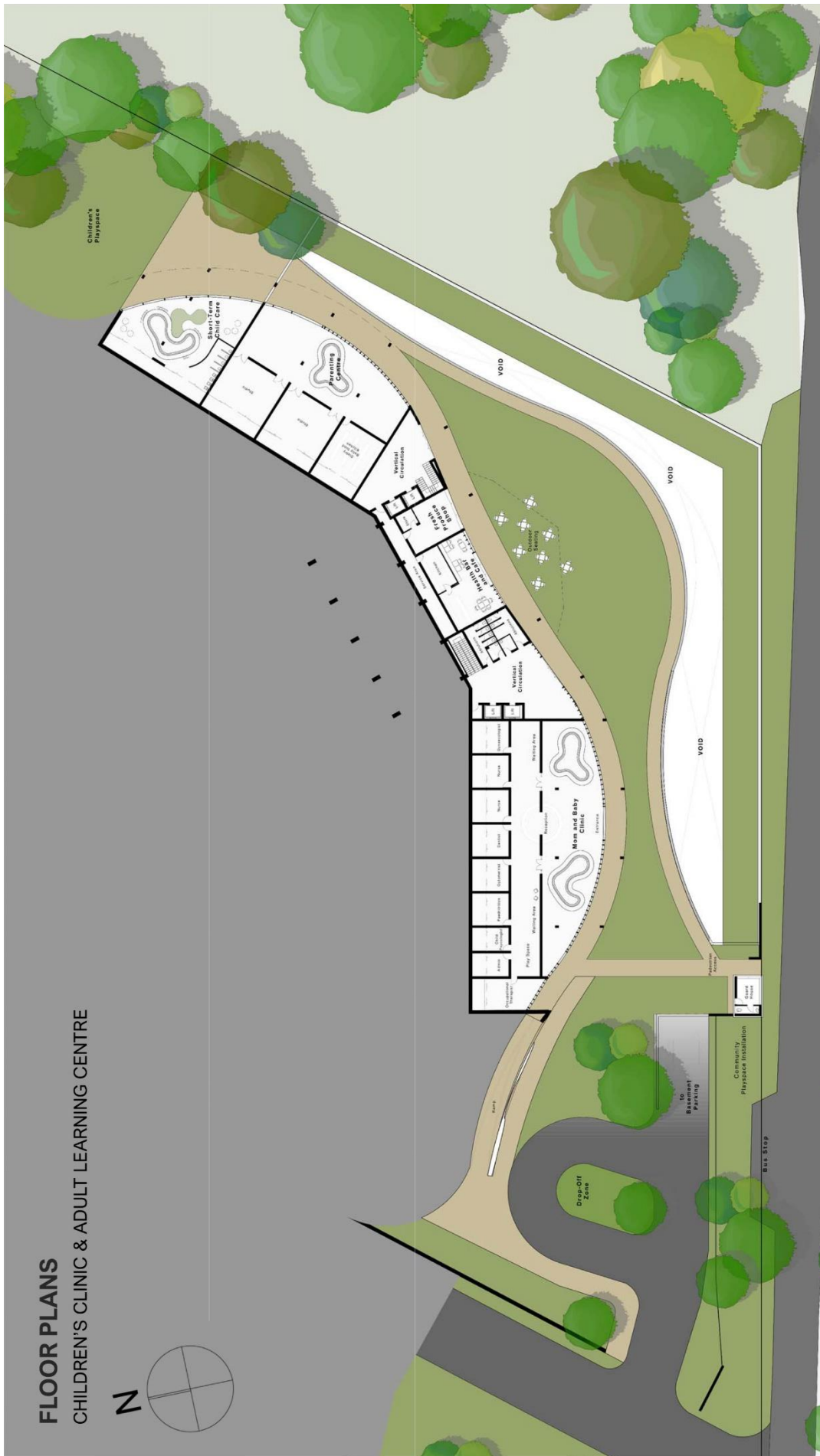


FLOOR PLANS
JUNGLE-WOOD NATURE SCHOOL





FLOOR PLANS
CHILDREN'S CLINIC & ADULT LEARNING CENTRE



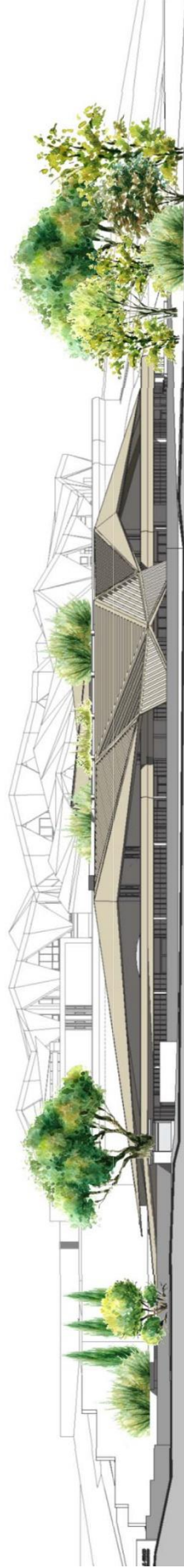
FLOOR PLANS
SEMI-BASEMENT PARKING



ELEVATIONS



NORTH-EAST ELEVATION



SOUTH-WEST ELEVATION (Street Elevation)



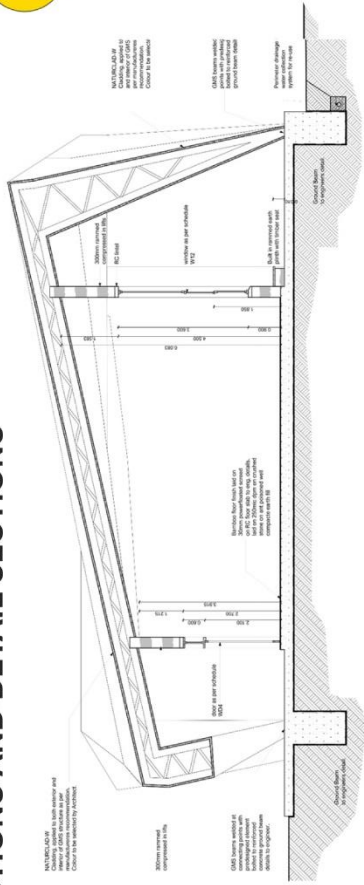
NORTH-WEST ELEVATION

SECTIONS AND DETAIL SECTIONS

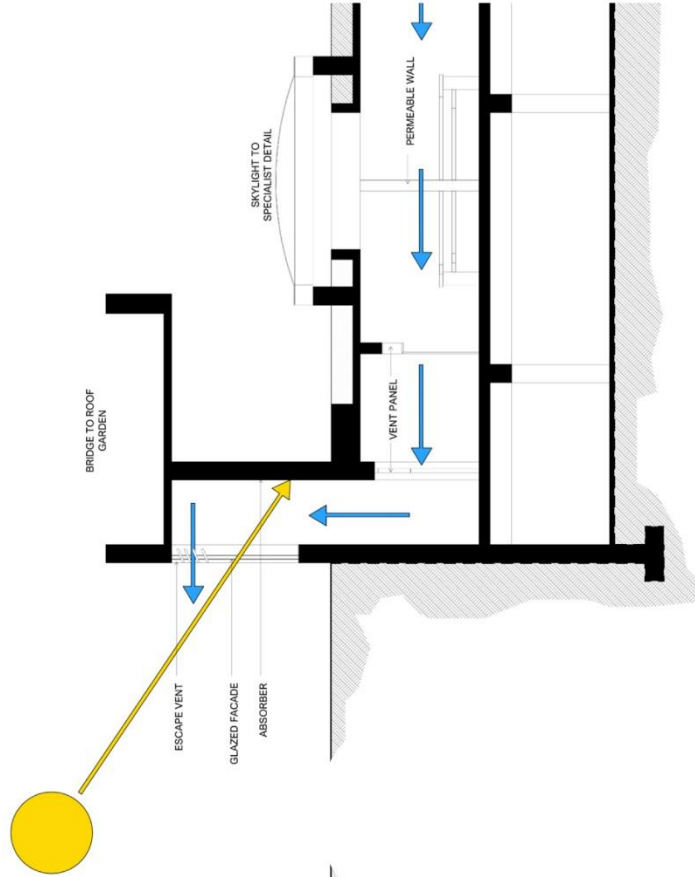
STRUCTURE TO BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE NATIONAL BUILDING REGULATIONS AND THE NATIONAL FIRE SAFETY REGULATIONS. CONSULT THE RELEVANT REGULATIONS.

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TIMBER CLADDED STRUCTURE DETAIL



SOLAR CHIMNEY DETAIL



LONGITUDINAL SECTION

“Good architecture lets nature in”

Mario Pei