

# **EXPLORING SCHOOL LEARNING ENVIRONMENTS THROUGH THE INTEGRATION OF GREEN SPACES**

A DESIGN PROPOSAL FOR AN ALTERNATE PRIMARY SCHOOL IN DURBAN

By

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## ABSTRACT

This study is focused on what architectural contribution can be made to existing learning environments by integrating green spaces within primary schools. In pursuit of quality education, alternative methods of teaching and learning that use the natural environment is explored. The literature explored is underpinned by educational and architectural theories that present an argument for *learning through experience of place* as a means of improving the teaching and learning environment. Existing primary schools in Durban do not provide opportunities for learning within and from the natural environment; therefore, this study is orientated towards countering this. The research presented informs the design for an alternate primary school in Durban which aims at expanding the traditional learning environment from the confines of built classroom spaces to the outdoor natural environment.

*Key words: green spaces, primary schools, built environment, natural environment, teaching and learning environment, learning through experience of place*

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## DEDICATION

This dissertation is dedicated to my parents and sister, without whom, I would not have been able to achieve this result.

Thank you for your unwavering support and encouragement during the completion of this degree.

I will always be grateful.

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## DECLARATION

This dissertation is a presentation of my own original work.

Where contributions of others are involved, every effort is made to acknowledge this clearly, with due reference to the literature and discussions.

This dissertation is being submitted to the College of Humanities, School of Built Environment and Development Studies at the University of KwaZulu-Natal, in partial fulfilment of the requirements towards the degree of Master in Architecture.

This dissertation has not been previously submitted for any examination or degree at any university.

Signed:

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Divita Isaac

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## DEFINITION OF TERMS

### **Green Space:**

- *land that is partly or completely covered with grass, trees, shrubs, or other vegetation*
- (Source: <http://www3.epa.gov/region1/eco/uep/openspace.html>)

For this dissertation, the term 'green space' specifically refers to vegetated garden spaces that can be used for recreational play or as part of a teaching method. These spaces do not include sports fields within the school.

### **Natural:**

- *existing in nature and not made or caused by people: coming from nature*  
(Source: <http://www.merriam-webster.com/dictionary/natural>)
- *of, relating to, or concerning nature*  
(Source: <http://www.thefreedictionary.com/natural>)

### **Environment:**

- *the conditions that surround someone or something : the conditions and influences that affect the growth, health, progress, etc., of someone or something*
- (Source: <http://www.merriam-webster.com/dictionary/environment>)

The term **natural environment** is used in this dissertation with reference to the following definition:

- *the natural conditions that surround someone and which influence factors of their development such as growth, health, progress etc.*
- *encompassing green spaces*

### **Primary School:**

- *the beginning of the formal schooling period for children aged from 6-11 years*
- *Consists of a Junior Primary phase that lasts three years where learners are taught the following subjects: Home Language, First Additional Language, Mathematics and Life Skills; as well as an Intermediate phase that lasts three years where learners are taught Home Language, First Additional Language, Mathematics, Natural Science and Technology, Social Sciences and Life Skills*
- (Source: National Curriculum Statement, Department of Basic Education, RSA)

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### **Environmental design:**

- *The adaptation of a building to its surroundings and the consequences of its incorporation into the setting.*
- (Source: <http://www.dictionaryofconstruction.com/definition/environmental-design.html>)

The term **environmentally- integrated** will be used in this dissertation to refer to a building design adapted to its environment by incorporating the green spaces into the building's built form.

### **Pedagogy**

- The art, science and profession of teaching
- (Source: <http://www.merriam-webster.com/dictionary/pedagogy>)

### **Experiential Learning Theory**

- The process by which knowledge is created through the “transformation of experience”
- (Source: Kolb, 1984)

### **Place-Based Education**

- *Provides “hands-on, real-world learning experiences” which “increases academic achievement, helps students develop stronger ties to their community, enhances students’ appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens”*
- (Source: Sobel, 2004)
- *Can be used interchangeably with **outdoor education***

### **Environmental Psychology**

- *Examination of transactions between individuals and their built and natural environments*
- (Source: Gifford, 2013)

# Chapter 1: INTRODUCTION

## 1.1 BACKGROUND AND MOTIVATION

This study is based on what contribution can be made by architecture to education through integrating green spaces within primary school built environments.

The educational debate over *education quantity* versus *education quality* is one that has been explored around the world. Internationally, emphasis is placed on *quality* of education, however, in Africa; emphasis has been placed on *quantity* of education by means of access to education. In South Africa, this has led to a further debate: whether focusing on greater access to education has led to the deterioration in quality of education (DBE, 2013). From an architectural perspective, a way of improving the quality of education in schools is through ensuring healthy, safe school environments with sufficient resources (UNICEF, 2000). This type of school environment is explored through making use of the entire school environment (built and unbuilt spaces) to improve the teaching and learning process.

This study is addressing how learning environments can be enhanced through the integration of green spaces by using nature as part of the learning and teaching process, while providing a wide range of health benefits for developing children (NLI, 2012). These benefits include mental, physical and social well-being (NLI, 2012). One concept of connecting with nature, as explored by Sobel (2004), is through Place-Based Education. An opportunity to promote Place-Based Education is afforded by primary schools, as learners develop their basic understanding of concepts, morals and values at the primary school stage (Palmer & Neal, 1994). Herman Hertzberger, on his writings of *Space and Learning* (2008), offers insight as to how architects can use the design of spaces to allow learners to learn:

“Architects should not get involved in debates about education; instead, they should create spatial conditions that will benefit learning in the general sense. The building should provide a general framework for education and learning, while being flexible enough to respond to changing demands and even (in a spatial sense) hold out a suggestion of pursuing avenues other than those laid down in the brief”.

- Herman Hertzberger quoted in a Conference on *Space and Learning*, (2008) PDF

Source: <http://www.mizs.gov.si/>

While research has been explored on different learning methods and environments, little research has been done in Durban regarding the use of the design of school environments, specifically natural environments, as part of the teaching and learning process. Coupling knowledge based on the effects of nature on children, and educational and architectural theories, architectural principles can be developed for a school alternate to the current school design in Durban. These principles integrate both built and natural environments of the school to improve the learning and teaching process in order to contribute to a better quality of learning.

## 1.2 PROBLEM STATEMENT

The National Norms and Standards for Public School Infrastructure (DBE, 2013), as well as the KwaZulu-Natal Space Planning Norms and Standards for Public Schools (KZNDoE, 2011, Version 7) make little provision, and have a low priority for the integration of natural environments within its guidelines. The natural environment consists of various natural processes within each different ecosystem. These processes and systems become apparent through visual (Observational Learning – a derivative of the Social Learning Theory, Albert Bandura, 1977), and physical (Place-based learning, David Sobel, 2004) interactions; and becomes relevant when explored further during lessons. By disregarding the natural environment as a priority space in the DoE's Minimum Requirements, it is unable to be used as part of the teaching and learning process, i.e. students are unable to 'learn' from the environment. This prevents optimum use of the school built environment to assist in the educational process, and lessens opportunities to learn, as well as impedes the creation of stimulating learning environments.

Through personal observations of some public primary schools in former "Indian" areas of Durban, it has been noted that there is reduced levels of integrated green spaces within them, although they are suburban schools. The existing green spaces are noted to be along the periphery of the school grounds and not as integrated components of built form.

An initiative such as the Wildlife and Environmental Society of South Africa (WESSA) Eco-school programme was implemented in South Africa to incorporate the natural environment within existing schools to support environmental learning in the classroom. Although programmes such as the Eco-school exist, the green spaces created within the

schools are not integral components of the schools' built environment, but merely act as "add-ons" to existing schools, hence schools are not integrated with the natural environment.

### 1.3 AIM

The aim of this study is to show how learning environments can be enhanced through integrating green spaces within primary schools. The research findings would inform the design of an alternate primary school in Durban.

### 1.4 OBJECTIVES

The objectives of this study are:

1. To explore and understand the contribution of green spaces to the teaching and learning environment.
2. To investigate how being in contact with nature can improve the teaching and learning experience.
3. To explore and determine the types and configurations of natural and built spaces that are effective for teaching and learning within in primary schools.
4. To generate architectural principles for the design of a primary school with integrated green spaces.

### 1.5 THE SCOPE

#### 1.5.1 DELIMITATION OF THE PROBLEM

The focus of this dissertation is architecturally based on the provision of green spaces in primary school built environments, and its contribution to the educational environment. The researcher understands that the scope of this dissertation extends beyond an architectural response, but this will not be the focus.

Although an exploration of green spaces in primary schools is used as a primary source of data for this research, the study will be delimited to a selection of government public primary schools in Durban. The study is further delimited within these schools by only selecting Natural Science teachers with which to conduct interviews. However, it must be noted that these teachers are not limited to teaching only Natural Science, but teach various subjects within primary schools.

The theories presented in this dissertation range from fields of education to architecture. The delimitation of theories related to education, such as Experiential Learning and Place-Based Learning, will be delimited to contain literature relevant to the built environment. This dissertation will primarily focus on teaching that can make use of the natural environment as the key component. The architectural theories will be delimited to contain literature pertinent to that of design for a primary school in Durban.

### 1.5.2 STATING THE ASSUMPTIONS

This research study makes the following assumptions:

1. The majority of the government primary schools in Durban do not cater for green spaces as integral components of the school built environment.
2. Teachers do not make use of the natural environment as part of teaching on a regular basis because it is not catered for.
3. By creating an architecture for school design that integrates green spaces with built form, teachers will be inclined to use it as part of the teaching and learning process.

### 1.5.3 RESEARCH QUESTIONS

KEY QUESTION:

1. How do green spaces contribute towards improving the teaching and learning environment within primary schools?

**SECONDARY QUESTIONS:**

2. Why does being near/ in contact with nature improve the learning and teaching experience?
3. What types of natural and built spaces are effective for learning and teaching, and how are they configured within primary schools?
4. What architectural principles can be generated to develop an architecture for school design that integrates green spaces within the school built environment?

## **1.6 RESEARCH METHODOLOGY**

### **1.6.1 APPROACH TO METHODOLOGY**

This research study is of a qualitative nature. It will use primary data in the form of the results of semi-structured interviews with teachers (chosen via a purposive sampling technique), and observations within primary schools. Secondary data in the form of literature papers, books, articles and internal search engines will be used in order to position the research topic within the current literature. A list of definitions of key terms and concepts has been provided at the beginning of this dissertation to avoid any ambiguity within the document.

### **1.6.2 PRIMARY DATA COLLECTION**

This study will target five government suburban schools within Durban. Four of these schools are in previously designated “Indian” areas, and one is in a previously designated “White” area, according to the apartheid regime in South Africa (Schlemmer, 1967). An exploration of these schools will provide insight as to how spaces within these school built environments are used.

The main source of data will be collected by means of semi-structured interviews with a total of six Natural Science teachers from the participating schools. Natural Science teachers were chosen to be interviewed because the subject’s curriculum best suits the



integration of green spaces as a tool in the learning and teaching process. The interviews with these teachers will allow them to describe their experiences of the school built environment, as well as allow the researcher to explain to the teachers' teaching concepts that lend itself to using green spaces. This will inform the researcher as to how these concepts are seen and understood within these schools.

The teachers will possess knowledge of the teaching curriculum required for their subject and whether it is, or will be enhanced or not by using green spaces as teaching and learning tool. Teachers will be able to provide insight as to what spaces will be beneficial for teaching and learning their subject. The teachers' responses will be translated into architectural design principles, which when coupled with existing architectural design theories, can produce principles for an alternate primary school with integrated green spaces.

The schools in which interviews are conducted are presented as case studies which contextualises the interviews. The names of these schools will remain anonymous to protect their identity. Observations by the researcher are used as the foundation of the analysis of the case studies. Observations of the school environment would direct the research by allowing the researcher an opportunity to study the existing architecture of the school built environment with regards to the relationship between built and natural spaces. The aim of the observational research is to have a first-hand view as to how spaces are designed and utilised in order to make conclusions towards devising architectural design principles that can be incorporated in an alternate primary school.

All primary data collected will be positioned within existing literature relating to the topic in order to collate a succinct pool of knowledge for the architectural design component.

### 1.6.3 SECONDARY DATA COLLECTION

A literature review is used to position the primary data through the exploration of existing architectural and educational concepts and theories.

Two key architectural examples are presented as precedent studies to substantiate the integration of the natural environment with built form. The first precedent is Crow Island

Elementary School (Illinois, United States of America), which promotes learning through the environment through courtyard spaces linked to each classroom for efficient access to an outdoor learning space. The second precedent is Sidwell Friends Middle School (Washington DC, United States of America), which promotes environmental stewardship and sustainability as the school's vision through a communal courtyard wetland. These precedents most appropriately demonstrate the concepts and theories explored within the research. Local Precedent Studies are included in Chapter 8: Design Report so as to merge the research gathered throughout the document to the design proposal.

## 1.7 THEORETICAL AND CONCEPTUAL FRAMEWORK

This dissertation is structured through a learning perspective. The research is grounded in educational and architectural theories, which are briefly discussed below.

### 1.7.1 EXPERIENTIAL LEARNING THEORY

This theory explored by David Kolb (2005), uses *experience* as the foundation for *learning*. It allows learners to gain knowledge based on their own experiences, as opposed to more traditional methods, in which teachers are the sole sources of information in a classroom environment (Kolb, 2005).

For this study, emphasis is placed on experiential learning through the natural environment. The concept of Biophilia is explored as an extension of this theory.

#### Biophilia

The Biophilia hypothesis is defined as a human beings inherent inclination to affiliate with natural systems and processes (Kellert et al, 2008). It can be translated into architecture through designing spaces with the natural environment that are needed for Experiential Learning to occur. Human functioning is dependent on the environment in which humans are surrounded. Therefore, because human beings have an innate connection with nature, the natural environment can affect human functioning (Kaplan & Kaplan, 1989).

### 1.7.2 PLACE-BASED EDUCATION

This concept is a derivative of the Experiential Learning Theory. Place-based Education uses the local environment and community as the source for learning. The design of ‘place’ is particularly important to this concept as it forms the foundation for learning. This concept can be combined with architectural concepts of The School as a Micro-city, The Learning Street and Public Squares by Herman Hertzberger (2008). Hertzberger’s book *Space and Learning* (2008) explores these concepts and the importance of them in the design of architectural spaces for learning. The careful and considerate design of *place* is a characteristic of Environmental Psychology.

### 1.7.3 ENVIRONMENTAL PSYCHOLOGY

Environmental Psychology is a concept that underpins human response in relation to context. This concept ties together *design of a space* to *experience of and reaction to that space*. An architectural philosophy that emerges from this is that of *phenomenology*.

#### Phenomenology

Pallasmaa (1986) describes phenomenology in architecture as if one was “looking at” architecture as though they were the ones experiencing it, through “architectural feeling”, as opposed to analysing its physical proportions and properties.

The theories discussed here are primarily based on *experience through learning* and *experience of place*, which forms the underlying theme of this dissertation.

## 1.8 OUTLINE OF DISSERTATION

Chapter One has outlined the structure of the study, while Chapter Two will expand on the theories and concepts briefly outlined in Chapter One, in order to provide a framework for the study.

Chapter Three will present a literature review of authors such as David Kold, Herman Hertzberger and Paulo Friere, to support the argument for the integration of green spaces in primary school design. By analysing the existing literature on the human-nature connection that has been developed through our evolution, one can see how nature directly influences people. The effect of nature on children is even stronger, with benefits including their physical, mental and social well-being. Therefore, a strong argument is put forth for the need of re-connecting children with the natural environment. Literature on architectural elements are explored in relation to designing with the natural environment in order to develop a set of guiding design principles that will inform the design process. These architectural elements, combined with literature defending the argument for using primary schools as the source for improving educational environments through nature, is the crux of this dissertation.

Key Precedents will be the foundation of Chapter Four, which provides built examples of the application of the literature explored. All literature explored will be localised through interviews with Natural Science teachers from a sample of Durban government primary schools. The location of these schools, along with descriptions of the school built environments will be presented as the case studies for this research study, presented in Chapter Five.

Chapter Six will present the findings of the interviews, which forms part of the primary qualitative data, and aims to answer the research questions outlined in Chapter One. The research study will be concluded in Chapter Seven by providing a conclusion to the research and recommendations towards an architectural design proposal. Chapter Eight will utilise the recommendations of Chapter Seven in a design report for the design of an alternate primary school in Durban.

# Chapter 2: ALTERNATIVE TEACHING AND LEARNING METHODS

The theoretical and conceptual frameworks used in this dissertation position themselves as the underpinnings for *learning through experience of place*. By understanding *what* these theories and concepts are, one can understand *how and why* these theories and concepts are relevant. This chapter outlines how a change in approach to learning can contribute to a better quality of education through improving the teaching and learning environment. The Experiential Learning Theory is presented as a different approach to learning by using *experience* as the key focus, with *experience of nature* supported by the Biophilia Hypothesis. The importance of *place* is highlighted within this theory as the key theme in education. From here, the concept of Place-Based Education is explored, and is supported through a brief description of Herman Hertzberger's learning spaces for children. Finally, Environmental Psychology is used to describe how the contribution of natural and built environments affect individuals, through phenomenology of place.

## 2.1 EXPERIENTIAL LEARNING THEORY

In this study, the Experiential Learning Theory is presented as one method contributing towards a better quality of education.

Paulo Friere (2005) describes the teacher-student relationship as a key element in understanding the pedagogy of education. Friere (2005) is critical in what he calls a "narrative characteristic" in which the teacher is the narrator and the students are "patient, listening objects". As a result of this method, education is suffering from *narration sickness*, whereby students are turned into "containers" or "receptacles" to be "filled" by the teacher. If education continues to be purely an act of depositing knowledge into learners, they will tend to lack creativity, transformation and knowledge (Friere, 2005). This may be a contributor to the decline in the quality of education, as no "new" information is passed on to learners.

David Kolb puts forth the Experiential Learning Theory as an alternative learning method to the passive method described by Friere. The method differs from the traditional method of learning of “banking” (Friere, 2005) or “transferring” knowledge (Kolb & Kolb, 2005). The Experiential Learning Theory emphasizes the critical role that experience plays in the learning process (Kolb, 1984). The Experiential Learning Theory falls in line with that of Maria Montessori who founded the Montessori Approach to learning. Montessori explains that “education is a natural process spontaneously carried out by the human individual, and is acquired not by listening to words but by experiences upon the environment” (Maria Montessori as cited in Scott, 2010)

Six salient points on *learning* through the Experiential Learning Theory have been put forward by Kolb & Kolb (2005). Through these six points, one can see that learning is an ongoing process that undergoes constant transformation.

The six points are explained as follows:

1. *Learning is a process, not an outcome.*
2. *All learning is re-learning.* Learning is a process of testing ideas in order to re-examine and integrate them with new ideas.
3. *Conflict, disagreement and differences are needed in learning.* These provide a back-and-forth process in order to change and explore between reflection and action, and feeling and thinking.
4. *Learning is not the result of recognition but rather an integral component of a complete person* i.e. thinking, feeling, perceiving and behaving all contribute to oneself.
5. *Learning comes from a collaboration between the person and the environment.*
6. *Learning is a process of creating knowledge.* This is in contrast of transferring pre-existing knowledge onto students.

-Kolb & Kolb, 2005:194

The specific areas of interest in this study is mentioned in points 4, 5 and 6 of Kolb's points on *learning* above i.e. learning contributes towards making a person complete, the environment contributes to learning, learning is not simply transferring knowledge. Direct experience, coupled with critical reflection and negotiation of one's environment, results in people developing knowledge and experience about, and within, that environment (British Columbia: Ministry of Education, 2007; refer to Figure 2.1).

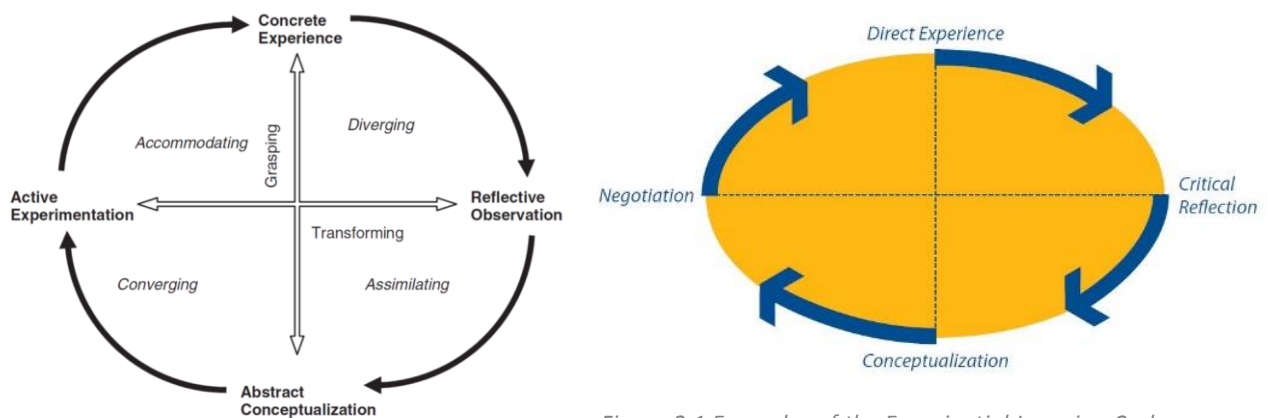


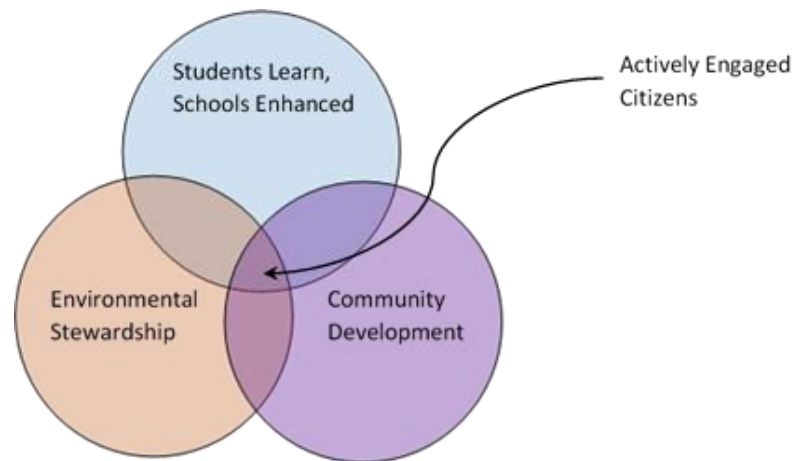
Figure 2.1 Examples of the Experiential Learning Cycle.  
Left: (Kolb, 1984), Right: British Columbia: Ministry of Education

The term 'environment' mentioned in point 5 is ambiguous. One can assume that both built and natural environments are intended; however, the focus in this study will be placed on the natural environment. The evidence that supports the claim that the natural environment can contribute to learning is found in the Biophilia Hypothesis, which explains the connection of nature to humans.

## 2.2 PLACE-BASED EDUCATION

The concept of Place-Based Education uses the environment as a teaching and learning tool. This concept has evolved over the years by updating and revising an old idea of "educational field trips" to nearby, local areas (Smith, 2007). Therefore, Place-based Education can be described as an approach to teaching and learning that connects learners to their local environment (Rote et al, 2015), while boosting learners' achievement (Powers, 2004). This can be achieved through providing "real-world" learning experiences

in order to enhance learners' educational experience. It also increases their appreciation for the natural world in order to create a greater sense of becoming active, contributing members of the community (Sobel, 2004). This is in direct contrast to traditional learning methods, which Friere (2005) notes as a method that is detached from reality. He goes on to explain that educators (when teaching) speak about reality as if it were static and lifeless.



*Figure 2.2: How Place-based Education produces actively engaged citizens (Rote et al, 2015 & adapted by Author, 2016)*

Educators that use Place-Based Education as a teaching method suggest that by basing education within the local community or context, learners are able to see the relevance in what they are learning about, and thus become more engaged in the learning process (Powers, 2004). In this way, schools and communities are developed. In addition, by promoting environmental stewardship, actively engaged citizens are produced (Parker & Vernet, 2009; Rote et al, 2015). Figure 2.2 graphically represents the interaction of these three elements. The architects' role in Place-Based Education is evident in the design of environments, both built and natural. This can allow the learning experience to be enhanced through a learner's connection to place if designed with deliberate consideration (Rote et al, 2015).

A leading architect and theorist in designing educational spaces, Herman Hertzberger (2008), is the key architectural theorist used in this study. Hertzberger states that school built environments can become the "interpreter of the educational needs of an individual" (Hertzberger cited in Faiferri, 2012). Using designed spaces within the school built



environment allows learners to “experience school” as a metaphor for “being in the world” (Hertzberger cited in Faiferri, 2012). It allows learners to engage with the space as well as the other users of that space. Hertzberger (2008) on the design of spaces, says that by designing less enclosed classroom units, and corridors as learning spaces, the opportunities for learning situations are expanded.

In summation, Place-Based Education uses ‘place’ as the source for learning and teaching. The built and natural environments (as places) become integral components of the educational experience and must be designed accordingly.

## 2.3 ENVIRONMENTAL PSYCHOLOGY

The field of environmental psychology is broad, and focuses on the interrelationship of human experience and the environment (Proshansky et al 1970; Holahan, 1982). By applying Environmental Psychology concepts of place identity and place attachment within school built environments, the connection to the school built environment is strengthened, thus enhancing the educational experience for learners.

Proshansky et al (1970) suggests that environments, when designed appropriately, are able to evoke certain expected behaviours from humans. These expected behaviours can become the basis from which all other human activities and relationships extend. Nature has proven to be a positive influence on humans in cases of aesthetic value, conservation, child development, human health and well-being (Gifford, 2013); the extent of which will be covered later on. For these reasons interaction with nature should become a part of everyday life. Proshansky et al (1970) states, as an example, that in order for a child to learn, he must feel at ease, comfortable and secure within his environment. His suggestion is that schools be designed as “light, airy, colourful and roomy” (Proshansky, 1970:170) in order to accommodate the child. Once these (design) parameters are in place, the psychological and social factors come into play.

The considerate design of a place to evoke a certain reaction or feeling can be explored through the architectural concept of phenomenology. Christian Norberg-Schulz (1980) describes phenomenology as an environment that is made up of “phenomena”, i.e. the characteristics that make up a place. Therefore, the use of phenomenological

characteristics in architecture can evoke a multisensory experience in humans; our mental, physical and emotional sensors are heightened (Pallasmaa, 1986).

By understanding both Environmental Psychology and phenomenology in architecture, architects are able to design built and natural environments with a conscious understanding of how humans will react and respond to those environments. Similarly, the intentional design of school can contribute towards improving the teaching and learning environment by evoking certain preconceived responses from individuals, specifically through the connection with green spaces.

## 2.4 CONCLUSION

This chapter has begun to outline the interplay of education, nature and architecture by describing the underpinning of this study as *learning through experience of place*.

Experience is the common thread that links the topics of education, nature and architecture together. Because experiences within environments can promote a different learning approach, the extent to which the environment contributes to the experiences is relevant. Experiences in nature, specifically, are beneficial to humans as suggested by the Biophilia Hypothesis. An educational approach such as Place-based education uses the natural environment as the source for learning through experiencing nature. Place-based Education is enabled in schools through architectural design of the school built environment by catering for spaces that allow for Place-based Education to occur. Environmental Psychology and phenomenology principles can also be applied to how these environments should be designed to create a cohesive school design.

The topics of education, nature and architecture are intertwined. This interconnectedness is explored in the next chapter, viz. the benefits of connecting with nature within learning environments.

# Chapter 3: THE INTERPLAY OF EDUCATION, NATURE & ARCHITECTURE

This chapter presents a literature review that builds on the theories of the previous chapter, where different approaches to teaching and learning using the natural environment were discussed. In this chapter, the human-nature connection is discussed first as a foundation for connecting to green spaces. This is explored in terms of its origins and the decreasing connection between humans and nature. Thereafter, the value of nature to children is explored, with emphasis placed on how learning environments can lead to improved learning. Once the importance of connecting children with nature is established, schools are posited as the source for promoting contact with children and nature. The ways in which nature can be integrated into schools through the overall layout of the school, the buildings, and the types of natural outdoor spaces that can be used, are discussed. Finally, specific sensory elements of design are discussed in relation nature, in order to create varied sensory experiences for the learners of the school.

## 3.1 THE HUMAN-NATURE CONNECTION

History tells us that man has been using the natural environment as a source of food, shelter, and overall, survival for centuries. It is because human beings have used nature as part of their daily living over a long period of time that one can say that they have an existing connection with nature.

As mentioned in Chapter Two, the Biophilia Hypothesis can attest to why human beings seek contact with the natural world. In a broad sense, contact with, and features within the natural environment can contribute to faster recovery time of patients in hospitals, improved worker performances within office environments, and a deeper valuation of the natural world. In addition to this, through the use of experience and learning with nature, childhood development is improved (Kellert et al, 2008). The biophilic principle of Evolved Human-Nature Relationships focuses on those traits of human behaviour that connect with nature, and how they can be used as part of architectural design in order to foster the connection (Kellert et al, 2008). The built environment acts as a source of protection and security for individuals; a place in which people can explore and discover. People tend

to seek out environments, both built and natural, in which they can relax from stress and compose their mental well-being (Sassi, 2006).

The benefits we receive from nature depend on the interaction between the individual and the environment, which can be either positive or negative (Bratman et al, 2012). A positive experience with nature will create positive psychological responses and vice versa. An example of this is seen through a study conducted by Hartig et al (2001), which showed that people who experienced greater restorative experiences through nature were more compelled to behave ecologically. Should human beings not nurture and stimulate their affiliations with the natural world sufficiently, their tendencies to connect with nature will be suppressed, leading to a generation unable to connect with and use the natural environment for their benefit (Kellert et al, 2008).

Unfortunately, rapid technological advances have allowed people to connect with each other virtually, but there has been an absence of direct contact with each other and the natural world, specifically in children (Charles & Louv, 2009). Children have become isolated from experiencing nature and understanding their environments. Increased time spent playing video games and watching television results in children spending more and more time indoors (GreenLINK, 2011). Richard Louv (2010) has coined the phrase, *nature deficit disorder* (a non-medical term) which explains the increasing gap between children and nature. Louv (2010) expands on nature deficit disorder by attributing a lack of connection between children and nature to designs of schools “turning inward” (Louv, 2010:2), coupled with a decrease in outdoor field trips. Apart from just school design, Louv (2010) states that urban design schemes show a disappearance of open spaces, along with parents fearing “stranger-danger” when allowing their children to explore neighbourhoods. The foregoing views serve as motivation for designing schools that incorporate more green spaces as part of the learning environment, as children’s learning ability is hindered when the value of the natural environment is disregarded.

## 3.2 THE BENEFITS OF NATURE ON LEARNING ABILITY IN CHILDREN

There is debate about the term “natural spaces” in terms of its relating to “wild” outdoor spaces unaltered by human means, or if natural spaces can be used in reference to outdoor spaces that have been designed by people to include natural elements (Alexander et al, 2015; Muñoz, 2009). For this research study, a clear difference between the two explanations is not defined. The effect of natural elements on children should be the same for both, so long as different natural elements, found both in “wild” and designed outdoor spaces are present.

The natural environment holds various benefits for people, which can be explored through many theories such as the Biophilia Hypothesis (Wilson, 1984), Attention Restoration Theory (Kaplan & Kaplan, 1980), Stress-Reduction Theory (Roger Ulrich, 1991) and Maslow’s Hierarchy of Needs (Maslow, 1943), among others. However, the basis of the research explored herein is on the benefits of nature on children concerning learning and the learning environment. The benefits of children being in contact with nature will be explored in three categories, viz. mental health and creativity, the influence of attitudes and behaviour on environmental consciousness, and physical benefits.

### 3.2.1 MENTAL HEALTH & CREATIVITY

#### Mental Health

In a positive sense, mental health can refer to the ability to reduce stress, the ability to concentrate, and having a high self-esteem. In a negative sense, it can refer to depression and to disorders such as Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD). A child’s mental health and well-being directly affects their ability to learn, which means that children with poor mental health usually have learning difficulties (Maller, 2009). ADHD is a significant mental health problem characterised by “overactive and impulsive behaviour” which contributes to children having low attention spans (The RSPB, 2010). According to Health24 (2015), South Africa has one of the highest rates of prescribing medication for ADHD. The ADHASA council believes that medication should not be the first solution, but other solutions such as examining the effect of the environment on the child by making lifestyle changes such as diet and exercise should be

explored (Health24, 2015). Studies have shown that children with ADHD have shown improvements of their symptoms when they spend time in nature doing outdoor activities (The RSPB, 2010). For example, a study by Taylor and Kuo (2009) (cited in Jacobi-Vessels, 2013), showed that a 20 minute walk within a park increased the attention of 7-12 year olds with ADHD.

Stressful life events have a negative impact on a child's ability to learn and concentrate; this increases their levels of anxiety and decreases their self-esteem (Townsend & Weerasuriya, 2010). Stressful life events are reduced by the restorative effect of being in contact with natural elements. Small "doses in nature" not only benefit children with mental health disorders, but also those without such disorders (Jacobi-Vessels, 2013:5). These small doses of nature are carried into the classroom, and this increases children's concentration levels, memory, problem-solving skills and creative thinking (Jacobi-Vessels, 2013; Townsend & Weerasuriya, 2010).

### Creativity

According to Beetlestone (1998), creativity is related to the act of creation. Nature has been an inspiration for many artistic works such as paintings of landscapes and poetry; in addition, it has inspired artistic elements such as proportion, patterns, colours and textures (Beetlestone, 1998). During nature play, children take in a wide variety of information that is not available indoors; their sensory experiences are heightened by using their visual, tactile, auditory or spatial senses (Jacobi-Vessels, 2013; Beetlestone, 1998). They are able to use natural resources such as clay, sand and water to develop their imaginative interpretation (Beetlestone, 1998).

Beetlestone (1998) speaks specifically of the effect of gardening on increasing creativity in children. Children are able to explore their own ideas through gardening in spots of land, an activity in which no one can foretell the outcome. Therefore, gardening provides children a sense of mystery and wonder. Beetlestone (1998) also expresses how gardening can become a social experience as children can share their creative ideas with one another. The natural environment does not only have to influence creativity outdoors; items from the natural environment can also be used for creative projects inside the classroom. For example, the 'I Ur Och Skur' (rain or shine) preschool in Sweden, allows their children to create artwork using leaves found in nature. Sharp (2004) mentions that the size and layout of a classroom can also contribute to a child's creativity; this is in line

with Hertzberger's views of the design of school spaces. Fostering creativity through the natural environment is not limited to subjects relating to the environment. Although this study focuses on Natural Science as the key subject for using the natural environment, other subjects such as English, Drama, Music and Art can also increase creativity by using the natural environment as a theme within these subjects (Wilson, 2011). Further evidence of the effect that nature has on creativity and children, is provided in a study conducted by Castonguay and Jutras in 2009 (cited in Townsend & Weerasuriya, 2010), which showed that when children were asked to describe elements from their favourite places, the majority of the children described elements referring to nature; some children even mentioning specific trees and flowering plants.

### 3.2.2 THE INFLUENCE OF ATTITUDES & BEHAVIOUR ON ENVIRONMENTAL CONSCIOUSNESS

The formation of close attachment bonds can be developed through personal experience of a place. This attachment to a certain place creates such familiarity with that place, which an individual can develop more than just a detailed knowledge of it. Rather, it develops a "deep care and love for that place" (Relph, 1976). Similarly, a child's attitude and behaviour towards an object can be influenced by their connection to that object. According to several studies, the natural environment allows children to show a concern and appreciation for their surroundings while learning about the living and non-living elements of those surroundings. Thus emphasis is placed on the relationship between learning about the natural environment as having a positive impact on children's attitudes towards the natural environment (Pooley & O'Connor, 2000). An example of this is illustrated by a school gardening program undertaken by Zajicek & Waliczek (1999) which showed that children's environmental attitudes were significantly more positive after participating in activities that involved the school garden program.

Better attitudes about the natural environment need to be adopted by people, as human modification of the earth has expanded dramatically owing to human population increases and advances in technology (Vitousek et al, 1997). Scientists are suggesting that the earth has entered the *Anthropocene*; i.e. the state of the earth's geology and ecosystems have been significantly altered through human activity (Lewis & Maslin, 2015). For this reason, reintroducing contact with the natural environment in children is beneficial to society as children can become stewards of the environment through learning to care and look after

the natural environment. Kaplan (2000) argues that motivating people to be environmentally responsible and to behave in an ecologically sustainable fashion helps to discover ways of relating to the world that would best promote its welfare. Kaplan (2000) suggests that this will not be accomplished by telling people what to do, as people are inclined to resist doing what they are told. Therefore, the experiential theory strengthens the argument for exploring the environment on one's own. One is able to investigate and discover in one's own terms, in order to come up with new methods and solutions to a problem (Kaplan, 2000). The degree to which humans see themselves as part of the natural world directly relates to their environmental concerns (Schultz, 2000). A study by Schultz (2000) showed that people who felt closer to nature reported more environmentally responsible behaviour and pro-environmental attitudes.

### 3.2.3 PHYSICAL ACTIVITY & HEALTH

It is in children's nature to play. One can argue for an increase in the extent of play that takes place outdoors in a natural environment, as it is a positive attribute in children's physical health. Increased sedentary behaviour, a result of children spending more time indoors (as mentioned earlier), can lead to health problems such as obesity. The more common justification for increasing physical activity in children is to increase overall fitness through muscle building, bone strength and lung capacity (Gleave & Cole-Hamilton, 2012). The natural environment adds another dimension to play spaces by introducing different textures and elements that can be used as part of play e.g. textures such as hard and soft landscaping, as well as bushes or grassy areas for hiding or catching activities. The natural environment, as part of increasing physical health in children, also contributes to a better learning environment. Children are able to burn off extra energy during play, thus being able to concentrate better inside the classroom. Furthermore, they are also exposed to various elements of the natural environment that they encounter during a task in the classroom.

While the natural environment contributes to physical health, it also contributes to how children interact with one another. The types of spaces provided for during "play time" affects the way a child perceives that space. Moderate sized grassed areas are open for group activities promoting social relations, while a bench under a tree on the periphery of a ground can be perceived as a quiet reading area (NLI, 2012).

The health benefits of nature discussed here can be supported through integrating nature with the built environment, specifically in learning environments, as discussed next.



### 3.3 INTEGRATING NATURE WITH LEARNING ENVIRONMENTS

Green spaces in learning environments should be used to complement the built spaces of the school built environment, in order for both built and unbuilt spaces to become sources of teaching and learning. In this way, the importance of built spaces in schools are not disregarded or over-shadowed by green spaces; but they are able to work together to improve the learning environment. Therefore, research on the types of natural outdoor spaces, as well as the design of the layout and buildings found in schools are explored, as both contribute towards the make-up of the school built environment.

Sassi (2006) describes characteristics of the built environment that can directly affect people. These characteristics range from the make-up of a building i.e. the use of specific structural and aesthetic building materials, to the spatial design characteristics of a building i.e. size, location, relation to outdoor environments and relation to human interaction. Seeing as human beings have an innate connection to nature, as explored previously, spaces within built environments should reflect a certain naturalness in order for people to feel connected to that place.

The concept of Biophilia is interpreted by the built environment by creating design principles that respond to nature; this is known as biophilic design. Biophilic design principles (Kellert, 2008) can be implemented into buildings and spaces to promote the human-nature connection. There are six biophilic design principles viz. Environmental features, Natural shapes and forms, Natural patterns and processes, Light and space, Place-based relationships and Evolved human-nature relationships (Kellert, 2008). Some of these principles form part of how nature can be integrated with learning environments, and will be discussed throughout this section.

#### 3.3.1 PRIMARY SCHOOL LEARNING ENVIRONMENTS

The school environment provides one with opportunities to learn to respect others, follow instructions and rules, as well as explore and participate in activities around us (Hertzberger cited in Faiferri, 2012). In South African schools, the primary school stage of education is a 7-year long journey. A considerable amount of time is spent within schools; this period offers learners opportunities to interact with other children, adults and

different types of spaces, all being within a controlled and secure environment. All of these interactions contribute towards the learning experience of a child. Learners at the primary school level develop their basic understanding of concepts such as morals and values, as well as develop personal experiences within the school environment by means of all their senses (Palmer & Neal, 1994; Palmer, 1998). Subjects such as language, numeracy, and sciences can be taught in an experiential manner, which as discussed, can be promoted using the natural environment. In promoting environmental consciousness within children, Davis (1998) believes that children at the primary school level can be introduced to accepted codes of environmental behaviour.

Unfortunately, current school built environments conform to minimum requirements that were set out by authorities with little integration of the natural environment. The opportunities of expanding the learning environment has rarely been explored; however this can be changed by understanding that learning is not limited to a classroom setting, as explored by Jilk (2005) who states, “...when we accept that learning is not limited to a classroom, we realise we can also learn in a closet, a café, or a cathedral” (Jilk, 2005:31). Similarly, through the theories and concepts already explored, learning and teaching can be enhanced by means of using the natural environment. Sassi (2006) believes that connections with nature should not be time or location-dependent, but rather part of everyday life. This provides an important motivation for arguing the importance of incorporating green spaces within schools.

### 3.3.2 CREATING A ‘SENSE OF PLACE’

Creating a ‘sense of place’ in architecture refers to creating a connection between (architecturally) designed spaces and the location in which they are built, as well as how these spaces can positively influence its users. For this study, the natural environment is regarded as a space which also contributes towards creating a sense of place.

According to Norberg-Schulz (1980), architecture creates spaces which individuals acknowledge, recognise and are comfortable within. He calls this characteristic of a place *Genius Loci*, or “spirit of place”. Christopher Day, in his book *Spirit & Place* (2002), expands on how spaces can be made into places (Figure 3.1).

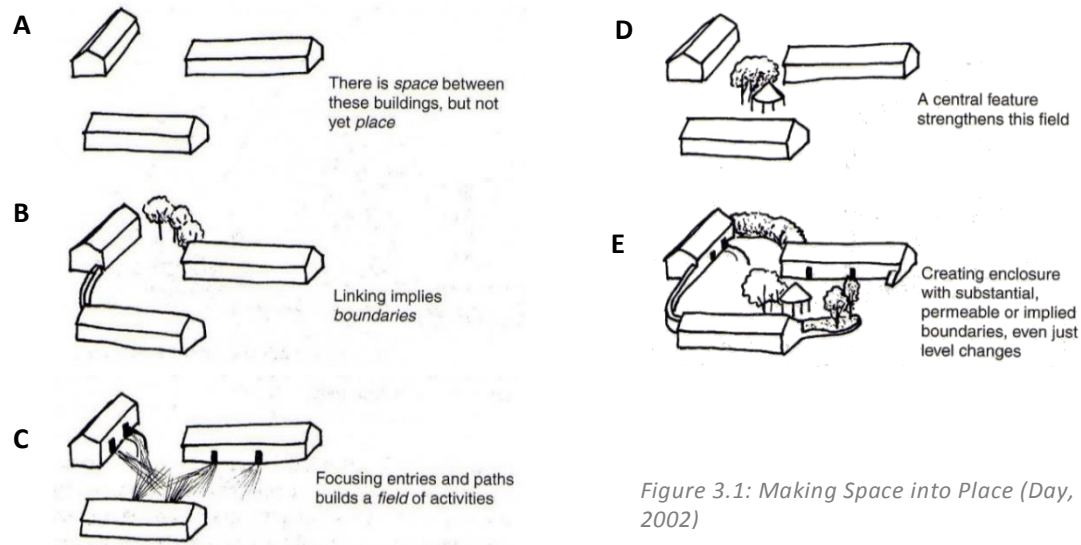


Figure 3.1: Making Space into Place (Day, 2002)

Day (2002) expresses the idea that form and space are contributors of shaping a person or community, in addition to nourishing and encouraging development, on a social and individual level. The way in which we respond to our surroundings is based on a deeper connection than just preference. Qualities of a surrounding such as air quality, sound, colour, form, temperature, are what architects must take into consideration when designing built form for a particular location, in order to create a sense of place for its users (Sassi, 2006; Day, 2002).

Kellert (2008) describes the biophilic principle of place-based relationships as the way in which architecture can connect to the place in which it is created. This is done by understanding how a landscape defines an architectural form, or the way in which a building captures the essence of a place through geography, ecology or cultural contexts. In line with Kellert, Righini (2000) explains how a 'sense of place' was crucial for man's survival in ancient times as our survival was based on having a good relationship between man and place in a spiritual, physical and psychological sense. A quote by Pallasmaa (1986) on phenomenology pinpoints the key issue that some places evoke more feelings in individuals than other places do, which directly correlates to Kellert's and Righini's lines of thought. Pallasmaa asks:

*"Why do so very few modern buildings appeal to our feelings, when almost any anonymous house in an old town or the most unpretentious farm outbuilding gives us a sense of familiarity and pleasure?"*

- Pallasmaa (1986:448)

In contrast to meaningful place, *Placelessness* is used to describe architecture void of any connection to its location or users. Edward Relph, in his book, *Place and Placelessness* (1976), uses phenomenology of place to describe the connection between individuals and place. Relph (1976) analyses an individual's identity to place by naming 3 factors: (1) the physical settings of the place, (2) the activities, situations or events of that place, and (3) the experiences and intentions of people in that place. Placelessness, should be avoided as it evokes alienation and strangeness within a person.

A sense of place is nurtured through the user experience within spaces of that place, therefore the school built environment should capture the essence of the learners within it through its design in order to avoid Placelessness. The writings by Herman Hertzberger on school design are explored in order to discuss how learners can positively experience spaces and elements, creating a stronger sense of place within the school environment.

For this study, the writings of Herman Hertzberger will be utilised as the primary grounding for the design of built features of the school.

### 3.3.2.1 THE SCHOOL AS A MICRO-CITY

According to Herman Hertzberger (2008), a school can be compared to a micro-city, where school building components are likened to city components; corridors become streets and communal areas become public squares. This allows for each component of the school built environment to be designed as integrated components of a completed whole, much like the make-up of a city. Each component is able to evoke certain feelings and responses from the users of that component (Hertzberger, 2008). The school, as a micro-city, should reflect the world within its confines, consisting of a network of "learning streets" and "public squares" (Hertzberger, 2008). In this way, a great number of social contacts and discoveries can occur throughout the school built environment. A school that represents a micro-city connects to the community around it, as it no longer functions as an isolated building, but is designed in the same way as how the community functions i.e. through creating social relations and connectedness with each other.

### 3.3.2.1.1 THE LEARNING STREET

In learning environments where a wide range of activities takes place, spatial organisation should allow for the right balance between collective and individual learning, while increasing the potential capacity of workspaces (Hertzberger, 2008). Learning environments should incorporate an array of different spaces including nooks, bays and ancillary spaces, thus allowing the user to decide upon how to use the space. Corridor spaces within schools, used in the traditional way, link classrooms and other areas of the school together i.e. they act purely as circulation spaces. However, as a result of increasing the learner per classroom ratio, corridors became an expansion of the classroom space, thus making it a more usable component for teaching and learning. In this way, it becomes a “learning street” as opposed to just a corridor (Hertzberger, 2008).

The Romanina Elementary School is part of an Urban Park and Integrated Complex of Primary and Secondary Schools, and Public Facilities in Rome, designed by Herman Hertzberger. Classrooms of the school are configured on one axis, which creates a series of communal spaces such as the canteen, school theatre and outdoor courtyards to encourage social interaction amongst learners. The outdoor courtyards, adjacent to the classrooms, offer an opportunity for classroom spaces to extend outwards (Figure 3.2). In order for corridor spaces to be a true expansion of the classroom, larger corridors, equipped with work stations will allow for students to work there effectively (Hertzberger, 2008).



*Figure 3.2: Aerial view of Model of Romanina Elementary school highlighting single axis  
(Source: Faiferri, 2012)*

Hertzberger (2008) describes fixed furniture as fixed platforms for working on, which when positioned within the centre of a space, can define that space, while allowing learners to access and use it from all sides (Hertzberger, 2008). Hertzberger (2008) attests to incorporating fixed elements of furniture within learning environments as they spark creativity, creating “hubs of activity”.

By creating flexible spaces in schools, teaching and learning can expand from the confines of traditional teaching and learning, thus allowing learners and students more freedom in the way that they learn, ultimately promoting the teaching and learning experience. Apart from just creating flexible spaces, these spaces must become optimal learning spaces for children by ensuring that all their senses are evoked through biophilic design principles within the design of the school built environment. The Learning Street, for example, creates an atmosphere of enticement, as passers-by can acknowledge the activities of other students. Out-of-classroom experiences peak learners' excitement; this contributes to creativity in learning, and should be considered in design. As part of the school built environment creating a variety of opportunities for learners to learn from, The Learning Street becomes an "educational promenade" through which a series of spatial and educational experiences can prosper, while enhancing Sense of Place (Hertzberger, 2008:113). The classroom setting gives one the feeling of a family or part of a group. However, once these classroom spaces open up onto more public and social areas such as the learning street, learners have more interaction with other learners from different groups. This explains further how the learning street contributes towards creating a city-like school environment. The educational promenade can be likened to that of Le Corbusier's writings on *promenade architecturale*, which describes how a series of experiences can be incorporated within a building to guide the user through the building, thus contributing to creating a Sense of Place.

### **3.3.2.1.2 PUBLIC SQUARES**

Public squares in cities act as a central focus, a gathering and recreational space. Many streets can lead to a square i.e. transitional spaces that lead one to a dedicated place, where streets encourage movement and squares encourage lingering (Hertzberger, 2008). Schools require both streets and squares to allow for both types of activities to take place. Square-like spaces in schools are used for gathering of teachers and learners, and on certain occasions, parents, therefore the assembly area in a school is likened to that of a public square. Hertzberger (2008) introduces an element of design that allows for the user of the space (specifically children) to determine the function of that space i.e. by using steps.

In relation to creating public squares in schools, the introduction of steps offer definition of spaces by lowering or raising sections of the floor. Steps are used as transitional elements, to provide views and give protection (Hertzberger, 2008- Figure 3.3). Using steps in conjunction with public square spaces in schools, creates a sense of place by allowing children to spontaneously “perform”, or create platforms on which to work i.e. they have a connection to that place through use of the designed elements of that place (Figure 3.4). The possibility for the use of sunken or hidden spaces are endless from a child’s perspective, and should be considered more in the design process.

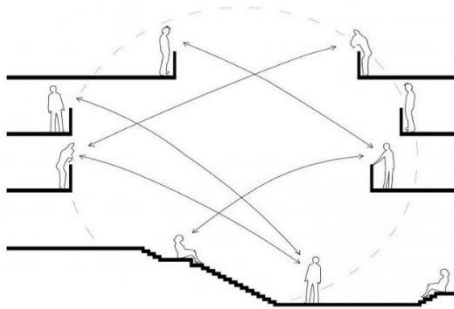


Figure 3.3: The use of steps with public square (Source: Hertzberger, 2008)



Figure 3.4: Use of steps adjacent to public space in Romanina Elementary School (Source: Faiferri, 2012)

### 3.3.2.2 THE SCHOOL BUILDING INTEGRATED WITH NATURE AS THE THIRD TEACHER

Hertzberger’s (2008) analogy of the school representing a micro-city can be elaborated on further by highlighting the buildings within the school. Nicolson (2005) discusses how school buildings should be integral components of the teaching and learning process. Nicolson regards the school building as a “third teacher” through which learners can learn: “a building can reflect and perpetuate ideas about how children learn, what they learn, how they are taught, and to what end they are taught” (Nicolson, 2005:45). This is evident as children perceive spaces in the physical environment in different ways, providing children various opportunities for things to do within the school built environment (Day, 2007). A school building can also communicate subtle messages about importance and respect by prioritising certain spaces over others. Nicolson (2005) compares a school community hall with a school sports hall, in which she states that a sports hall passes on a more important message than a school community hall. That message is that physical education is just as important as the community it serves. In this way, teaching children

more than just what is required by the education system, but life experiences as well (Nicolson, 2005). It must be noted that although Nicolson does not mention the outdoor environment, the concept of communicating importance through prioritising spaces should also be acknowledged when designing outdoor spaces.

The school building should be child-orientated, with spatial characteristics such as walls and windows that reflect and communicate the life of the school, and illustrate the activities executed by the children (Nicolson, 2005). Although the writings of Nicolson do not include the natural environment specifically, they focus on the school building, i.e. the importance of the school building to the teaching and learning process. Nicolson explains that “every aspect of an educational environment represents a choice about what is to be provided and what is not to be provided” within a school (Nicolson, 2005:45). The debate here lies within determining *what* is important for children to learn from. The discussion, following on from the Experiential Learning Theory and Place-based Education, lends itself to incorporating the natural environment with school buildings as a method of teaching and learning.

Using this as a point of departure, Chiles (2005) explores “the classroom as an evolving landscape”, in which the exterior spaces around classrooms have the potential to provide different experiences for learners. Nicolson (2005) discusses a similar concept, called filter zones, in which exchange between children and families can occur. In a school case study designed by Chiles (2005), the relationship between inside and outside spaces, and how it related to the curriculum was a key theme, where elements from the natural environment are designed as part of the school. Chiles (2005) describes how the classrooms are designed as if surrounded by the outdoor environment. In this way, design promotes the relationship between inside and outside spaces, and its link to learning.

The connection between inside and outside spaces is strengthened when the spaces complement each other; therefore, understanding different types of outdoor learning spaces is necessary in order to connect them to school buildings.



### 3.3.2.3 NATURAL OUTDOOR LEARNING SPACES

Outdoor spaces can contribute towards creating a sense of place within schools by fostering Place-Based Relationships between the outdoor spaces and the learners. This can be done by integrating outdoor spaces with built form in order to supplement the teaching and learning process.

Traditionally, natural spaces within schools took the form of sports fields with little vegetation as components of the school environment (Higgins, 2006). However, vegetated natural spaces can be implemented within school environments to supplement the teaching and learning process. As previously discussed, the use of gardening within a school promoted various benefits for learners. Types of gardens that can be implemented within schools to strengthen the connection between nature and the learning environment will be explored here. Site experiences is a key component of schools promoting Environmental Education. Primary school case studies analysed by Palmer and Neal (1994), showed that not only did learners develop knowledge and understanding, concepts, skills and attitudes through their out-of-school experiences, but also an enhanced awareness and concern for living things in the environment around them. A site model proposed by Troost & Altman (1972:310) suggests that the site areas used for environmental investigations should be “immediately adjacent to or within walking distance of the school”. In this way, it is more easily accessible for frequent visits, there is no time limitations for investigations, and changes to the site may be observed over a period of time (Troost & Altman, 1972:311).

#### Edible Gardens

Gardens that provide edible plants allow for a variety of learning experiences. By exposing children to concepts of growing, harvesting and eating fresh fruits, vegetables and edible herbs, learners are more aware of the process involved in sustaining their lives as well as about healthy eating (Tai et al, 2006; Center for Ecoliteracy, 1997). Gardens with different species of vegetation allow for learners to understand concepts of biodiversity which in turn promotes environmental consciousness (Center for Ecoliteracy, 1997). School gardening programmes also allow for learners to become more involved with their community, as providing vegetable gardens in schools can create opportunities to give back to the community (Tai et al, 2006). Water collection and storage facilities can be provided as part of the buildings, and for learning and teaching, thus contributing to a more environmentally-conscious design. Depending on the level of integration of edible

garden programmes with the school, garden plots can be small areas as part of classroom design, or in the case of farming schools, be represented throughout the entire school built environment. A “farming pre-school” in Vietnam is constructed as a continuous spiral form with accessible roof gardens used as part of the school farming programme (Figure 3.5).



*Figure 3.5: Farming Pre-school integrates edible gardens as part of the school built environment. (Source: Stevens, 2014, [www.designboom.com](http://www.designboom.com))*

### Instructional Gardens

Garden spaces with general vegetation provide a backdrop to teach many types of lessons using the vegetation as sources of inspiration e.g. for writing, arts, drama, mathematics and sciences (www.laschools.org, 2016; CSGN, 2006). They also promote group learning, which may not always be possible in classrooms. Different types of instructional gardens can cater for different elements of teaching. Some spaces may include work stations to encourage reading or writing within the natural environment (www.laschools.org, 2016).

### Sensory Gardens

Gardens can also create spaces in which all senses are evoked, an idea which is in line with Sensory Architecture. Sensory gardens include elements of water and scented plants to create a serene atmosphere. Water features, drinking fountains, and small bodies of water in which to house small fish and other aquatic life, create excitement within children. This can serve to benefit the learning and teaching environment as water saving, purification and the importance of water can all be experienced first-hand within the school environment (Tai et al, 2006). Flower gardens, not only aesthetically improve the learning environment, but also add different scents to the learning environment from which to learn. By integrating green spaces within the school built environment, the school environment can become part of greater community greening programmes that rely on community involvement in maintaining school green spaces (Higgins, 2006). This creates a stronger opportunity to teach learners more than curriculum-based subjects.

The types of natural outdoor learning spaces that are used in learning environments should complement the built forms as this plays a role in the way in which the outdoor spaces and buildings are perceived and used within schools. The appropriate configuration and integration of built form and green spaces in schools will create a cohesive learning and teaching environment that promotes education and wholesome development through all aspects of its built environment.

### 3.3.3 SENSORY ARCHITECTURE

Day (2007) explores how sensory stimuli of the environment is needed in learning environments as it aids the educational process, as children are naturally prone to exploration through their senses (Nicolson, 2005). Sensory experiences is vital for alertness and attention, both required for effective learning (Day, 2007). In environments that are unvarying, the brain “goes to sleep” (Day, 2007:83), decreasing concentration levels, and experience of that place is dulled (Nicolson, 2005).

The idea that architecture is a multisensory experience has been defined by phenomenology, however, the ways in which architecture can respond to our senses will be explored here in order integrate elements of nature into buildings and spaces of learning environments. Biophilic Design principles can be explored by means of creating and using sensory variability within architecture in order to create built and natural spaces that respond to the sense of senses: sight, touch, smell and sound (Kellert et al, 2008).

Architecture can be regarded as an extension of nature and its principles; it is the relationship between a building and its environment; an integration of built and natural form (Cruz, 2012). As Day (2002, 2007) comments, curves, flowing lines and forms are representative of nature, whereas rigid, straight lines and forms are representative of a man-made world. The biophilic design principle that encompasses natural shapes and forms supplements Day’s differentiation. Some of the elements that contribute towards this principle include tree-like support structures, natural floral motifs, shells, spirals and egg-like forms.

A brief explanation of the characteristics of the buildings that contribute to a stimulating sensory experience is explored here.

### 3.3.3.1 MATERIALS AND TEXTURES

Materiality and tactile qualities of materials are important component of design, as they become the skin of the built form, which can be used to evoke senses of sight and touch.

Classroom spaces are known to be the crux of a school as this is where majority of the learning process takes place (Hertzberger, 2008). Classroom design should therefore recognise and acknowledge the way in which children learn and how teachers teach, and should aid the learning process (Hertzberger, 2008). Educationists have established that there are four main types of classroom learning organisations in primary schools viz. whole class, individual, paired, and group work (Edwards, 2005). Elements that make up a school, and classroom spaces, should respond to these learning organisations. Barrett & Zhang (2009) refer to this as the Level of Stimulation that is provided for in school buildings through Complexity, Colour and Texture.

#### Complexity

The appearance of a school building, and the spaces within, present an opportunity to inspire learners and teachers through diversity. Diversity allows for a variety in shapes and forms, as well as material choices, in the school environment (Barrett & Zhang, 2009). Natural materials are able to exude a feeling of continual life existence and process as opposed to what can be done using artificial materials (Kellert, 2008). On the use of natural materials in architecture, Pallasmaa (1994) notes that natural materials like wood, stone and brick, can express age, history and human use within architecture. These materials also add an experience of time through weathering (Pallasmaa, 1994; Kellert 2008). Natural materials may not always be suitable or available for school design, therefore, alternative ways of improving the sensory experience of learning environments are explored.

#### Colour

The use of specific colours in educational settings have been noted by colour psychologists to be more than just aesthetically pleasing, they also promote mental and physical health and development in children (Barrett & Zhang, 2009). Through research studies, children of pre-school to primary school age were found to respond to warm, bright colours in learning spaces, which reduced tension, nervousness and anxiety (Barrett & Zhang, 2009).

The colours identified include yellows, oranges, corals and peach. In other spaces such as libraries, more subtle colours such as pale greens should be used to evoke a sense of quietness within learners (Barrett & Zhang, 2009).

### Texture

Different textures within school environments stimulate children's sense of touch. Apart from the effect of general material choice of building materials on teaching and learning, Barrett & Zhang (2009) note that tactility of materials make a considerable difference to children's senses within outdoor spaces. The outdoor environment provides various opportunities to introduce different textures to children through the use of natural planting and hard and soft landscaping. Learners are able to watch the same setting change over time i.e. from lush planting to bare trees, while stimulating their learning.

**Complexity**



Figure 3.6: The Green School in Bali (Source: [www.ad-energy.ro](http://www.ad-energy.ro), 2016)

**Colour**



Figure 3.7: Example of colour design in Classroom space. (Source: Barrett, 2015,

**Texture**



Figure 3.8: Example of different textures in school sensory garden (Source:

### 3.3.3.2 NATURAL LIGHT & VENTILATION

The biophilic design principle of Light and Space attests to using natural light and spatial characteristics of architectural form to enhance sensory experiences as well as incorporating nature with built form (Kellert, 2008). The use of natural light is particularly important as it boasts restorative and healing properties for people, creating uplifting environments for learning. The use of shadows, and diffused and reflected light create interest, contrast and a relation to the natural environment through elements of design such as courtyards, vistas, fenestration and openings in facades in order to allow for natural light to enter a building (Kellert, 2008). In school design, in order for sufficient natural light to enter classrooms and other spaces within the school, correct orientation,

coupled with large windows with correct shading devices must be incorporated into the buildings (Barrett & Zhang, 2009). Ideally, windows should be situated at lower heights in order for children to be able to open and close them (Hertzberger, 2008). Clerestory windows and light shelves allow for light to be distributed in larger volume and deeper spaces, maintaining a good visual quality of a space. Natural light can also be affected by the closeness of surrounding buildings or trees in relation to the window configuration (Barrett & Zhang, 2009).

### Sound

Although sound is not a direct derivative of integrating nature in school design, it must be acknowledged as factor that affects the learning environment. Adequate room acoustics must be created within classrooms and other enclosed spaces in order to provide good sound quality. Sound control within classroom spaces improves communication and promotes working and learning efficiency (Barrett & Zhang, 2009). The calming sounds of natural features such as running water and rustling leaves can be used to improve sound control when designed in close proximity to classrooms.

#### 3.3.3.3 NATURAL VIEWS AND PLANTING

Together with windows that are suitable for natural light and ventilation, windows that allow views to the natural environment create a spatial extension of the classroom while creating a sense of inclusiveness rather than enclosure (Scott, 2010). In line with biophilic principles, views to the natural environment promote comfort, satisfaction, well-being and performance (Kellert, 2008). Introducing plants into the classroom design also contributes to user satisfaction. Plants contain air-purifying properties and by increasing oxygen levels within classrooms, they improve concentration levels amongst learners (Sassi, 2005). The school case study examined by Chiles (2005) presented children's opinions of box bay windows, which were completely openable. Children who used these windows felt as if they were half inside and half outside—enhancing the connection of children to nature. Therefore, conscious design decisions are important in creating stimulating school environments.



*Figure 3.9: Box Bay window promotes inside-outside relationship in school (Chiles, 2005)*

### 3.4 CONCLUSION

Humans have an existing connection to the natural world, in both wild and designed spaces. This connection provides various benefits for our general health and well-being, and these were explored using a range of existing studies. Therefore, if this connection is fostered, promoted and nurtured in children, benefits relating to their general health and well-being are enhanced, and their learning ability improved.

Primary schools were found to be suitable for integrating natural elements into the design of the school built environment, through the concept of Sense of Place. Natural elements should complement built spaces, and both needed to be explored to understand the extent of their connection and benefits to each other.

Herman Hertzberger's (2008) concept of the school as a micro-city comprising of a series of streets and public squares, was found to allow learners to feel connected to different spaces created within the school built environment. Building on from this connection, it was found that through studies by Nicolson (2005) and Chiles (2005), school buildings can be designed in a way that enhances teaching and learning by using the school building as a "third teacher", and by creating a connection between inside and outside spaces. Hertzberger's, Nicolson's and Chiles' writings do not expand on the types of outdoor spaces that should be provided for in schools; however, through other writings on natural outdoor learning spaces, it was found that various types of garden spaces can contribute towards improving the teaching and learning environment.

The connection formed through creating a sense of place within schools, as well as the integration of nature with the school buildings were found to be enhanced through sensory architectural elements that evoke learner's senses within the different spaces of the school. The way in which senses are heightened was found to be primarily through using biophilic design principles in a way that connects spaces to nature.

Hertzberger notes "the things you recall best of your own school are the classrooms, the corridors, the stairs, the windows you looked out through, the space, the materials..." (Hertzberger, 2005:9).

For this reason, it is important that the school built environment be as rich and varied as possible in order to evoke positive associations for the rest of a learner's life.

The sections discussed here should not be looked at in isolation, but rather as a collective in designing a school that connects with nature by using green spaces, as well as natural sensory elements to promote learning and teaching.

Built architectural examples will demonstrate the concepts discussed here in the following chapter, which will contribute towards devising a new set of architectural guidelines for a primary school with integrated green spaces.



## Chapter 4: KEY PRECEDENT STUDIES

This Chapter presents two architectural examples that reinforce the literature discussed in Chapter Three. The precedents explored are Crow Island Elementary School (Perkins + Will Architects), and Sidwell Friends Middle School (Kieran Timberlake Architects), both located within the United States of America. It must also be noted that Crow Island Elementary School is a public school, while Sidwell Friends Middle School is a private school, which explore two different ways of integrating nature with learning environments through school design. These examples are placed within a contextual evolution of school design in order to understand the period in which they were built.

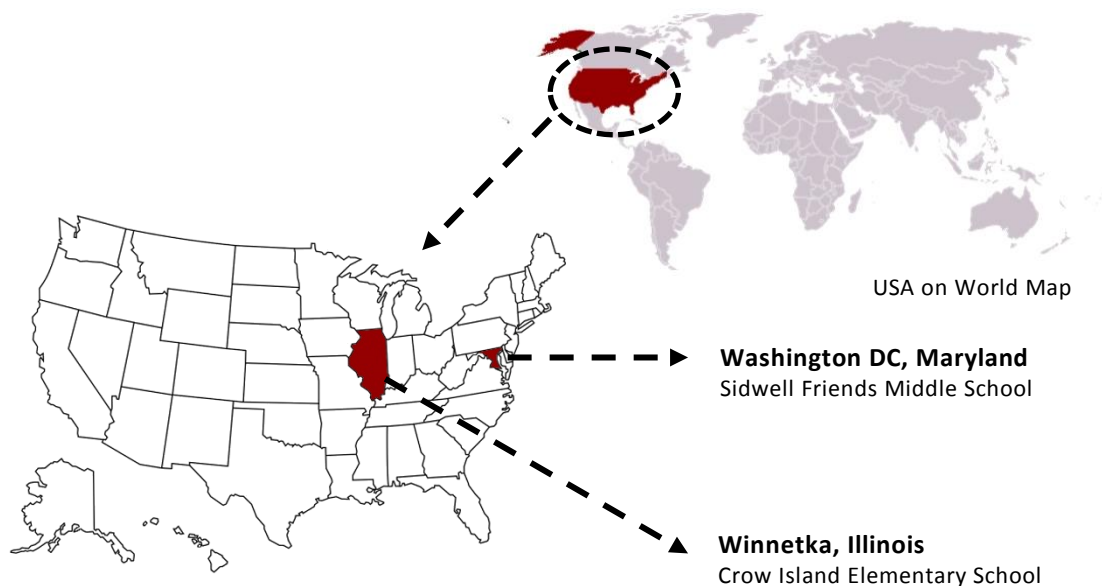


Figure 4.1: Location of Precedents (Source: [www.freeusandworldmaps.com](http://www.freeusandworldmaps.com), 2016)

### 4.1 EARLY HISTORICAL EVOLUTION OF SCHOOL DESIGN

Over the years, education and its subsequent learning environments, have progressed and evolved. Early forms of education within the 1800s were based on a Monitorial System, created by Joseph Lancaster, whose motto was “He who teaches, learns” (Reigart, 1916). Lancaster encouraged the use of “child-monitors” (more able students chosen by the teachers) to teach the rest of the class (Reigart, 1916). The Lancaster method of education was evident in America, England, India, West Indies, Canada and Africa. The school

building for the Lancasterian System usually took the form of a large hall filled with rows of desks (see Figure 4.1). On the floor of the passages within the hall would be semi-circles in which the different classes would stand around in order to proceed with their reading lessons, which were pinned on the wall (see Figure 4.2).

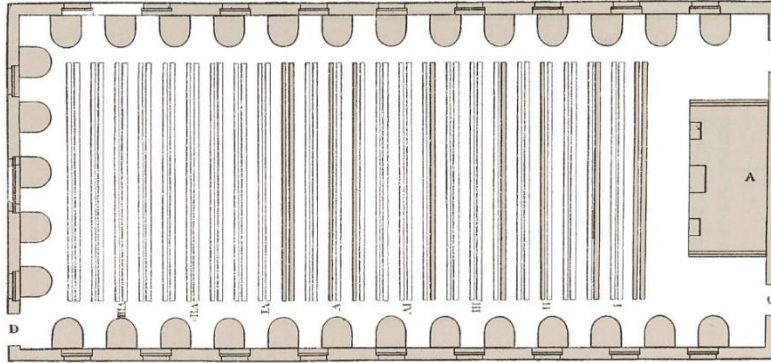


Figure 4.2: Layout of School hall as classroom in Lancaster Monitorial System (Source: Reigart, 1916)



Figure 4.3: Illustrating use of semi-circles along the wall (Source: Reigart, 1916)

From the Lancaster Monitorial System of Education, school buildings started creating “fixed function spaces”, which included dividing a typical school hall into different areas with furniture (Abbasi, 2009).

During the 1900s in Europe, a new schooling system was developed; the systems used “open air” schools, in line with The Modern Movement in architecture. Classes were held outdoors, or in small buildings with folding glass doors that could be widely opened (see Figure 4.3). Larger schools during the same period mimicked the design of hospitals, which reinforced the idea of “hygienic architecture” (see Figure 4.4).

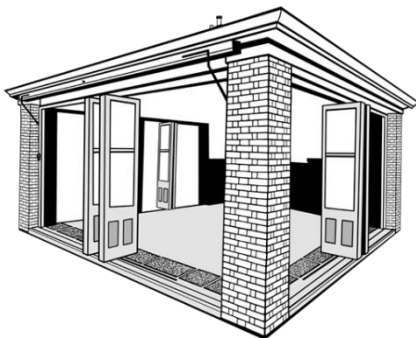


Figure 4.4: Uffculme Open-Air School, England, 1911 (Source: Nelson, 2014)



Figure 4.5: Larger Open-Air School by Johannes Duiker, Amsterdam, 1930 (Source: Nelson, 2014)

The open-air school concept evolved during the 1920s through the Progressive Era. Emphasis was placed on fresh air, ventilation, daylight, and outdoor learning which all assisted with student health and well-being. Focus shifted towards designing for the “whole man”. Schools were configured with a central school walkway, a community wing, classroom wing, an assembly hall and courtyard spaces. This new configuration allowed designers and planners to focus on the classroom spaces, such done at Crow Island Elementary School.

## 4.2 CROW ISLAND ELEMENTARY SCHOOL

Crow Island School is an old public elementary school (primary school) located in Winnetka, Illinois, in the United States of America. American architect, Lawrence Perkins (founder of the company Perkins + Will) developed the school in 1940, part of the Progressive Era. At the time of development, this school was an icon of progressive school design, with a vision of experiential, child-centred learning. This school has since revolutionised thinking on school design (Mortice, [www.citylab.com](http://www.citylab.com), 2015).

This school is presented as a precedent on school design for this study as it allows for Experiential Learning. Due to its pioneer design in forward educational thinking, the Crow Island School was designated a National Historic Landmark in 1990.

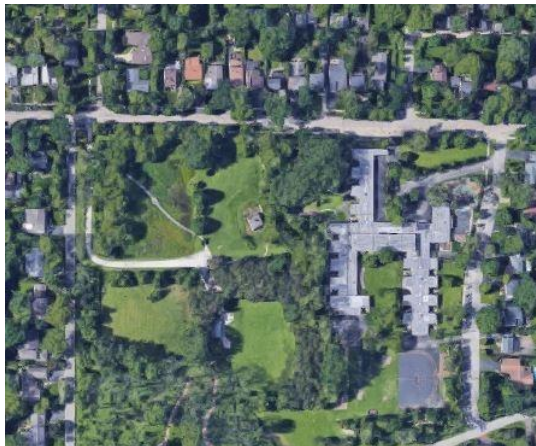


*Figure 4.6: Entrance of Crow Island Elementary School (Source: [www.perkinswill.com](http://www.perkinswill.com), 2013)*

#### 4.2.1 LOCATION

The site on which the school sits was formerly a swamp with an adjacent wooded area named “Crow Island” due to the abundance of crows found within it. During the 1930’s, the swamp was filled up and deemed suitable as the school site, with the natural Crow Island Woods remaining adjacent to the new school ([www.winnetka36.org](http://www.winnetka36.org)). This contributes towards Norberg-Schulz’ Genius Loci as the site holds value for the existing community by maintaining the Crow Island Woods.

Apart from maintaining the connection between the woods and the community, it provides the school with a natural outdoor area for learning that includes natural wildlife and wildflowers. This learning method is synonymous with Place-based Education, as the woods provide an opportunity to venture out of the classroom, therefore learning through *place*. Crow Island School illustrates the importance of location, as having an existing rich natural environment as part of the site presents various opportunities for people and the built environment to interact with it.

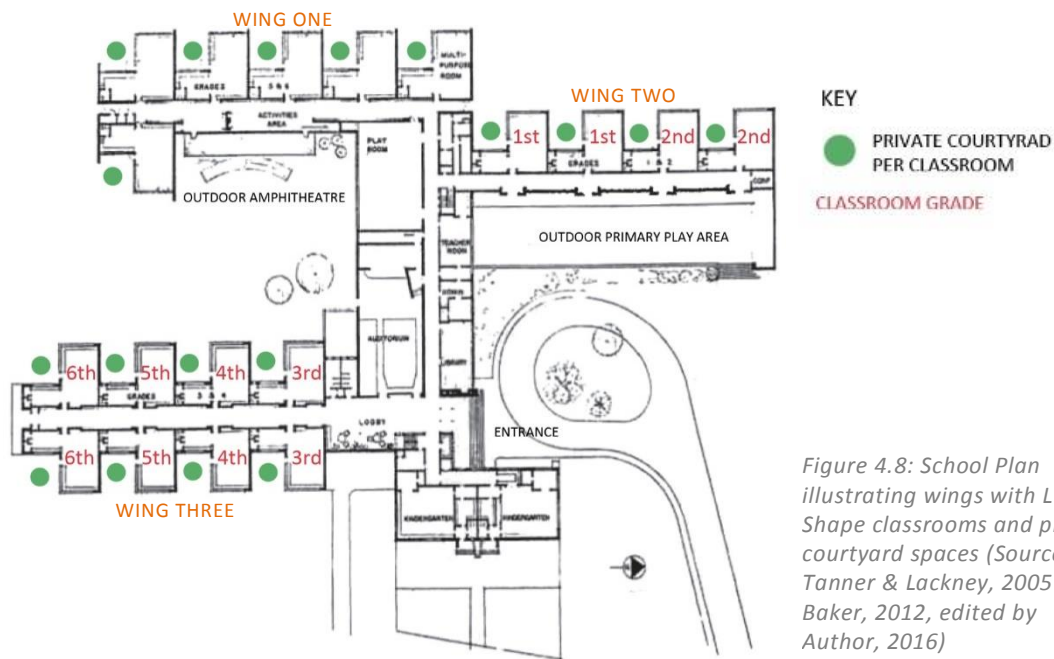


*Figure 4.7: Aerial Map of school and adjacent Crow Island Woods (Source: Google Maps, 2016)*

#### 4.2.2 LAYOUT AND SPATIAL PLANNING

The architects followed a bottom-up approach in the design process, spending ample time within classrooms in existing schools in the area in order to investigate the learning process. This led to a school that was designed from “the inside out” i.e. it responded to both teachers and children’s needs (Boss, 2015). The original school building was designed with three classroom wings (a 4<sup>th</sup> one was added later on), divided by the different age group of learners. The three wings were joined by a core of common spaces such as the library, gym, auditorium and administration.





The layout of Crow Island School lends itself to be examined through Hertzberger's concepts of the Learning Street and Public Square, regardless of not being originally designed using them. Wings one and two have corridors with the potential to expand outward into the communal outdoor spaces through the use of the corridor as a Learning Street, where the corridor of wing one is widened in front of the outdoor amphitheatre in order to create an "activities area" (Figure 4.9). In this precedent, the public squares are represented by the communal outdoor courtyard spaces, although they are not at the end of the learning street as explained by Hertzberger, but filter out through the middle of the corridor (Figure 4.10).

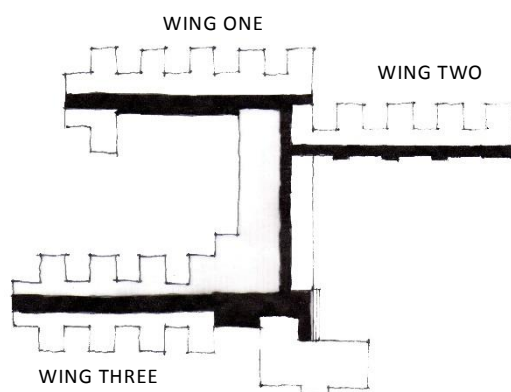


Figure 4.9: Sketch highlighting corridor circulation as Learning Streets (Author, 2016)

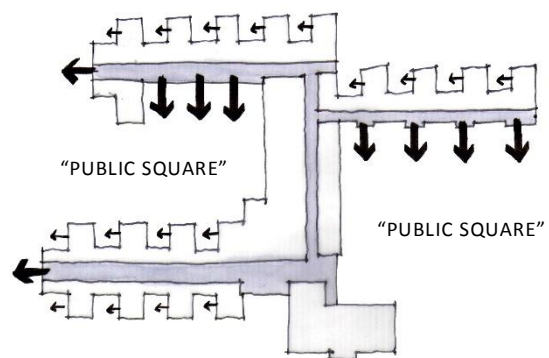


Figure 4.10: Sketch highlighting access from Learning Street to outdoor public squares, and private courtyards (Author, 2016),

Moving away from Hertberger's concept of public squares, Crow Island School has smaller private courtyard spaces for each classroom. These spaces are defined by the classrooms on each wing, as each classroom is L-shaped. This L-shape configuration is composed of an ordinary classroom working space with an adjacent smaller workroom and private toilet. The focus of this school was to learn through the private courtyards of each classroom, therefore the relation of the communal outdoor courtyard spaces to the classrooms through the corridor is not as strong as Hertzberger's use of the learning street, as the classrooms have greater openings towards the private courtyard, and have just one opening towards the corridor space. However, if the classroom was able to be permeable on both sides, the learning space would benefit from both the private and communal outdoor courtyard spaces.



Figure 4.11: Artist render of private courtyard between classrooms (Source: [www.schoolbuildings.com](http://www.schoolbuildings.com), 2016)

#### 4.2.3 THE SCHOOL BUILDINGS

Crow Island School exemplifies Nicolson's (2005) writings on the school representing the learners by being child orientated, through details of the construction of the school building. This is done through the corners of brick columns being rounded, creative animal sculptures created on the buildings exterior and benches varying in sizes so as to allow learners of all heights to have their feet on the ground (Boss, 2015).



Figure 4.12: Exterior façade of classroom wings (Source: [www.marvelbuildings.com](http://www.marvelbuildings.com), 2016)

#### 4.2.4 OUTDOOR SPACES

An environmental master plan was devised in which the whole school built environment- the building and surrounding outdoor spaces- would become a learning tool. Each classroom wing had a designated outdoor play area zoned for that age group. This increased freedom and promoted safety within each area. As part of the natural outdoor learning spaces, features such as “mega maps” on hard landscaped areas, various garden spaces, a palaeontologist “dig” area and an amphitheatre were proposed and some built. The private classroom courtyards allowed learners to learn to grow plants, as well as care for and maintain them throughout the course of the year.



Figure 4.13: Outdoor amphitheatre (Source: [www.worldarchitecturemap.org](http://www.worldarchitecturemap.org), 2016)

#### 4.2.5 MATERIALS & FINISHES

This example does not make a great contribution towards sensory architecture through the use of materials and textures, but rather through its connection to the outdoor environments by means of the large windows that allow natural light and ventilation to enter the space, as well as provide views to the adjacent Crow Island Woods, and surrounding school natural environment.

### 4.3 CONTEMPORARY SHIFT IN SCHOOL DESIGN

Through educational practice shifts and the evolution of school design, schools such as Crow Island Elementary evolved further through the 1960s and 1970s as Experimental Schools. As part of the experimental school phase, an Open-space schooling programme encouraged a shift in education through active student participation, creating greater ties to the surrounding communities, and more flexibility and freedom within teaching and learning (Abbasi, 2009- Figure 4.14).

This period of school design also introduced prefabrication of school construction, de-emphasising the need for natural light and ventilation by use of smaller openings, thus decreasing optimal learning potential within these spaces (Nelson, 2014- Figure 4.15).

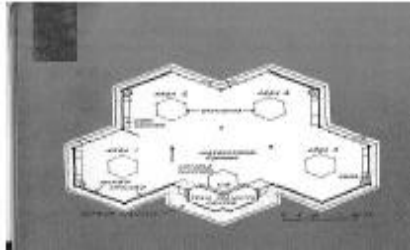


Figure 4.14: Example of an Open-Space Classroom design (Source: Abbasi, 2009)



Figure 4.15: Example of prefabricated school (Source: Nelson, 2014)

The 1990s and 2000s brought with it a more positive, social approach to school design and education, looking at ways in which learners can connect with the community and outdoor spaces through the school building (Abbasi, 2009). The emergence of a social approach to education allowed for school buildings to be treated as a community in itself, which turned circulation spaces into meeting places for socialising. The social approach also encouraged buildings to be more environmentally conscious, in line with the teachings on the subject.

From the 2000s to the present day, great emphasis was placed on “green schools”, promoting sustainability of a school through the construction of the buildings using newer technological methods. There are various methods in place, architecturally, to ascertain whether a school is sustainable or not, e.g. The Living Building Challenge (challenging schools to gain full certification through rainwater collection, generating their own electricity, using non-toxic building materials and promoting the health and well-being of its occupants). In addition to, the Leadership in Environmental Energy and Environmental Design (LEED), focuses on energy consumption and saving in buildings. The Smart Academic Green Environment (SAGE), deals specifically with making portable school environments healthy and conducive for learning (Nelson, 2014).

Sidwell Friends Middle School, falls within this period, and emphasises sustainability within the school design and teaching methods. It is discussed as a precedent study below.



## 4.4 SIDWELL FRIENDS MIDDLE SCHOOL

The school is located in Washington DC, United States of America. Renovations to the school were completed in 2006. The focus is on the addition to the existing school, which incorporates environmental responsibility teachings through the school design. The addition to school is designed to foster social and environmental behaviour by demonstrating a responsible relationship between the natural and built environments.

### 4.4.1 LOCATION

The school is located between two heavily water-dense surroundings. As a result of this location, water management plans and landscaping of the school built environment were crucial factors in connecting the school to the community, thus developing a strong Sense of Place (Drake et al, 2012). The new addition to the school forms a courtyard which creates the key environmental feature of the school. It is accessible to all visitors, making it part of the greater community, as well as a teaching and learning tool (Kweon et al, 2012).

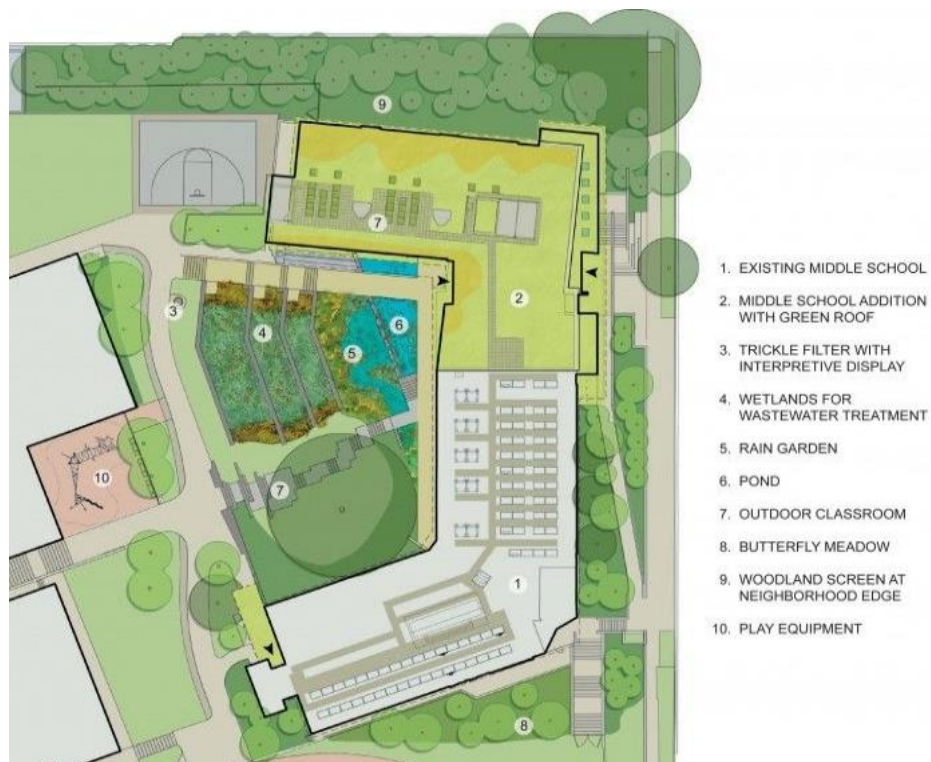


Figure 4.16: Site Plan of Sidwell Friends Middle School new addition and landscaping  
(Source: Drake et al, 2012)

#### 4.4.2 LAYOUT AND SPATIAL PLANNING

The spatial configuration of this school does not exemplify Hertzberger's concept of the learning street, but the communal courtyard wetland can be regarded as a public square, as this is the focal point of the school.

Public access to the wetland is through one main thoroughfare which runs from the street, through the school lobby, and out directly into the courtyard wetland. However, the relationship between the outdoor learning space and the classroom spaces is disjointed as there is no direct access from the indoor learning spaces to the outdoor learning space.

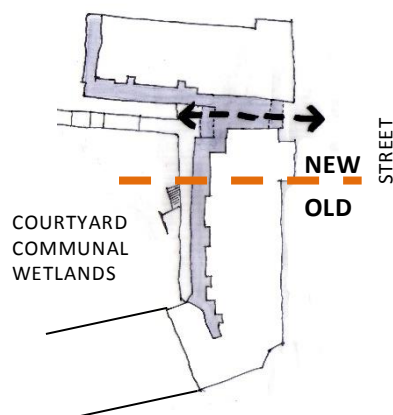


Figure 4.17: Sketch highlighting public access thoroughfare from street to wetland (Author, 2016)

#### 4.4.3 THE SCHOOL BUILDING

The curriculum in this school is grounded in “Quaker” values which teach learners about the natural environment and their relationship to it (Drake et al, 2012). Therefore, the new addition exemplifies these beliefs. The school building was designed with various environmental features with which learners engage as part of the teaching and learning process. For example, the roof is fitted with solar voltaic panels and roof gardens through which learners record solar consumption and grow vegetables respectively (Drake et al, 2012).



Figure 4.18: Learners planting vegetables on the green roof (Drake et al, 2012)

#### 4.4.4 OUTDOOR SPACES

The constructed wetland is the key feature of this school; it creates a traditional academic quadrangle, but focuses on integration with the natural world and systems. The courtyard wetlands reduces storm water runoff and municipal water consumption within the school, which emphasising the school's environmental values. Rainwater is directed from the green roof through downpipes to the biology pond and rain garden within the courtyard, while wastewater is managed on site before being filtered into surrounding water beds by means of a Water Treatment Tank (Kweon et al, 2012). The treated water is reused within the toilets and cooling towers, reducing the school's consumption of potable water. In addition to the water cycle of the wetlands, native ecosystems and plant species are incorporated to create a park-like atmosphere as well as a learning tool (Drake et al, 2012).



*Figure 4.19: Aeration Course and Biology Pond  
(Source: [www.detail-online.com](http://www.detail-online.com), 2016)*

#### 4.4.5 MATERIALS & FINISHES

The visual connection between inside and outside was strongly considered in the courtyard side of the school addition, as classrooms have visual access to the courtyard through multiple windows. The building envelope makes use of many other sustainable building choices that contribute towards creating a sensory experience for the users as well as creating a better environmentally responsible building. Shading devices around the building change according to orientation, allowing different amounts of light to enter the building, thus contributing to perception of space within the building. The sunscreens used on the building façade are repurposed old wine barrels, which add an element of texture and pattern (Drake et al, 2012). Horizontal shading on the courtyard side allows more visual access on a child's level, while vertical shading creates more enclosed spaces. Other material choices for the school include reclaimed wood for exterior cladding, flooring and decking, as well as reclaimed stone for landscaping (Drake et al, 2012).



Figure 4.20: View of courtyard wetland and exterior façade (Source: Drake et al, 2012)



Figure 4.21: Vertical shading devices on building façade (Source: Drake et al, 2012)

## 4.5 CONCLUSION

The two precedents discussed here are positioned within a historical timeline representing educational and architectural progression, therefore the school designs have various differences. However, both schools share the commonality of using the natural environment as part of teaching and learning within the school, regardless of being public and private schools. The following summary presents the key findings from the precedent studies, underpinned by the literature review.

### *The School as a Micro-city*

» **Layout of built form and green spaces:** Crow Island School is designed with many axes and wings in order to create several courtyards that connect to each wing. Whereas Sidwell Friends Middle School is designed on one main axis which runs the entire length on the building, creating one communal courtyard. The benefit of various courtyards can allow for different age groups and subject matter to be taught at different times, whereas the benefit of one communal courtyard is that it allows for greater school interaction and development (Figure 4.22).

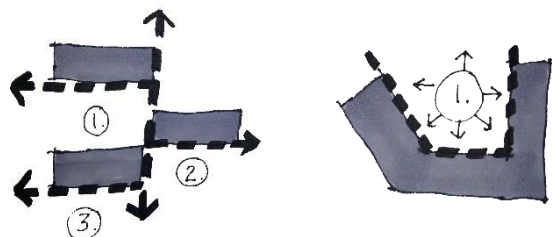
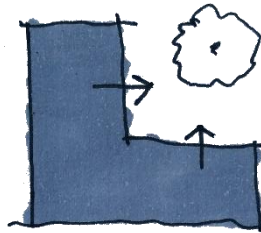


Figure 4.22: Sketches representing many courtyards (left) versus one single courtyard (right) due to spatial planning of the precedents (Source: Author, 2016)

### » Relationship between Classroom Spaces and Green Spaces

The L-shaped classrooms in Crow Island Elementary School creates private green spaces for each classroom. This allows for flexibility of spaces, as teaching and learning can extend beyond the classroom, into the outdoor space without disrupting other classes. The classrooms in Sidwell Friends Middle School, however, have supporting spaces that sit between the corridor space and classroom space creating a separation between the courtyard wetland and the classroom.



*Figure 4.23: L-shaped classroom allows for private green spaces for each classroom*

*(Source: Author, 2016)*

### *Natural Outdoor Spaces*

#### » Types of Green Spaces in Schools

In both schools the courtyards act as green spaces, however they differ in type of green space. Due to the proximity and use of the woods in Crow Island School, the courtyard spaces within the school are found to be grassed areas with little vegetation. The courtyard wetland in Sidwell Friends Middle School however, is rich in vegetation, including environmental water elements as it is the focus of the school design. These schools highlight the difference in what types of green spaces is necessary in a school, depending on how the school plans to use that green space.

### Sensory Architecture

- » **Scale of buildings:** The dispersed forms of Crow Island Elementary School creates a low-lying, child-orientated one storey building, as compared to Sidwell Friends Middle School, which is contained as one form, emphasising the height of the three storey school. The lower scale buildings are more child-orientated, contributing towards creating a sense of place for learners within the school built environment (Figure 4.23).



Figure 4.24: Sketches representing scale of one storey dispersed buildings (left) versus one 3 storey building (right) of precedents (Source: Author, 2016)

- » **Materials and Finishes:** The two schools were developed sixty years apart; this must be taken into account with regards to the materials, technology, and finishes used in construction. Crow Island School was constructed primarily of face brick, creating a monotone exterior façade, not greatly contributing towards creating a sensory architectural experience. Sidwell Friends Middle school however, uses various materials, including natural materials, in order to create varied sensory experiences throughout the school. Furthermore, it is a more environmentally friendly school, by virtue of its water recycling program and solar voltaic panels. The use of various different materials brings the building to life through the use of colours and textures, positively enhancing the school experience.

Elements from both precedents can be taken forward towards the design development of an alternate primary school for Durban. Crow Island Elementary School is more relevant for our local context, as it responds to green spaces on a smaller, less technical, more cost effective scale, being a public school. However, for an ideal school that does not have to contend with cost or quantity limitations, the technical aspects from the private Sidwell Friends Middle School can be implemented into a design.

The following Chapter presents a description of the Case Studies used in order to localise the literature explored thus far.



# Chapter 5: CASE STUDIES

An analysis of five Case Studies is presented here in order to provide local examples of schools that are currently in use. The school names have been withheld to maintain anonymity according to the regulations of the Department of Education. The schools are analysed using the key findings from the previous chapter.

## 5.1 BACKGROUND AND JUSTIFICATION OF CASE STUDIES

South Africa has evolved as a country from apartheid to democracy. During the apartheid era, education differed drastically amongst the different races. The Bantu Education Act was established during the apartheid era which limited the funding and quality of education and infrastructure within black schools, while white schools thrived (Kallaway, 1984).

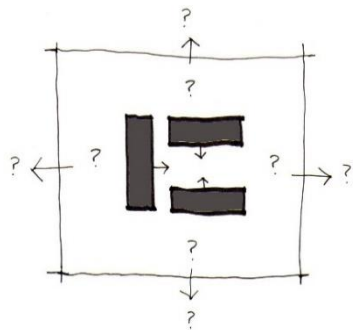
Fortunately, along with South Africa's evolution into democracy, the education system also evolved, in order to represent the new South African values (Jansen, 2001). Curriculum changes were made, as well as provisions for improved and equal education opportunities for both blacks and whites. However, the post-apartheid built infrastructure component of South African public schools has made little change towards improving the education system (Equal Education, 2016). With reference to the Space Planning Norms and Standards for Public Schools (KZNDoe, 2011, Version 7), school environments still make little provision for the integration of green spaces in schools. According to the guidelines, Specialist Teaching Spaces are required, which include access to outdoor spaces. However, this requirement is not made a priority within the guidelines, with little indication of how it should be designed relative to classroom spaces.

B. Norms and standards			
Space category	m <sup>2</sup> /FTE band between		Design issues
General teaching Space	1.0	1.2	The design of classroom space should be flexible and adaptable. Modular standard furniture should be used. Some storage for materials and equipment should be provided in or near classrooms.
Specialist teaching space	0.1	0.3	Space and equipment should be provided that can be used for specialist teaching. Access to outside spaces and facilities for practical learning should be provided, such as planting, painting, and experiments.

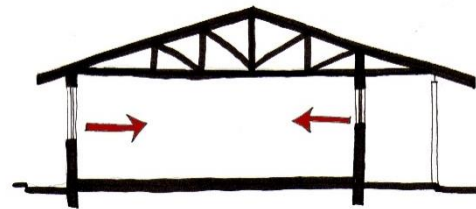
Figure 5.1: Table illustrating Specialist Teaching Space description  
(Source: KZNDoe, 2011)

The guidelines also allow for the inclusion for garden plots, yet this is also not made a priority, or expanded upon in its description for design.

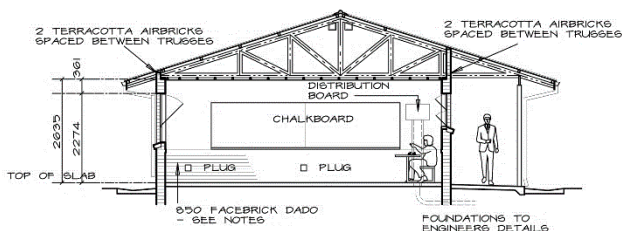
Furthermore, little consideration is made to adapt each school to its site; thus losing a connection to the community in which the school and learners sit. Apart from this, the buildings are designed as isolated, inward-facing structures, with little opportunity to connect and expand with the surroundings. This affects how learners interact with each other, and the rest of the school built environment. The design of each building within schools uses a standard structure, regardless of what function that building houses. Therefore the resultant school built environments are uniform, lifeless, and alienated institutions. This is evident from the standard drawings for school infrastructure provided by the KwaZulu Natal Department of Education (KZNDoE).



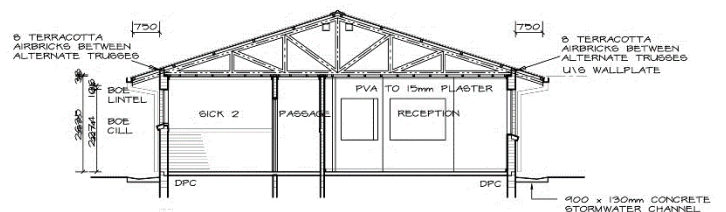
**Loss of Connection**



**Inward facing buildings**



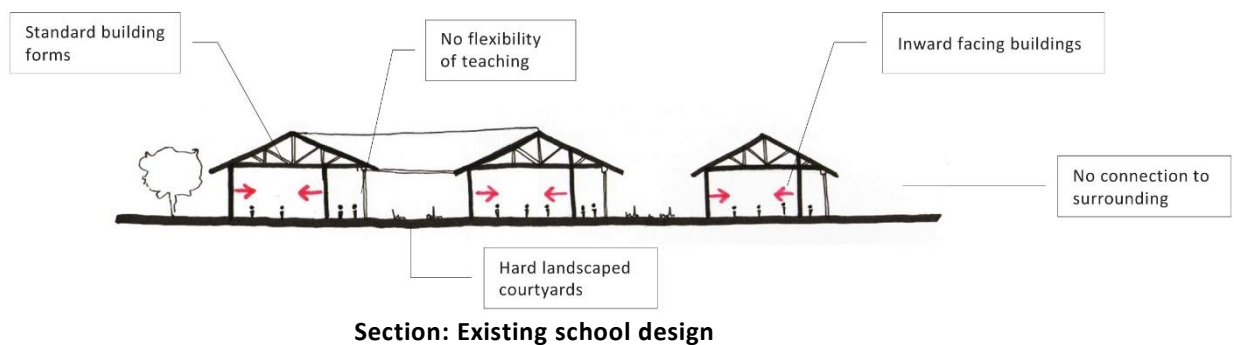
**classroom section**



**admin section**

### Standard structure of different function buildings

Figure 5.2: Graphical illustrations of current school problems  
(Source: Author, 2016 & DoE, 2009)



**Section: Existing school design**

Figure 5.3: Current school built environment  
(Source: Author, 2016)



## 5.2 SELECTED LOCAL SCHOOLS

Four of the selected schools are built within former “Indian” areas of Durban, namely Asherville, Newlands and Reservoir Hills. These schools were selected as they represent a standard school design found within Durban, and which have varying amounts of green spaces within them. School Five is identified as a different primary school design, which has slight deviations from the standard school design. It is built within Manor Gardens, a former “white” area within Durban.

School One (S1) is situated within the residential area of Asherville. The school is only visible from its access point, which is through a minor arterial road, which leads into the school parking lot. The school sits in front of a vacant, unused, inaccessible green space.



S1

School Two (S2) is located within the residential area of Newlands West in Durban. The school sits on an isolated site, with poor visual and public access through a minor arterial road.



S2

School Three (S3) is located on the periphery of the suburb of Newlands. It has poor visual, pedestrian and vehicular access, with access through a dead-end road. The school is also adjacent to an industrial area. A community ground, and open public green space separate the school from the residential area.



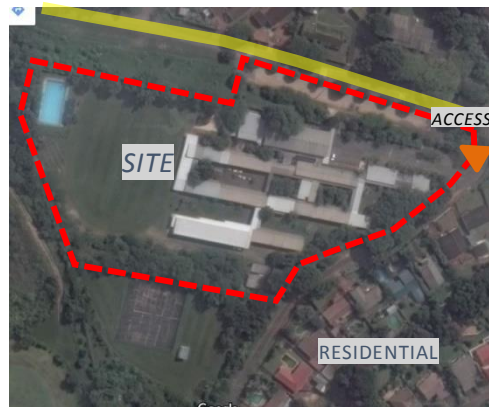
S3

School Four (S4): This school is situated on a hill within a residential area in Reservoir Hills. Owing to its location upon a hill, the school has good visual access from the main road. Pedestrian and vehicular access however, is through a minor arterial road.



S4

School Five (S5): This school is located within the residential area of Manor Gardens. It is set upon a slight hill, which provides the school some visual access to the surrounding. Public vehicular access is granted to the school by means of a parking area at a lower level than on which the school sits. Pedestrian access is via a staircase from this parking area. These access points are off an arterial road within the area.



S5

Figure 5.4: Location maps of Schools One to Five (Source: Google Maps, 2016; edited by Author)

### 5.3 LAYOUT OF BUILT FORM AND GREEN SPACES

The selected schools present two types of layouts which differ from each other in terms of their general configurations of built form and position of green spaces within the schools. The approximate percentages of built and unbuilt spaces of each school are tabulated and discussed within this section. The percentages are calculated according to each school's site area. For ease of readability, the following descriptions apply:

- » Built Space: all buildings within the school
- » Unbuilt space: all open spaces within the school. Unbuilt spaces comprise of usable green spaces, peripheral green spaces and the remainder of open space.
- » Usable Green Spaces: Easily accessible, vegetated spaces, identified as being integrated with teaching and learning within the school

- » Peripheral Green Spaces: Vegetated spaces found along the periphery of the school site, identified as not being used as part of teaching and learning.
- » Remainder of Open Space: Spaces allocated for sports, hard landscaped areas, or unsuitable for teaching and learning due to site topography.

School One and Two share the same configuration of built form which is a composition of several linear “blocks”. Each block is made up of two parallel forms with a narrow, paved courtyard space between them (Figure 5.5). In School One, the blocks are positioned with enough distance between them for a sufficient amount of open space to occur, although these spaces are not vegetated, but remain sandy. However, in School Two, the blocks are more closely positioned to each other, with less green spaces between them.

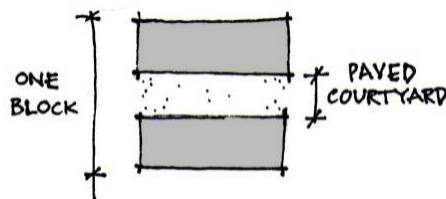
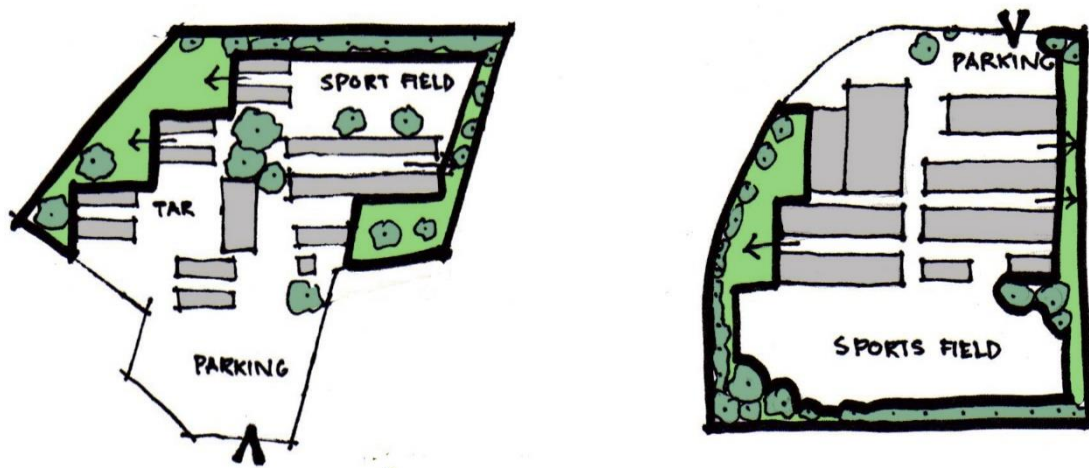


Figure 5.5: Sketch illustrating one “block” (Source: Author, 2016)

From the calculations shown in the tables below (Figure 5.6), one can see that although these schools have a high percentage of unbuilt spaces, they do not have usable, integrated green spaces, as the majority of green spaces occur along the periphery of the school site. These green spaces are not directly accessible from any interior space, but are accessible through and around the built form, and can be regarded as left-over spaces. The building configurations in these two schools do not represent Hertzberger’s writings on the school representing a micro-city, as the layout of built form and green spaces are not seen as integrated components of the school design.



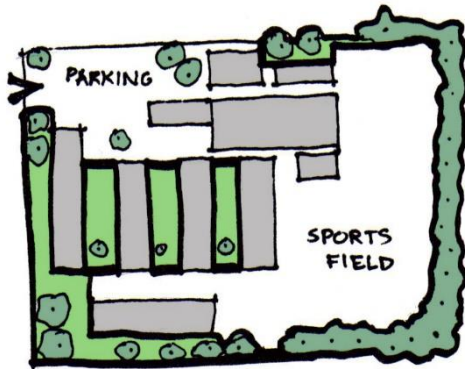
- Peripheral Green Spaces  
■ Built Spaces  
■ Remainder of Open Space

S1 Type of Spaces	%
<b>BUILT</b>	<b>13</b>
<b>UNBUILT</b>	<b>87</b>
- Usable Green Spaces	0
- Peripheral Green Spaces	32
- Remainder of Open Space	55

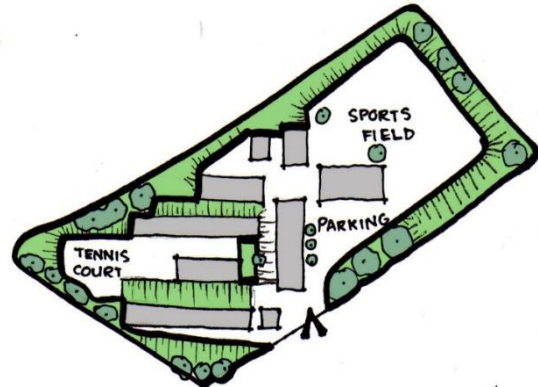
S2 Type of Spaces	%
<b>BUILT</b>	<b>24</b>
<b>UNBUILT</b>	<b>76</b>
- Usable Green Spaces	0
- Peripheral Green Spaces	35
- Remainder of Open Space	65

Figure 5.6: Site Sketches and corresponding tables illustrating built form in relation to green spaces of Schools One and Two (Source: Author, 2016)

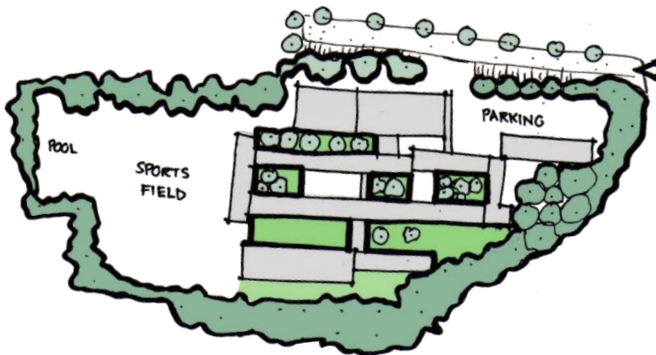
In contrast to this configuration of built form, Schools Three, Four and Five are composed of a series of single, linear, parallel buildings with green spaces between each building. In the cases of Schools Three and Five, the percentage of usable green spaces in relation to built form is relatively high, which gives the buildings the opportunity to connect with these green spaces (Figure 5.7). In School Four, although there is a lot of unbuilt spaces, due to the topography of the site, these spaces are banks. Apart from the green spaces between each building in Schools Three and Five, the remainder of usable green spaces sit along the periphery of the school site. Access to the open spaces within these schools is also not through any direct interior space, but through and around the buildings. The usable green spaces between each building can be regarded as integrated components of the built form, thus contributing more to the school representing a micro-city.



S3 Type of Spaces	%
<b>BUILT</b>	<b>40</b>
<b>UNBUILT</b>	<b>60</b>
- Usable Green Spaces	22
- Peripheral Green Spaces	65
- Remainder of Open Space	13



S4 Type of Spaces	%
<b>BUILT</b>	<b>15</b>
<b>UNBUILT</b>	<b>85</b>
- Usable Green Spaces	1
- Peripheral Green Spaces	48
- Remainder of Open Space	51



S5 Type of Spaces	%
<b>BUILT</b>	<b>19</b>
<b>UNBUILT</b>	<b>81</b>
- Usable Green Spaces	10
- Peripheral Green Spaces	44
- Remainder of Open Space	46

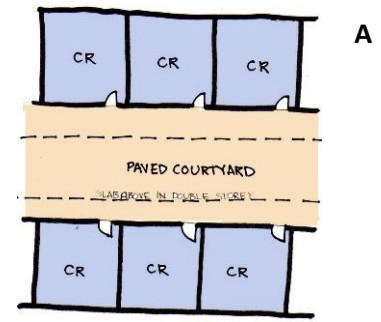
- Peripheral Green Spaces
- Built Spaces
- Remainder of Open Space

Figure 5.7: Site Sketches and corresponding tables illustrating built form in relation to green spaces of Schools Three, Four and Five  
(Source: Author, 2016)



## 5.4 RELATIONSHIP BETWEEN CLASSROOM SPACES AND GREEN SPACES

The classrooms in all the schools share similar layouts in that they are positioned next to each other in a linear configuration, with no supporting spaces between them. Due to the layout of the forms that make up the blocks in Schools One and Two, no defined corridor spaces exist as access to the classrooms are through the narrow paved courtyards (Figure 5.8 – A).



However, defined corridor spaces exist in schools Three, Four and Five (Figure 5.8 – B). These corridor spaces lie parallel to the green spaces, and have the potential to become learning streets by becoming extensions of the classrooms, thus creating connections from the classrooms to the green spaces.

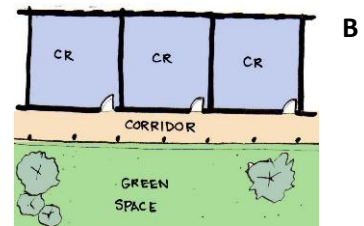


Figure 5.8: Relationship between classrooms and outdoor spaces (Source: Author, 2016)

## 5.5 TYPES OF GREEN SPACES WITHIN THE SCHOOLS

The prominent green spaces found between the blocks in Schools One and Two are open grassed areas, but with little dense vegetation.



S1

The green spaces between the buildings in School Three are also grassed areas, but have an increase in vegetation in the form of small shrubs and trees.



S3

In comparison with the above-mentioned schools, the green spaces between the buildings in School Five are densely vegetated, with a variety of plant life. These green spaces are further divided by designating certain types of garden spaces to each green space. The different green spaces include a vegetable garden and sensory garden, as well as unspecialised vegetated spaces.



S5

Figure 5.9: Photos highlighting types of green spaces within schools (Source: Author, 2016)

## 5.6 THE SCHOOL BUILDINGS CONTRIBUTING TOWARDS A SENSORY EXPERIENCE

School One, Two and Four have buildings that are one and two storeys in height, while schools Three and Five are all one storey buildings. In cases where the buildings are adjacent to green spaces, the upper levels of the double storey buildings have no connection to the green spaces, disconnecting learners from them. The low scale of the one storey buildings creates a more child-orientated building, contributing towards creating a sense of place for learners within the school.

Visual access from classroom spaces to outdoor spaces is by means of two or three rows of high level windows evident in Schools One, Two and Four, while School Three uses one row of evenly spaced windows. Both these window configurations provide poor visual access to the outdoor spaces, with only higher level of tree branches visible where green spaces are present.

School Five, however, uses window configurations that allow views across the expanse of the school, as they sit at desk height. This creates a sense of openness within the classroom, creating a strong connection between classroom and green spaces.

The materials used within the school environment are limited to face brick buildings, and concrete and paved floor finishes (with the exception of the grassed areas within the school that have already been mentioned).



S1

Figure 5.10: Double storey block (Source: Author, 2016)



S1



S3



S5

Figure 5.11: Photos of Different window configurations (Source: Author, 2016)



S2

Figure 5.12: Photos of Types of wall treatments (Source: Author, 2016)

These materials create schools that are very monotonous in appearance. However, School Two creates variation with the school buildings by using different coloured face bricks. Schools Four and Five use visual stimuli that break away from the monotony of standard building materials, and this adds to the sensory experience within the school. School Four has walls of the school buildings that have artwork painted by children, and School Five displays art work of the children on windows and walls around the schools. These subtle variations create more inviting, child-centred environments.



Figure 5.13: Photos of Types of wall treatments (Source: Author, 2016)

## 5.7 CONCLUSION

The schools presented here illustrated the standard design of public schools. They possess key similarities and differences within their designs. The key findings from the analysis are presented here.

### **Layout of Built Form and Green Spaces**

From the layout of the five schools presented, Schools Three, Four and Five better exemplify Hertzberger's concept of the school as a micro-city, composed of streets and squares. However, within these schools, School Five presents a greater network of streets and squares as the school works off a multitude of axes (Figure 5.15 – B), as opposed to single axes in the other two schools (Figure 5.15 – A). The layout of School Five creates various opportunities for learners to interact with each other along the network of streets and courtyard spaces throughout the school, creating a cohesive school. This contributes towards creating a sense of place for learners within the school built environment.

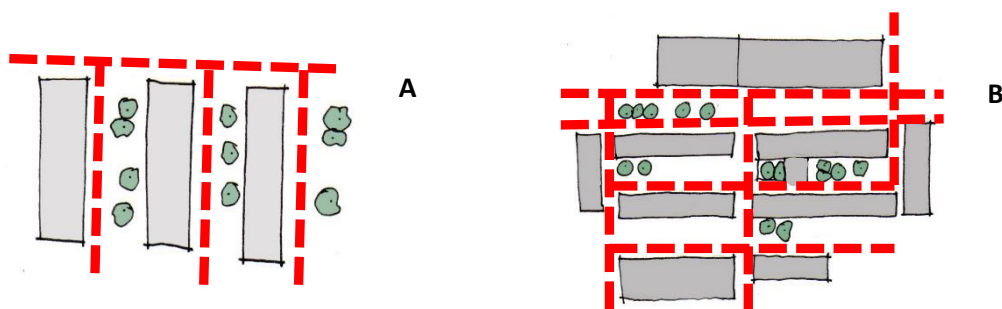


Figure 5.15: Sketches highlighting schools as a micro-city (Source: Author, 2016)



The remainder of green spaces within the schools found to be along the periphery of the school, are not seen as integrated components of the school design as there is no dedicated access or circulation routes that lead to these spaces. These green spaces can therefore, not be viewed as public squares, as they are not designated public gathering spaces.

The way in which the overall school buildings are designed affects the way in which the outdoor spaces are created. In turn, this affects accessibility and usability of these spaces.

### ***Relationship between Classroom Spaces and Green Spaces***

The classrooms with corridor spaces that are directly adjacent to garden courtyard spaces from Schools Three and Five, have the potential for the classrooms to extend outwards into the green spaces, becoming part of the teaching and learning process (Figure 5.16 – A). This is a better configuration for expansion of the classroom into the green space, as only one row of classrooms expand into a green space. This is also an example of how the Department of Education (DoE) guidelines relating to Specialist Teaching Spaces can be achieved, as there is a connection between classroom and outdoor space. If the narrow courtyard spaces between the blocks were not paved, but vegetated green spaces, these classrooms would also have the opportunity to expand into these green spaces, but would have two rows of classrooms expanding into one green space (Figure 5.16 – B & C).

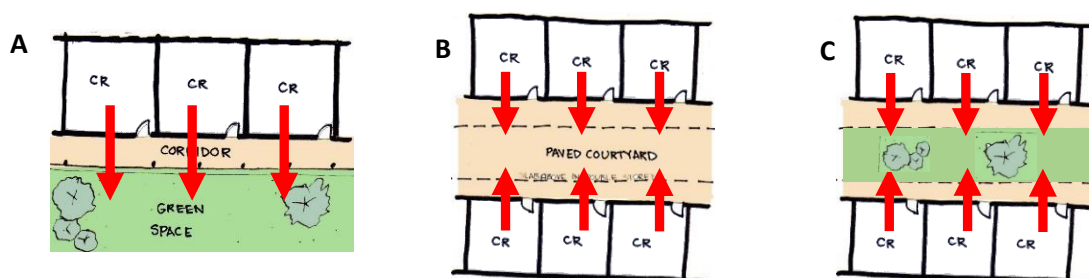


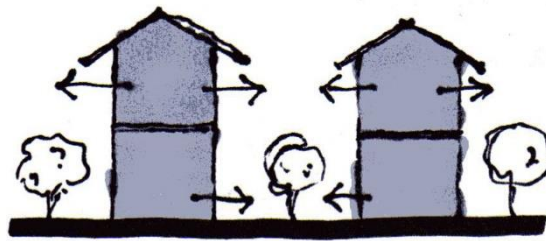
Figure 5.16: Sketches highlighting expansion of classroom spaces into green spaces  
(Source: Author, 2016)

### ***Types of Green Spaces***

School Five, by having a variety of different types of green spaces viz. vegetable gardens, sensory gardens as well as ordinary vegetated spaces around the school, provides different areas of the school different characteristics which give learners various opportunities to enjoy different experiences around the school.

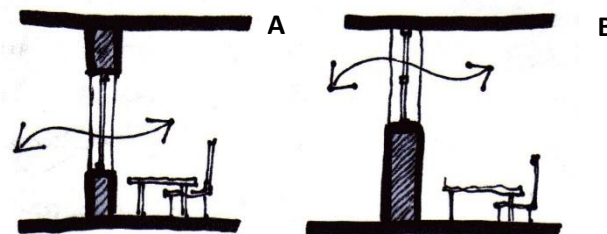
### ***The School Buildings Contributing to a Sensory Experience***

Single storey buildings also have the opportunity to open directly into green spaces. However, the upper level of the double storey buildings have little potential to connect with green spaces.



*Figure 5.17: Sketch illustrating no connection of upper level of double storey to green spaces (Source: Author, 2016)*

The types of window configurations found in Schools One to Four do not provide good visual access to the surrounding outdoor spaces within the schools (Figure 5.18 – B). However, desk-height windows in School Five, allow learners to have full visual access to the green spaces between the buildings (Figure 5.18 – A). This adds to the sensory experience of the school as the spaces within the school are light and transparent, not creating harsh barriers between inside and outside spaces.



*Figure 5.18: Location of window affecting visual access (Source: Author, 2016)*

As in Schools Four and Five, adding learners' artwork onto the surfaces of the buildings creates a child-orientated buildings (Figure 5.19). This creates a sense of ownership within the buildings, and gives learners the opportunity to feel connected with them. This also contributes towards creating different sensory experiences within the school by breaking away from the standard aesthetic of the school buildings, and also has the potential to change over time by simply changing the artwork presented on the buildings.

**S4****S5**

*Figure 5.19: Photos highlighting wall treatments (Source: Author, 2016)*

The descriptions and findings outlined here form the framework for the discussions and analyses of interviews in the next chapter.

## Chapter 6: ANALYSIS AND DISCUSSION

This Chapter discusses the results from the interviews conducted, and analyses the responses by using the literature discussed in this study. The discussions are set out so as to respond to the key and secondary questions presented in Chapter One.

### 6.1 THE NATURAL SCIENCE CURRICULUM

The interview questions were structured specifically towards Natural Science teachers as the curriculum within this subject lends itself to learning about the natural environment through the use of green spaces.

*“For some reason, the kids at this age enjoy the life science aspects.”*

- Teacher, School Two

All the teachers from the selected schools teach a range of grades viz. grades 4 to 7. All teachers shared similar opinions with regards to the amount of the curriculum dedicated towards learning about the environment, as all schools follow the same curriculum guidelines. From the results, it was found that there is a progression of knowledge that is based on the natural environment from grade 4 to 7. Teachers made specific reference to themes and topics with regards to the natural environment. Some of these topics were “life and living”, “photosynthesis”, “plant dispersal and pollination”, “water purification”, the “importance of recycling” and “plant and animal habitats”. It was noted how some teachers’ personal enthusiasm for learning about and caring for the natural environment has influenced their teaching methods and styles:

*“I’m very passionate about the environment. I have an Environmental Management degree, so I incorporate it into my lessons. There’s always an opportunity, in every lesson, to make the learners aware of looking after our environment, protecting our environment and encouraging sustainability.”*

- Teacher, School Three

From the responses of the teachers, it can be understood that the existing natural science curriculum lends itself to being taught within the natural environment.

The literature discussed the benefits of nature being unrestricted to subject content, such as in the case of improving creativity within learners. This is supported by the teachers, as some teachers expressed how the use of the natural environment is not limited to the subject of Natural Science, but can be used for subjects such as English, Art and Drama.

These responses highlight the opportunities for the school curriculum to connect with the natural environment; thus the need for schools to have green spaces is apparent.

## 6.2 RESPONSE TO THEORIES AND CONCEPTS

### **Experiential Learning Theory**

This theory uses experience as the foundation for learning, thus allowing learners to make up their own opinions and gain knowledge based on their own experiences.

*“They (the learners) are actually seeing things for themselves, because when you experience things you remember it much better, you’re using all your senses. You’re able to remember things for longer, and keep and understand that information.”*

- Teacher, School Three

-

With regards to the Natural Science Curriculum, teachers recognised the potential of the subject to be understood through an alternative method of learning. Several teachers mentioned practical examples from the curriculum that link to the natural environment. For example, the “bean and cotton wool experiment”, and “water filtration projects” and “recycling projects”. These types of experiments provide opportunities for teaching and learning to deviate from a classroom setting as pointed out by Jilk (2005) who says that learning is not limited to a classroom.

### **Place-Based Education**

This concept is an extension of the Experiential Learning Theory, which uses the local environment and community as the source for learning.

*“I encourage learners to go outside. I actually do some of my lessons outside. It gives them (the learners) the freedom to talk, brainstorm.”*

- Teacher, School One

The concept of Place Based Education was familiar to some teachers; however, it was recognised by other names such as “outdoor learning”. It was noted that teachers were excited about the use of the concept, expressing how being outdoors during lesson time breaks away from the monotony of being in a classroom all day.

### **Environmental Psychology**

This concept deals with the way in which humans experience the environment and is important in school learning environments to ensure that children feel comfortable within the spaces. Combined with place-based education, Environmental Psychology focuses on using nature as a restorative element in design.

*“I tell them (the learners) to look outside and listen to the birds in the trees, and the beautiful plants, and it does seem to help them with their concentration levels. They seem to calm down.”*

- Teacher, School Three

Without using the term Environmental Psychology, several teachers expressed how nature affects learners by “restoring their mind set”, or being able to see a “change in their attitudes and behaviours”. Teachers showed awareness of nature’s ability to improve the teaching and learning experience, and agreed that it should become part of the everyday learning environment.

### 6.3 LAYOUT OF BUILT AND GREEN SPACES

Herman Hertzberger discusses the school as a micro-city which is made up of a series of learning streets and public squares. These components work together to create a sense of community within the school environment. The discussed precedents in Chapter Four explored different methods of accessibility between classrooms and green spaces on a smaller, private level, as well as on a larger, communal level.

A teacher from School Three described how the “patch of garden outside the classroom” became part of the teaching and learning process as “beans and other things” were planted there (Figure 6.1). The teachers from School Five describe how experiential learning is possible in the lessons by having dense vegetation easily accessible to the classroom spaces: “you can immediately step out of the classroom, and right here (points outside), there’s a whole lot of plants right outside here” (Figure 6.2).

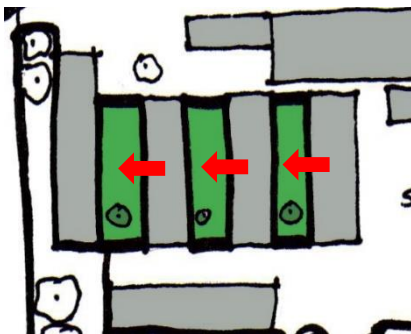


Figure 6.1: School Three highlighting access to green spaces from classrooms used during lessons (Source: Author, 2016)

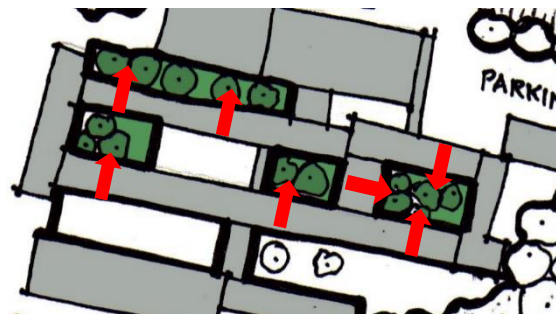


Figure 6.2: School Five highlighting access to dense vegetation from classrooms used during lessons (Source: Author, 2016)

In support of this, another teacher from the same school noted how the proximity and availability of green spaces to classroom spaces makes a noticeable difference to the learning environment by saying “it’s almost as if you have nature in the classroom. It’s right there.”

In contrast to these responses, a teacher from School One described how the school lacked grassed areas, and mentioned how “the areas here (the school) are very sandy”.

It can be deduced from these responses that the availability and close accessibility of green spaces relative to the buildings is an important factor when determining whether or not the natural environment is used as part of the teaching and learning process. None of the schools had the same configuration of the precedents, but elements from both are evident.

## 6.4 CLASSROOM SPACES AND GREEN SPACES

### Flexibility of Classrooms

The design of the classroom is important in determining its functionality. As seen in Crow Island Elementary School (Chapter Four), the additional workspace adjoining the classroom allows for a different function within the classroom environment. The same concept is seen with the learning street, whereby the classroom is no longer confined to a room, but extends out into the corridor space.

*“It would be nice if classes could have verandas for kids to spill out into. We have lots of corridor spaces which could be used maybe as part of the green space. So it filters before you enter a class.”*

- Teacher, School Two

Teachers from School One, Two, Three and Four expressed how over-crowding of classrooms impedes teaching, as walking around the classroom between desks and arranging students into groups becomes cumbersome. It has already been mentioned that classrooms directly adjacent to green spaces (as seen in schools Three and Five – Figures 6.1 and 6.2), have the ability to expand outwards into the green spaces. The Learning Street concept can be applied by combining the need for a flexibility of spaces in classrooms with adjacent green spaces. This creates an expansion of the classroom and corridor spaces, as well as including green spaces as part of the teaching and learning process (Figure 6.3).



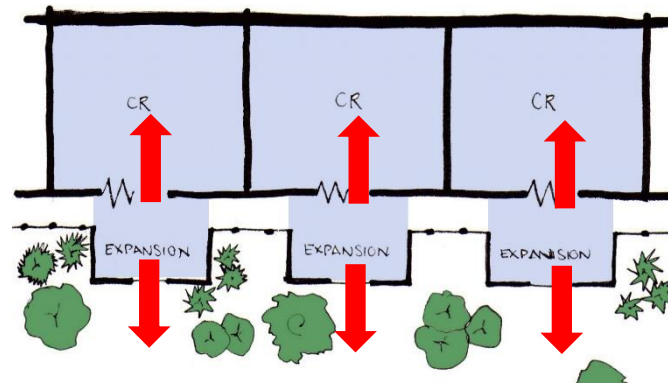


Figure 6.3: Expansion of classroom space into corridor space and adjacent green space (Source: Author, 2016)

A teacher from School Five explained that the new classrooms in the school were provided with new angled desks for the learners. This had the ability to fit together with other desks to allow for group work to occur (Figure 6.4). She notes that “these were the new layouts that were supposed to give more freedom of movement”.

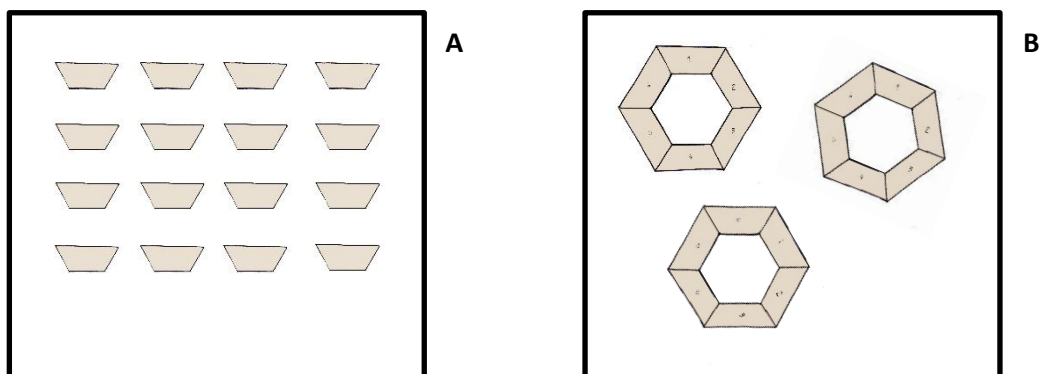


Figure 6.4: New desks in classroom from School Five illustrating standard layout (A) and hexagon layout (B) for group work. (Source: Author, 2016)

### Lack of Storage Space for Teaching Materials

*“It would be nice if we could have classrooms with little mini showcase spaces. Maybe even every 2<sup>nd</sup> or 3<sup>rd</sup> class, so that borrowing becomes easier”.*

- Teacher, School Three

The lack of storage space within classrooms was a common theme throughout schools One to Four. Teachers said that because they walked to different classrooms for each lesson, carrying specific teaching material to each class became cumbersome. Suggestions to alleviate this problem were to either have bigger classrooms to accommodate the number of learners, introducing a storage area, decreasing the number of learners in each class or creating storage rooms between classrooms (Figure 6.5).

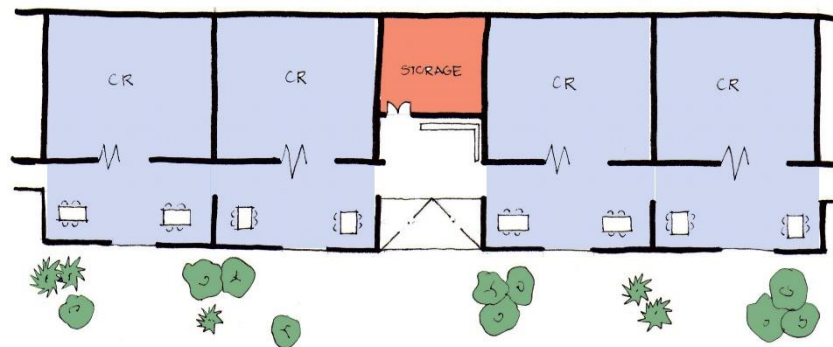


Figure 6.5: Storage space shared between classrooms for ease of access suggested by teachers (Source: Author, 2016)

A teacher from School Five explained how her classroom (a new addition to the school) was fitted with extra storage along the walls. The teacher said that the new storage was greatly used.

### ***Variation of Green Spaces***

The literature explored the different types of green spaces that benefit the teaching and learning environment. These include: edible, instructional and sensory gardens. A school with a varied arrangement of these types of spaces creates more opportunities for learning, in addition to creating a varied environment, both of which benefit the learners.

*“There isn’t plants in every classroom or even between the blocks”.*

- Teacher, School Two

All teachers agreed that having green spaces as part of a school is something that would benefit both learners and teachers. The teachers’ responses described the varying amounts of greenery evident within the schools they teach in.

School Five presented the most information with regards to nature within the school, as this school was found to have the most vegetation. The teachers explained that there is a permaculture garden used as part of the school's "Eco-club", as well as different types of garden spaces within the school. These garden spaces include a sensory garden which has plants with different scents and items of different colours and textures such as sand and paving, and small vegetable gardens that have been planted in old pallets. A teacher notes that it was designed "specifically to have different experiences". The rich variety of garden spaces adds to the character of the school and allows for teaching and learning of different types of natural life. Teachers from the other schools described how teaching and learning could be improved "if we had a nice big green space to learn from". Other environmental features were mentioned by the teachers which could also contribute towards education. These included "swamp-like space", "a little stream and all the life that comes with it to learn about that eco-system", and "green houses".

## 6.5 CREATING A SENSORY EXPERIENCE IN SCHOOLS

The literature states that a variety of environments in schools stimulates a child's learning ability. Phenomenology explores how architecture should be a multi-sensory experience. This experience should also be child-orientated, as the school should cater for its users i.e. the children. Integrating nature into learning environments can further enhance the learning environment. This can be done by using biophilic design principles. In contrast to this, schools that lack variation and sensory excitement, create learners that are unmotivated and tend to lose concentration more easily.

### Scale

*"I think the layout (of the school) and the fact that everything is on one level and has contact with the outdoor environment. It's not a case of having to come down a staircase and a corridor to get to a garden space."*

- Teacher, School Five

A teacher from School Five notes how scale of the building (being a one storey building) contributes towards easy accessibility between indoor and outdoor spaces. Only two of the five schools analysed represent one-storey buildings. This means that three schools have less opportunity to connect with nature. This highlights that not all schools are designed by integrating the natural environment with built form. It can be deduced that because the teacher from School Five has ease of access to nature from a one storey building, that the teacher is aware of the value nature adds to the teaching and learning process. The upper storey of the two storey buildings have the potential to connect to green spaces if balcony gardens or roof gardens are present (Figure 6.6)

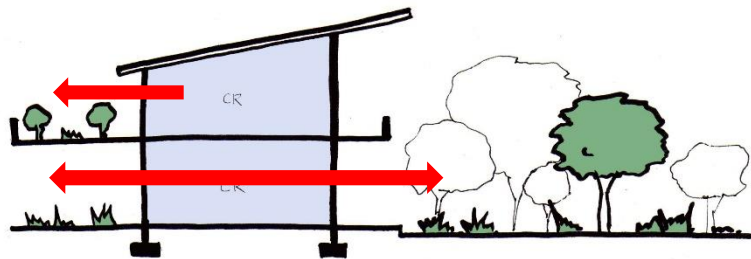


Figure 6.6: Garden balcony proposed as an option for double storey buildings to have access to green spaces at a higher level (Source: Author, 2016)

Scale, however, does not only refer to the volume of buildings, but also to the entire school complex. Nicolson (2005) explored how school learning environments should be child-orientated, which helps with creating a sense of place within the school. For younger children in a primary school, spaces should be easy to navigate without them feeling lost or alone. Thus, the entire school complex, along with the spaces and buildings within it, must be designed at an appropriate scale for the learners who are using it.

### Visual Access to Nature & Natural Ventilation

Kellert's (2008) Biophilic principles include writings on creating sensory spaces through integrating nature with built form. Scott (2010) explained how windows that provide visual access to the outdoor environment creates a further extension of the classroom as well as a sense of inclusiveness. This was only achieved in some of the schools as noted below.

*"I feel the windows should have been lower. Instead of two rows, there should have been three rows of windows."*

- Teacher, School One

This quote illustrates how a teacher from School One supported the argument that visual access to the outdoor environment from the classrooms are a necessary feature of school buildings. Another teacher from School One pointed out that only “the tops of branches” are visible through these windows. In comparison, a teacher from School Five pointed out that, “as soon as there’s more windows and you can see outside, it has an effect on you”.

The teachers from School One to Four highlighted that the window configuration was not suitable for adequate natural ventilation to occur with the large number of learners in each class which ranged from approximately 40 to 50. A teacher from School One commented that, “the windows are high up, so even if they’re open, you’re not getting a direct breeze.” In contrast to this, School Five has a maximum of 25 learners per class, coupled with large, desk-height windows. This allows ample natural ventilation to enter the classroom spaces. However, a teacher from School Five noted that with the large windows there comes ample sunlight which needs to be controlled at times.

### **Colour**

Colour Psychologists have noted that colour in educational settings also contributes to learning ability. However, the existing schools do not all make provision for this.

*“Everything is very brown here, if you’ve noticed”.*

- Teacher, School One

This teacher notes how the face brick materials of the school, together with the lack of vegetation around the school, creates a very monotonous and dull school environment. This is in direct contrast to what a school environment should represent, as explored in the literature review.

## **6.6 CONCLUSION**

Various key themes were raised by the participating teachers on the necessity of green spaces within the school (specifically towards the Natural Science Curriculum), the current

availability and accessibility of green spaces within the school, the use of these spaces, and the relation of these spaces to formal classroom spaces.

From analysing the interviews, other issues indirectly related to the focus of this study. These issues are briefly discussed as follows:

- **Over-crowding:** Teachers from School One to Four mentioned the high number of learners (40-50) per class. The problem of over-crowding leads to other knock-on effects such as control, noise levels, and shortage of space. In comparison, the School with 25 learners per class did not mention any of these problems.
- **Time:** There is limited time during the school day to organise and control a large class of 40 -50 learners to take them outside for outdoor learning.
- **Maintenance:** Greening projects that were started during the course of the school terms were found to “fizzle out” over the school holiday period, as some schools do not have any on-site maintenance during these periods.

The teachers acknowledge the contribution that green spaces and nature can make to learners within school learning environments. For example, calming them down and increasing their concentration levels. The teachers were also strongly passionate about how the natural environment can be used as part of the curriculum. However, the lack of green spaces in some of the schools does not allow opportunities for place-based learning to occur. It is apparent from the responses of the teachers from School Five that the design of the school, that is, the layout and types of built and unbuilt spaces available, presents better opportunities for Experiential Learning and Place-based Learning to occur, unlike Schools One to Four.

# Chapter 7: CONCLUSIONS AND RECOMMENDATIONS

The following chapter outlines the outcomes of the research with regards to the aims and objectives set out in Chapter One. These outcomes are explained in terms of how they were achieved and a way forward is suggested.

## 7.1 ACHIEVING THE AIM AND OBJECTIVES

### **Aim**

*The aim of this study is to show how learning environments can be enhanced through integrating green spaces within primary schools. The research findings would inform the design of an alternate primary school in Durban.*

The aim of this study was achieved by highlighting the potential that school built environments can make to the learning process. This is done by utilising the entire school built environment. By integrating green spaces into schools, teaching and learning is not limited to classroom spaces, but can extend into the entire school built environment. This provides teachers opportunities to use alternative teaching and learning methods – ones that make use of these natural outdoor spaces to improve the teaching and learning experience. Furthermore, the daily interaction with nature sustains and improves the learning ability of learners.

### **Objectives**

1. *To explore and understand the contribution of green spaces to the learning and teaching environment.*

This objective was achieved by means of the findings of the supporting objectives. It was discovered that nature in the form of dedicated green spaces can be used for various activities, other than only improving the teaching and learning experience. Green spaces also contribute towards creating soothing environments that enhance the learning ability of learners, as well as provide areas within the school for recreation.

2. *To investigate how being in contact with nature can improve the teaching and learning experience*

Teachers supported the writings of Place-based Learning and the Experiential Learning Theory by discussing personal accounts of their learners interacting with nature. These interactions either allowed learners to better understand concepts or enabled learners to relax within therapeutic and sense-evoking environments. This is a part of Environmental Psychology.

3. *To explore and determine the types and configurations of natural and built spaces that are effective for teaching and learning in primary schools*

The precedent studies served as the basis for achieving this objective as the analysed schools contained both built and natural spaces that are used for teaching and learning on a daily basis. The interviews with local teachers raised unforeseen issues within local schools; however, the teachers were also able to provide new and insightful ideas of spaces needed in their schools that can be used for teaching and learning. The precedent studies were compared with the case studies which determined positive and negative elements of the designs of the different schools. These elements, when combined with the views of local teachers, contributes towards determining new architectural principles for a school that integrates green spaces with built spaces.

4. *To generate architectural principles for the design of a primary school with integrated green spaces*

Architectural design principles that closely connect the current classroom-based teaching with green spaces are essential to integrating green spaces with the teaching and learning process. This is because eliminating the current method of teaching and learning would not acknowledge this method of teaching used in so many schools. It would therefore be better for a new school to provide both types of spaces, viz. indoor and outdoor spaces, for teaching and learning. Apart from this, it has been noted that green spaces in learning environments do not serve the sole purpose of education, but add towards creating a more inviting, and sense-evoking environment. It can also be deduced from the research gathered that the type and relationship of built and natural spaces is a key factor in determining the architectural principles for an alternate primary school.



## 7.2 CONCLUSION TO RESEARCH

From the schools explored in this study, it can be deduced that schools in Durban do not have natural spaces dedicated for teaching and learning, nor for recreational purposes, even though the KZNKZNDoe's Minimum Requirements make provision for these spaces in their guidelines. These schools tend to adhere to the standard classroom-based method of teaching which exclude natural spaces, even though the teaching and learning process can be strengthened and enhanced by using alternative methods of teaching and learning, i.e. using nature in outdoor spaces. This was shown by the responses of Natural Science teachers, whose curriculum has the most opportunities to be taught within green spaces. However, the use of green spaces as part of teaching and learning is not limited to this subject.

Nature within learning environments not only provides teachers and learners a chance to personally interact with subject matter from the curriculum, but also creates safe, secure and soothing environments that promote a sense of place and belonging in learners. This is an important feature of schools, as the literature describes human beings' decreasing connection to nature. In light of this, schools can provide the ideal means through which learners are able to come into contact with nature on a regular basis through the presence of green spaces.

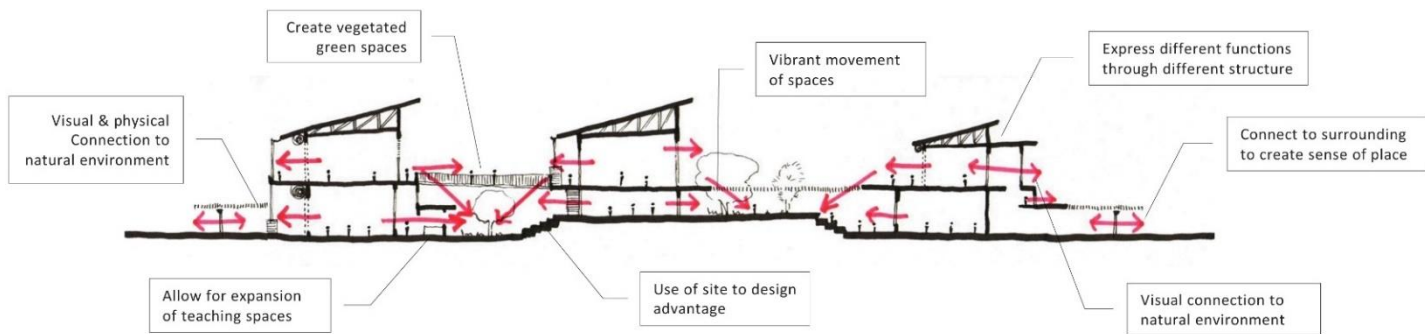
The research study has brought forward the key idea that school learning environments can be used for more than just education through the architectural design and layout of the built and unbuilt spaces, and through the integration of green spaces. It can become an environment where learners are able to develop with a better understanding and respect for each other and for nature which becomes part of their everyday lifestyle.

## 7.3 RECOMMENDATIONS FOR A DESIGN PROPOSAL

The following section outlines the framework for the design proposal of an alternate primary school in Durban. The research study was based on public schools in Durban which must be acknowledged within the recommendations.

Notwithstanding the feasibility limitations of providing schools, simple variations of the

current designs can maximise the potential of these learning environments, i.e. by increasing the connection between built and natural spaces. In line with South Africa's evolution, an evolved school should bring together the community and acknowledge its site surroundings. It should prominently connect with the natural environment to increase the teaching and learning spaces within the school as well as improve learning ability of learners, and should also reflect the life of the learners through the buildings and spaces.



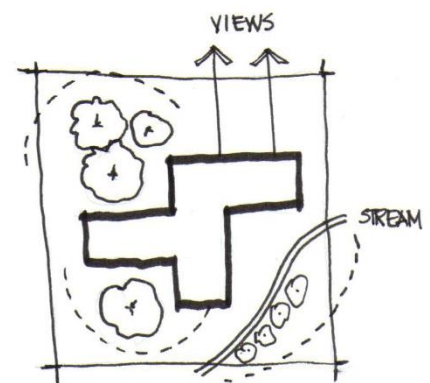
**Section: Proposed example of alternate school design**

*Figure 5.14: Proposed example of school design (Source: Author, 2016)*

The design encompasses the research findings presented throughout this study by means of the architectural principles that follow.

### **Response to Natural Environmental Site Features**

In order for an architectural design to be unique to a location, it should acknowledge and respond to its site characteristics. For this study and the proposal of an alternate school that makes use of green spaces as a prominent feature, it should integrate as many natural site features as possible. This strengthens learning and teaching from the environmental aspect, as well as preserves any connecting ties that the site and its features may have to its existing context, hence preventing Placelessness.



*Figure 7.1: Response to environmental features (Source: Author, 2016)*

### The School as a Micro-city

Herman Hertzberger's concept of the school as a micro-city is presented as a recommendation for the alternate school design as it poses many opportunities for social interaction, ease of wayfinding and navigation, as well as allowing connections between built and unbuilt form to occur. This is the backbone of the design proposal as it provides the framework for the school building layout, as well as the "in between" spaces created as a result of the buildings.

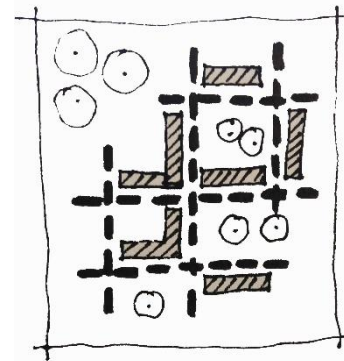


Figure 7.2: The school as a Micro-city (Source: Author, 2016)

The concept is taken further by establishing that within the school, the classroom is regarded as the "home-base", as the majority of the school day is spent within the classroom. For this reason, the following recommendations must prioritise classroom spaces.

### Proximity & Accessibility to Green Spaces

Following on from the relationship between classroom spaces and green spaces, the above two principles work together to ensure that the close relationship is maintained in order to enhance teaching and learning in schools. The proximity of green spaces to classroom spaces is an important factor to acknowledge, as the closer the green spaces

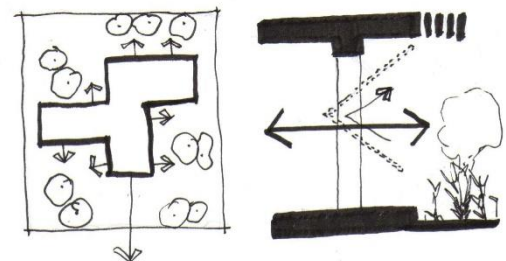


Figure 7.3: Proximity & accessibility (Source: Author, 2016)

are to existing methods of teaching, the easier the transition between the two methods of teaching i.e. classroom based teaching and Place-based Teaching. The close proximity of green spaces to classroom spaces, enhances accessibility to these green spaces, an important consideration since it can benefit more than just teaching and learning. Accessibility and Proximity of spaces can also address the issue of limited time during the day to go outside to use the outdoors on a regular basis.

### Expansion & Flexibility of Classroom Spaces with Green Spaces

Traditional classroom spaces should have the potential to be flexible and be able to expand to address current over-crowding issues. This expansion can also support Place-based teaching by combining the principle of Proximity and Accessibility of green spaces with above-mentioned principle. Learning environments need to be flexible for an ever-changing society. This characteristic allows spaces to adapt and move forward. In the case of learning environments, it lends itself to allowing various different types of learning approaches to be recognised and administered.

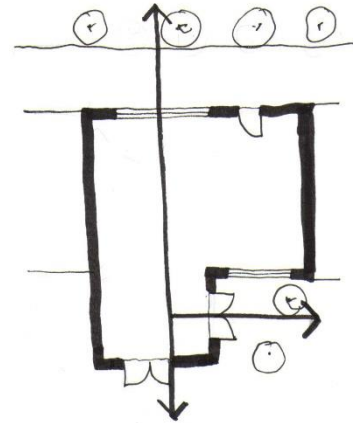


Figure 7.4: Expansion & flexibility (Source: Author, 2016)

### Sensory Variability

The concept of Environmental Psychology can be realised by creating varied environments that evoke all of one's senses. In learning environments, this can be done by varying the types of green spaces used, the scale of the school complex, the buildings within it, and the colours and textures of finishes throughout the school. In this way, every aspect of the school built environment contributes towards enhancing the teaching and learning experience.

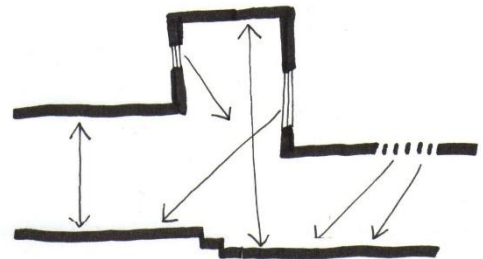


Figure 7.5: Sensory Variability (Source: Author, 2016)

### Child-orientated Environments

Continuing from the point that learning environments can be more than just educational settings, spaces within the school should make learners feel comfortable, and a part of the growth, structure and meaning of these environments. Spaces, built and unbuilt, that are dedicated to

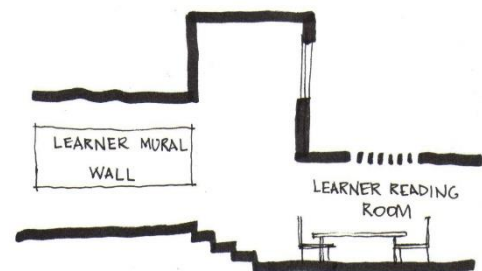


Figure 7.6: Child orientated environments (Source: Author, 2016)

learners – to study, or socially interact with each other – creates a more wholesome environment in which a true sense of place, ownership and belonging can be achieved by learners. This principle works in harmony with Sensory Variability in devising the types of spaces created within the school built environment.

These principles are all intertwined and have knock on effects on one another, and should therefore be used in relation to one another. The design proposal will benefit most from a cohesive amalgamation of all the principles stated here, as they represent an interpretation of the research findings.

The next Chapter finalises the research study by presenting a design report of the proposal for an alternate primary school in Durban, one which integrates green spaces as prominent features used to enhance the learning environment.

## Chapter 8: DESIGN REPORT

The following chapter presents a design report for the proposal of an alternate primary school in Durban that makes use of green spaces as part of the teaching and learning process. The proposal responds to the research presented throughout this dissertation, and uses the architectural principles outlined in the last chapter as the framework for the design.

### 8.1 PROJECT DESCRIPTION

#### What

The design proposal addresses the need for quality education in South Africa by introducing alternative methods of teaching and learning. This is done by extending teaching and learning to more than the confines of the traditional classroom, by means of integrating green spaces with built form.

#### Who

This design targets the teachers and learners of the alternate school, as well as the education system as a whole.

#### Why

The alternate school will harness the benefits of nature on children by integrating them within the school built environment in order to create healthier, more stimulating environments for learners. This can lead to greater opportunities for learners to learn, thus pursuing a better quality of education, as well as creating school environments that can make an impact on children and the community. Furthermore, by utilising the whole school built environment, equal opportunities are presented for learners to learn, as everyone learns in different ways.



Figure 8.1: Graphical representation of outline of design proposal (Source: Author, 2016)

## Concepts & Theories

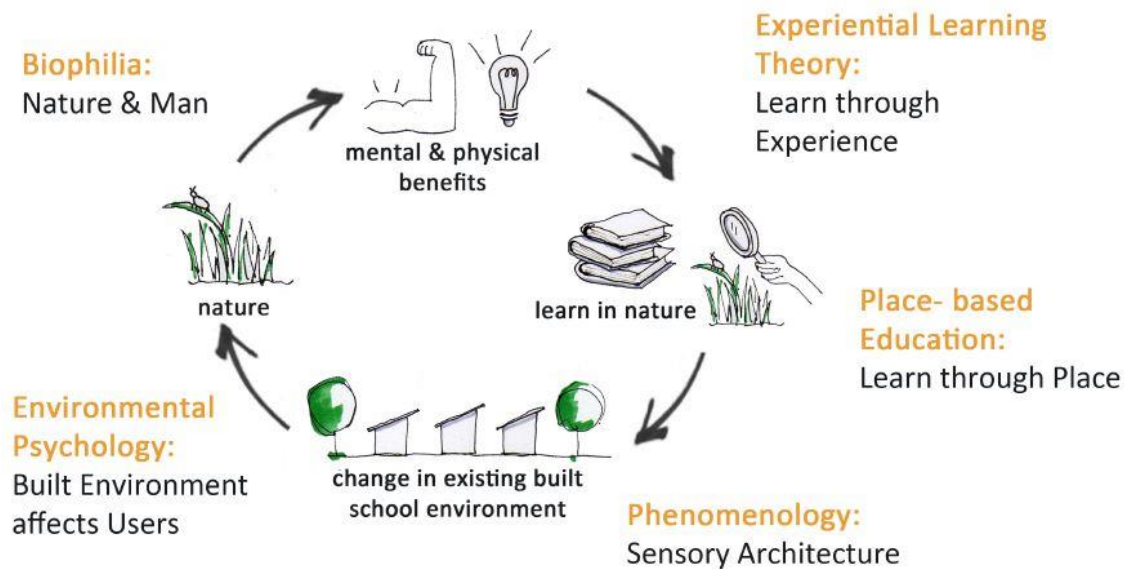


Figure 8.2: Graphical representation of concepts & theories for design (Source: Author, 2016)

## 8.2 PROPOSED CLIENT

Government schools in South Africa are governed and run by the Department of Basic Education of the Ministry of Education. Therefore, the proposal of an alternate primary school would be managed by this department. However, it must be noted that the existing norms and standards for school infrastructure presented by this department is what this research has scrutinized, i.e. there is little green spaces provided in schools which can be used as part of the teaching and learning process. In proposing the Department of Education as the client for this design, it suggests that the existing norms and standards can be adapted to accommodate green spaces, as well as other facilities for this design.

In conjunction with the Department of Education, the Accelerated School Infrastructure Delivery Initiative (ASIDI) is also a proposed client of this design. This initiative was developed as part of the Development Bank of South Africa, and has worked with the



Figure 8.3: Client Logos (Source: [www.education.gov.za](http://www.education.gov.za), 2016)

Department of Education previously. One of the aims of ASIDI is to upgrade the standard of schools within South Africa, in order to meet optimum functionality of school infrastructure. In addition, Angie Motshekga (Minister of Basic Education) elaborates that the aim of ASIDI is to make all South African schools “whole schools”, where children are able to develop academically, socially and physically.

### 8.3 CLIENT’S BRIEF

#### 1. Project Description:

- The DoE requires an alternate primary school which facilitates teaching and learning through the use of green spaces.
- The school can should be flexible, in order to expand, as well as be able to accommodate after-hour use of certain facilities.
- An appropriate site shall be selected by the architect, with sound justification and appropriate consent from the Municipalities.
- The architect must be able to design an appropriate scale of school, and is responsible for ensuring sound structural environments.
- The architect’s role is to ensure the school built environment is a suitable space for teaching and learning to occur throughout the school, as well as to ensure spaces are equipped for their intended user groups in order to feel inspired and comfortable.

#### 2. Primary School Built Environment:

- All traditional school facilities must be catered for in accordance with the Norms and Standards set out by the DoE.
- The school must be a **medium (311-620 learners) or large (621-930)** school according to the DoE Minimum Requirements.
- The school built environment must meet the basic safety requirements outlined by the DoE. A school built environment is deemed unsuitable if there is:
  - a lack of access to potable drinking water and sanitation facilities;
  - toxic substances in the school environment;
  - extremely unsafe building structures that could collapse on top of the learners;
  - classrooms that are overcrowded; and



- Inadequate fencing.
- The school must comprise of the standard spaces such as educational spaces, support spaces, and administration spaces. Thereafter, additional spaces may be motivated for sufficiently.
- **Educational Spaces:**
  - The required number of classrooms must be provided with optimum space for each learner to be 1.5m<sup>2</sup>
  - Classrooms must accommodate sufficient storage
  - Access to green spaces must be provided for classrooms
- **Support Spaces:**
  - A school Hall must be easily accessible
  - Traditional support spaces must be incorporated into the new design such as tuck shop, staff rooms, maintenance rooms etc.
  - Ablution facilities for male and female learners must be accommodated for in appropriate quantities.
  - All walkways and corridor spaces must be covered
- **Administration Spaces:**
  - All admin spaces must be grouped together for ease of access.
  - All admin spaces must be closely located to the school entrance for visitor access.
  - Separate ablutions must be allocated for staff
  - Sick rooms must be located with the admin spaces
- **Sport's Facilities:**
  - The school must incorporate sport facilities such as netball or volleyball court and a cricket/soccer field.
  - Supporting sport's facilities such as change rooms must also be incorporated in close proximity to the sporting fields.
- **Green Spaces:**
  - The design of the school must preserve and integrate as much existing vegetation and environmental aspects of the site as possible. This will ensure a more environmentally conscious school to encourage teachers and learners within it.
  - A variety of green spaces must be incorporated throughout the school built environment.

- These spaces must range in size and must respond and cater for different ages of learners, and for teachers and visitors.
- Dedicated green spaces must be in close proximity to classroom spaces to be used as part of the teaching and learning process.
- Green spaces must contain a variety of vegetation, preferably all indigenous.

### 3. Safety and Security:

- The school component of the design must be secure from external parties entering the site as safety of the learners is the department's first priority.
- All public accessible facilities must not be entered through the school, but through a separate entry point.

## 8.4 SCHEDULE OF ACCOMMODATION

UNBUILT SPACES :	
Site Area	<b>13 782m<sup>2</sup></b>
Green spaces for teaching/learning	850m <sup>2</sup>
Recreational green spaces	1040m <sup>2</sup>
Sensory gardens	200m <sup>2</sup>
Vegetable gardens	380m <sup>2</sup>
Parking	34
Sports field	60m x 100m (soccer/cricket) 16m x 31m (netball)

BUILT SPACES :	
ADMINISTRATION SPACES	
Reception	20m <sup>2</sup>
Waiting area	20m <sup>2</sup>
Principal's Office	30m <sup>2</sup>
Deputy's Office	20m <sup>2</sup>

HOD Offices	15m <sup>2</sup> x 3
Nurse's Office	15m <sup>2</sup>
Strong & printing rooms	10m <sup>2</sup>
Sick rooms/counselling rooms	45m <sup>2</sup>
Staffroom	120m <sup>2</sup>
Staff Computer Room	100m <sup>2</sup>
Kitchenette	15m <sup>2</sup>
Ablutions	3 ladies, 2 basins; 1 men, 2 urinal, 1 basin
<b>EDUCATIONAL SPACES</b>	
Classrooms	80m <sup>2</sup> x 23
Workspaces	20m <sup>2</sup> x 23
Outdoor Work Spaces	60m <sup>2</sup> x 4
<b>COMMUNAL SPACES</b>	
Assembly Hall	600m <sup>2</sup>
Library	250 <sup>2</sup>
Computer Room	100m <sup>2</sup>
<b>SUPPORT SPACES</b>	
Learning Streets	790m <sup>2</sup>
Circulation	510m <sup>2</sup>
Ablutions	12 girls. 8 basins; 5 boys, 5 urinals, 3 basins
Change rooms	90m <sup>2</sup>
Tuck shop	10m <sup>2</sup>
Storage	50m <sup>2</sup>
Guard House	10m <sup>2</sup>

## 8.5 SITE SELECTION & LOCATION

### 8.5.1 Site Selection

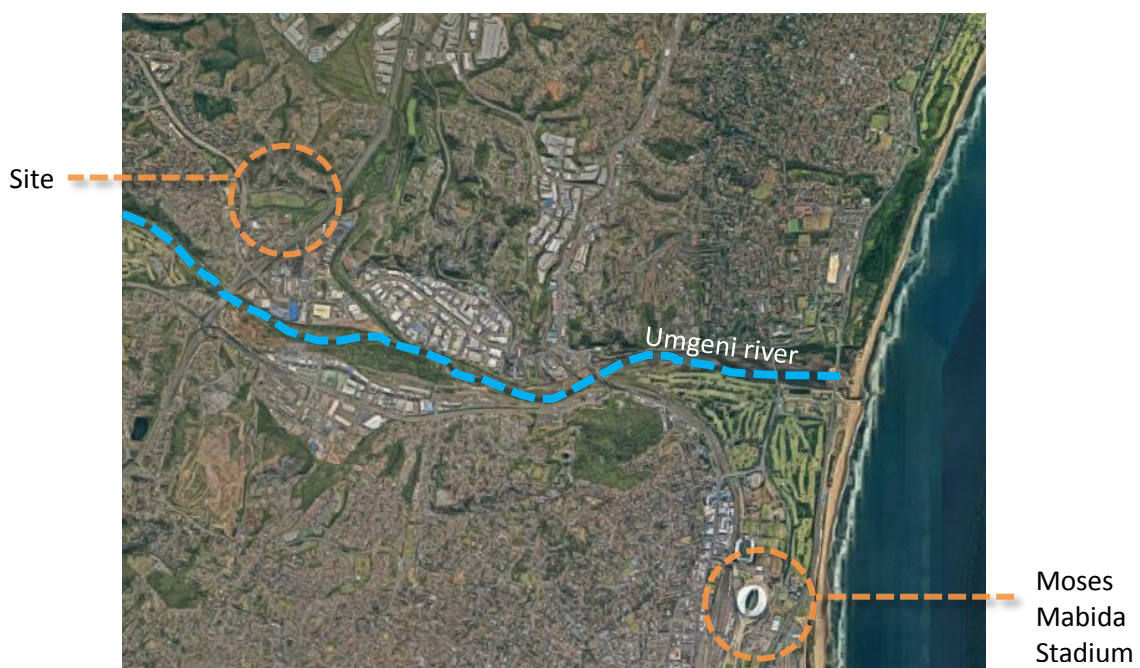
The site was selected based on the school case studies presented in Chapter 5 in order to design a school that would respond better within these already established areas. The school was selected based on the following:

- Poor existing school design in relation to research.
- Being able to relate to the theories and concepts presented throughout this dissertation.
- Having the most potential to connect with its surrounding community.
- Having strong existing environmental features.

Using this as the basis of site selection, the site of School Three of the case studies was selected. A detailed explanation and analysis of the site follows.

### 8.5.2 Site Location

The site is located within Durban, KwaZulu-Natal; north of the Umgeni River. The map below shows the site location relative to landmarks in Durban such as Moses Mabida Stadium, Umgeni River, and the beach front.



The site is located on the periphery of the residential suburb of Newlands and the Light Industrial and Commercial area of Sea Cow Lake. The area is accessed via the N2 Freeway (yellow) and Inanda Road (orange) intersection.

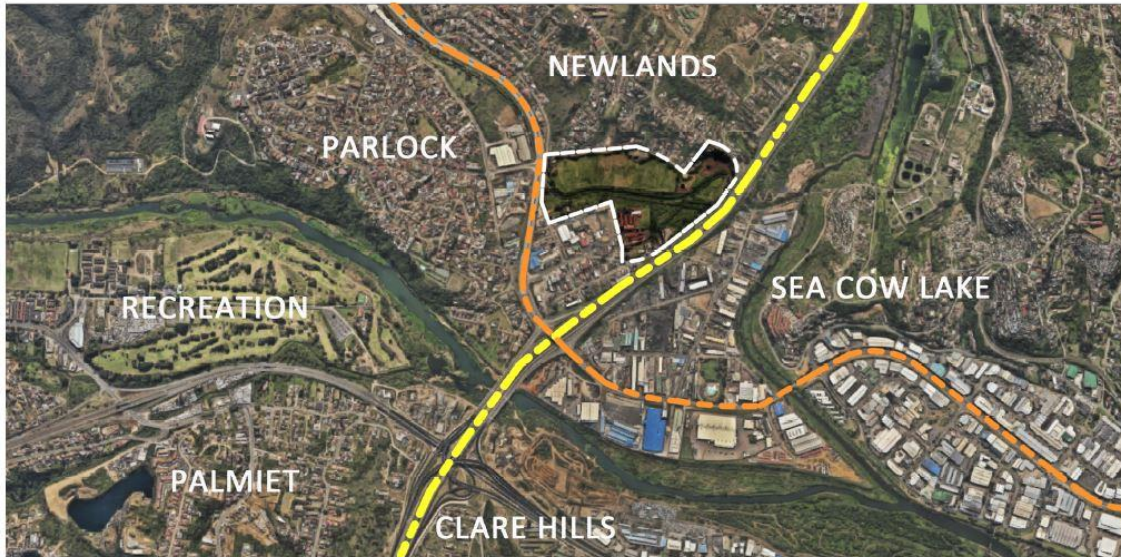


Figure 8.4: Contextual Site Location Maps  
(Source: Google Maps, 2016)

### 8.5.3 Urban Context

The site has a strong community orientated urban context. Three sports fields sit north of the site which serves as the community grounds. On the right of the site lies an open plot of land which is being utilised as community farming land, and on the left of the site lies existing light commercial and small residential buildings. The existing school serves the areas of Newlands, Parlock and Sea Cow Lake, which are radially positioned around the site. The site is also surrounded by dense vegetation, product of a stream that runs between the community grounds and the site.





Figure 8.5: Urban Context Map  
(Source: Google Maps, 2016)

#### 8.5.4 The Site

The extent of the site is composed of two existing schools, viz. School Three (as described in Chapter 5) and Inanda Special Needs School. Although the schools lie next to each other, they function as independent Schools.

However, Inanda Special Needs school is in the process of being relocated to a site 500m away, within the Newlands area, as discussed with the principal of the school. For this reason, the site of Inanda Special Needs School will be consolidated with that of School Three for the proposed alternate primary school.

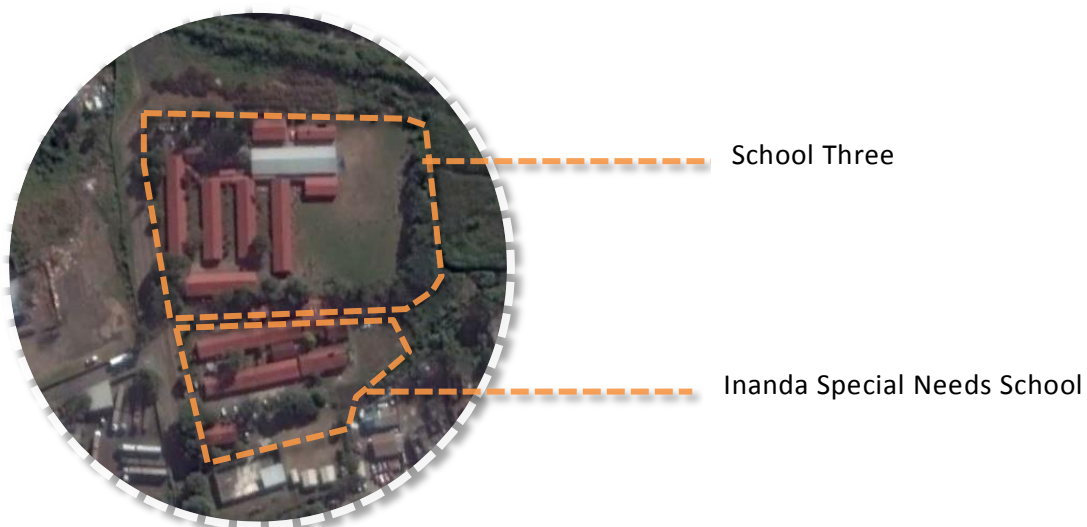


Figure 8.6: Site Map (Source: Google Maps, 2016)

The current schools face many of the problems described in Chapter 5 based on the Planning Norms and Standards. The schools are poorly accessible, buildings face incorrect orientation for learning, green spaces are along the periphery of the school, as well as all the buildings look identical to each other. For these reasons, the school built environments are poorly designed, and do not provide optimum learning environments for the learners.



*Figure 8.7: Photos from School Three  
(Source: Author, 2016)*

## 8.6 SITE ANALYSIS

### 8.6.1 CONTEXTUAL ANALYSIS

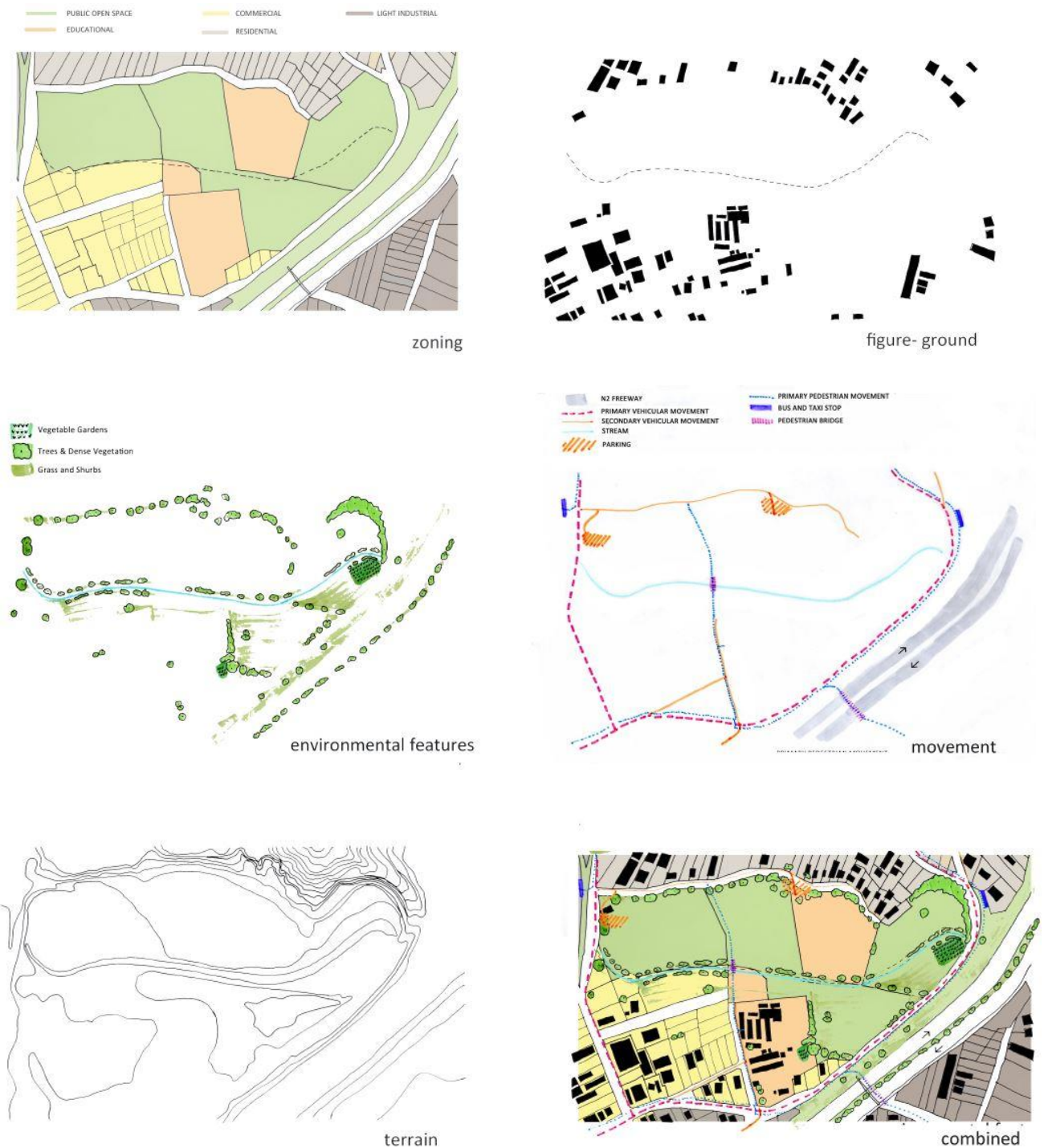
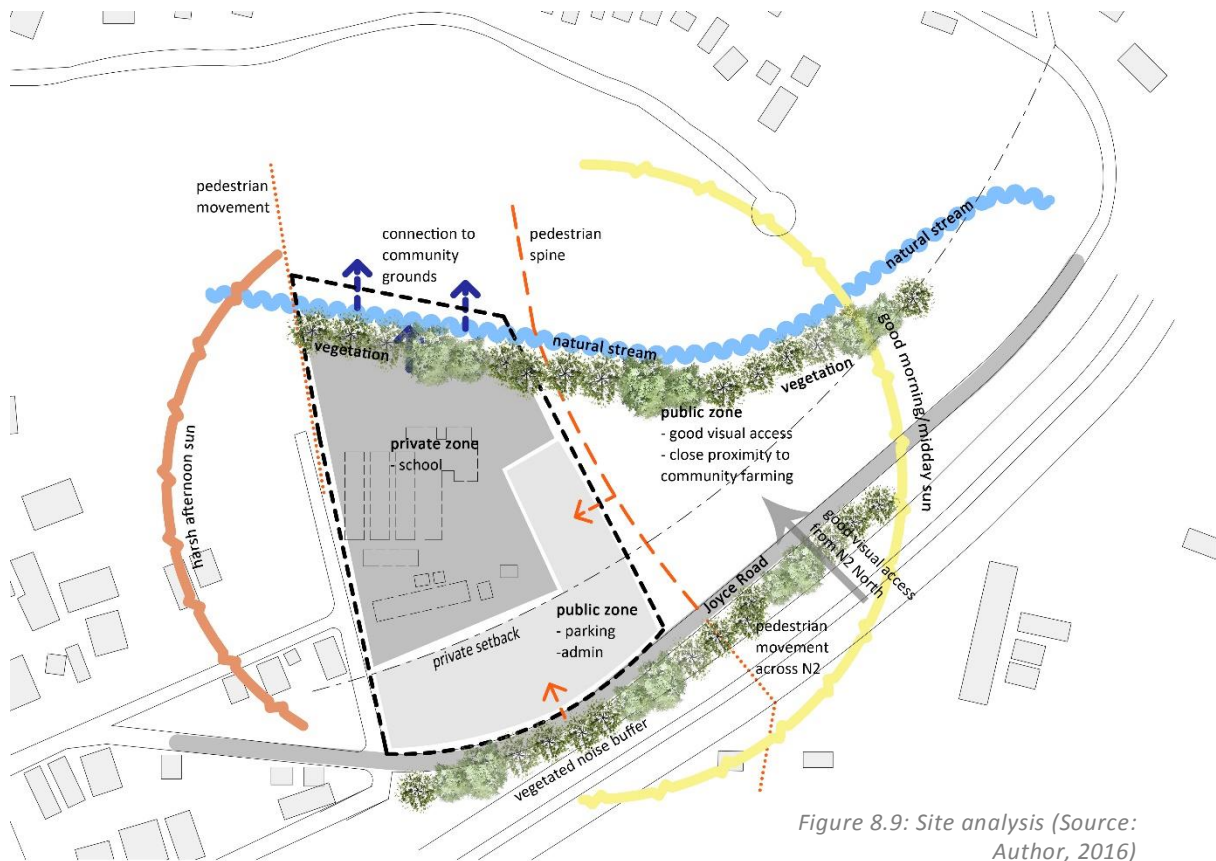


Figure 8.8: Contextual Site analysis  
(Source: Author, 2016)



## 8.6.2 SITE ANALYSIS



## 8.7 DESIGN PRECEDENTS

### 8.7.1 VELE SECONDARY SCHOOL

This school, designed by East Coast Architects (completed in 2005), is located within a rural part of Limpopo Province., South Africa. The school was designed to incorporate the community's environmental and cultural heritage.

The school is a public school, and was designed with the same budget allowed for public schools in South Africa, and follow Norms and Standards for public schools.

#### Layout and Spatial Planning

Hertzberger's concept of the learning street is evident in the layout of this school as the classroom blocks all have corridor spaces which are adjacent to the classrooms. The in between spaces of the classroom blocks can be regarded as public squares, as they act as courtyard spaces that are used for social gathering, fitted with concrete steps (a concept

explored by Hertzberger, 2008). The classroom spaces in this school do not expand onto the corridor spaces which prevents the corridors to act as anything more than circulation spaces. It would be beneficial if classrooms were more permeable to the outdoor spaces to integrate with them.



Figure 8.10: School Layout (Source: [www.eastcoastarchitects.co.za](http://www.eastcoastarchitects.co.za), 2016)

### The School Buildings

In order to accommodate the school and community's environmental values, the school buildings are designed with various environmental features. The design has various environmental sustainable features such as green roofs, water collection Jojo tanks, and solar panels, and makes use of natural local materials throughout the design.



Figure 8.11: Green Roofs (Source: [www.eastcoastarchitects.com](http://www.eastcoastarchitects.com), 2016)

## Outdoor Spaces

The school has a wide variety of green spaces throughout the school that softens built environment. These spaces also become part of the teaching and learning process. Key green spaces include food gardens and botanical gardens, as well as vegetated spaces for recreational purposes. This is direct relation to the research outlined in the literature review with regards to a variety of green spaces needing to be included in school learning environments in order to relate to different types of children. The heart of the school consists of a food garden which is used as an educational focal point of the school for the learners and the community.



*Figure 8.12: Green Spaces (Source: [www.eastcoastarchitects.com](http://www.eastcoastarchitects.com), 2016)*

## Materials & Finishes

The school buildings range in scale throughout the school, with each building having its own unique architectural characteristic, creating interesting spaces both internally and externally. The buildings make use of natural local materials which enhances its connection to its location while creating sensory experiences throughout the school. This also connects the buildings to the natural outdoor environment.





Figure 8.13: Sensory Variability (Source: [www.eastcoastarchitects.com](http://www.eastcoastarchitects.com), 2016)

### 8.7.2 LEBONE II COLLEGE OF THE ROYAL BAFOKENG

Lebone II is located in the North West Province of South Africa, and designed by Afritects and Activate Architects. It is an independent facility consisting of a primary and secondary school, as well as boarding facilities on site for learners. Although this school is private, and therefore its architecture reflects a certain grandeur to it, the smaller intimate spaces between classrooms and green spaces, is the key focus of this precedent.



Figure 8.14: Lebone II buildings (Source: [www.sbd2050.org.com](http://www.sbd2050.org.com), 2016)

#### Layout and Spatial Planning

The focus for this precedent is on the primary school development within the school built environment. The layout of classrooms are designed in clusters around communal courtyards landscaped with indigenous vegetation. This creates a communal learning environment which is easily accessible to all learners. Hertzberger's learning street concept is not evident within the layout of this school, however, the cluster configuration of classrooms create public square courtyards used for communal gathering and learning.

Primary school  
development



Figure 8.15: Lebone II Layouts (Source: Google Maps, 2016)

The classrooms are designed as flexible learning environments. The outcome of this was to encourage creativity in their thinking and learning by creating lessons that transition between inside and outside spaces throughout the day. In order for this to be possible, all classrooms extend outwards into an enclosed private courtyard.

Communal  
courtyard



Figure 8.16: Primary school layout (Source: [www.sbd2050.org.com](http://www.sbd2050.org.com), 2016)



Figure 8.17: Classroom layout (Source: [www.sbd2050.org.com](http://www.sbd2050.org.com), 2016)

### The School Buildings

In this precedent, because the classrooms are centred on a courtyard, visibility and accessibility to green spaces is possible. However, the construction and scale of the buildings are not child orientated, as most buildings are 2-3 storeys high. The school makes an effort to be sustainable by harvesting all water on site to be used for the irrigation of their school sport fields. There are a series of dams that also work in tandem with a sewerage treatment plant which is used as a learning opportunity to teach the learners of being conscious of water resources.



Figure 8.18: School buildings with vast greenery around (Source: Knoll, 2013)

## Outdoor Spaces

This school is rich in a variety of outdoor spaces which contributes to the schools learning program. The courtyard spaces and gardens throughout the school are planted with indigenous plants to help increase the biodiversity in the area. Furthermore, attenuation ponds are evident in the school which are connected to the rain water collected from the roofs of the classrooms. The sports fields were also sited on an existing quarry and are shaped to allow for excess rainwater to drain to grassed channels along the edge of the field. The school's rich connection to environmentally friendly endeavours relates it to the literature uncovered which allows learners to be more involved in the school process of sustainability.



*Figure 8.19: Water attenuation pond (left) and indigenous plants in the school gardens (right)  
(Source: Knoll. 2013)*

## Materials & Finishes

Although the buildings make little use of natural materials apart from timber cladding on certain buildings, the vast amount of greenery present in the school softens the school learning environment making it a pleasant experience to go to school. The classrooms consider the connection between indoor and doors as the courtyard is enclosed in glass.

## 8.7.3 CONCLUSION

### *The School as a Micro-city*

» **Layout of built form and green spaces:** Vele Secondary School is designed in the more traditional layout in that classrooms are accessed through corridors, whereas the cluster layout of the primary school of Lebone II College does not have any defined corridors which can be regarded as extensions of the built spaces. Instead, the cluster



design, like the L-shaped classrooms, create private green spaces as well as clustering around one common green space. The courtyard spaces in both schools allow for the different age groups to gather in specific areas, while allowing interaction between the whole school.

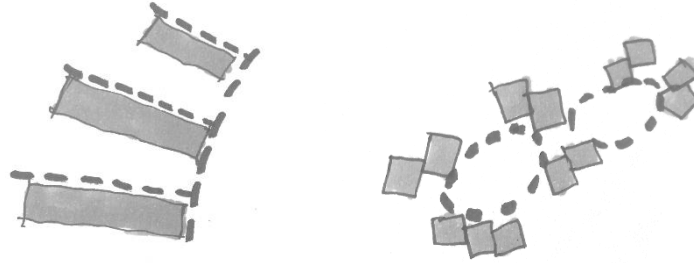


Figure 8.20: Many circulation corridors (left) and Central cluster courtyards gardens (right) (Source: Author, 2017)

» **Relationship between Classroom Spaces and Green Spaces:** The classrooms in Vele Secondary School are no different from those presented in the Case Studies. These classrooms therefore have no real connection to natural green spaces, apart from through the windows of the classrooms. In contrast to this, Lebone II College uses a central private courtyard as the centre of the classroom, surrounded by teaching and support spaces. This allows learners easy access to a green space while in close proximity to the traditional teaching space. This concept of classroom design is effective in connecting to the natural outdoors, but each classroom compromises its orientation in order to achieve the cluster layout.

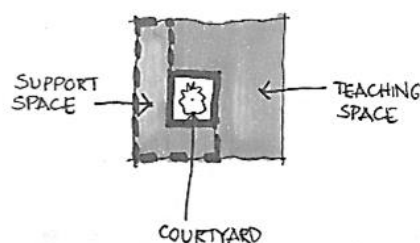


Figure 8.21: Classroom designed around private courtyard (Source: Author, 2017)



*Natural Outdoor Spaces*

- » **Types of Green Spaces in Schools:** In both schools, green spaces are evident. In Vele Secondary School, the courtyards between classroom blocks are hard landscaped with little vegetation. However, the remainder of the school spaces are planted with dense vegetation in the form of the food garden or recreational spaces, as well as having plants on flat roofs. Lebone II College, being a private school, allows for the school learning environment to be equipped with more technical environmental features such as the attenuation ponds and irrigation systems for sustaining water. The different schools showcase that although there is a difference in funds with regards to public and private schools, green spaces are able to be implemented in different ways and scales.

*Sensory Architecture*

- » **Scale of buildings:** The compact nature of the design of the classrooms of Vele School result in the classroom blocks being 3 storeys high, not a child-orientated scale. However, other buildings around the school vary in height which creates a variety in built form. The buildings in Lebone II College are of a much larger scale, as the complex consists of primary to tertiary phases of education. The primary school classrooms, however, are one storey buildings. This is ideal for learners of this age group.
- » **Materials and Finishes:** Both schools use natural materials wherever possible in order to relate to their contexts. However, both schools benefit by having dense vegetation around the school learning environment as these soften the larger buildings in both schools and make them appropriately designed for younger learners.

Built and unbuilt spaces in Vele Secondary School work together so as to create a cohesive, sense-evoking environment, which contributes towards the learning and teaching experience. As the proposed design for this dissertation is a primary school, the classroom layout is an important element of design, as the learners remain in their class for majority of the school day. Lebone II College is an ideal example that highlights importance of the classroom by providing supporting spaces attached to the classroom, as well as making allowances for a variety of teaching and learning experiences from one space. Both schools

make use of green spaces in different ways, both of which can be integrated in the design proposal of an alternate primary school.

## 8.8 FINAL DESIGN

### 8.8.1 URBAN LAYOUT

The layout of the urban design is to allow for existing pedestrian movement to connect and interact with the current context i.e. existing community farming, existing community grounds, existing school site, as well as a proposed environmental park and centre. The urban scheme is to allow for a cohesive community environmental learning precinct to be created within an area rich with opportunity.

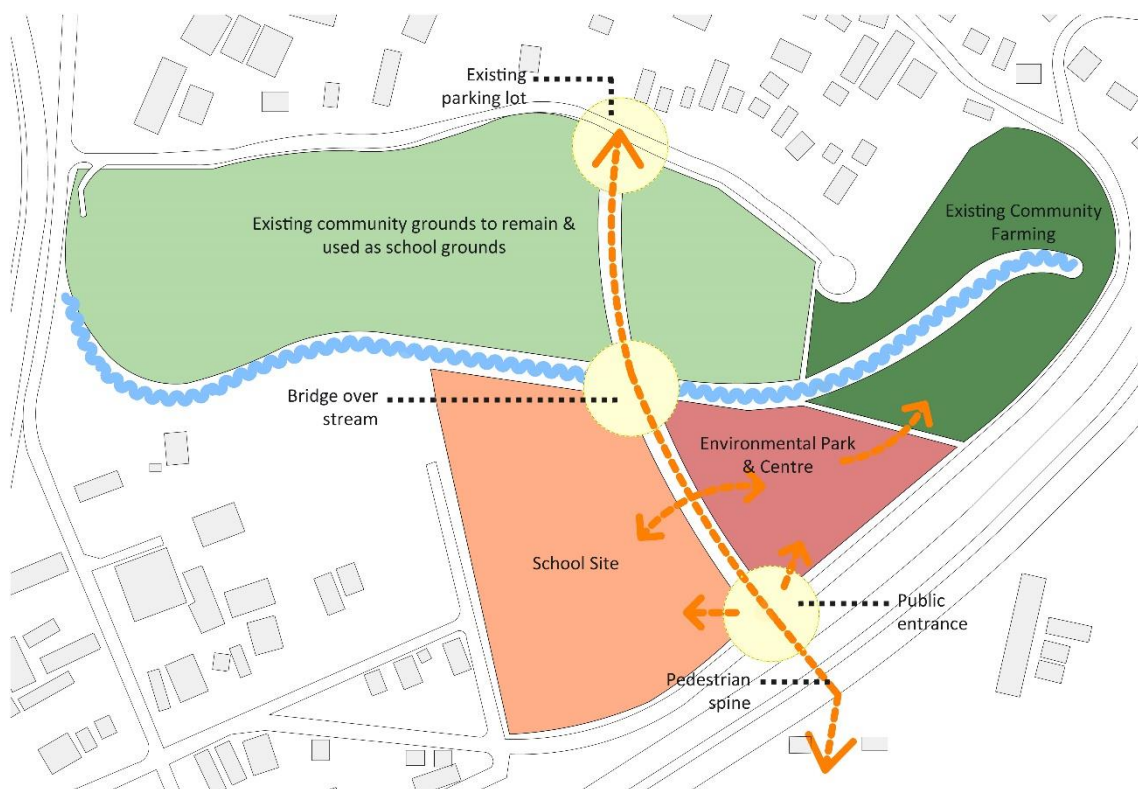


Figure 8.22: Urban Layout (Source: Author, 2016)

### 8.8.2 FINAL PRESENTATION

The following pages are the layouts presented of the proposed design for an alternate primary school in Durban.

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## APPENDIX A: INTERVIEW SCHEDULE

**Icebreaker:** Tell me something about yourself. Do you have children? Are you married? Where did you study? When did you qualify? How long are you teaching for? In what schools? What grades do you teach? Etc.

### **Explain the problem**

*There is a decline in the quality of education in South Africa. One method of approach to contributing to the teaching and learning process is through using the natural environment of the school as part of the educational process. However, not all schools are designed with this in mind.*

### **Science subject related questions**

*You were selected as a participant because you teach natural science. Is this your favourite subject to teach?*

- 1.1 What grades do you teach?
- 1.2 How much of the curriculum is dedicated towards learning about the environment?
- 1.3 Are children enthusiastic towards this topic? More so than other topics?
- 1.4 How much of the subject is practical? i.e. growing a plant?
- 1.5 Does the school or you partake in any extra mural activities in regards to the natural environment? E.g. labour day, plant a tree day? Etc

*For my dissertation, I've used the term green spaces as slightly more specific than the natural environment. Defined as vegetated garden spaces that can be used for recreational play or as part of a teaching method. These spaces do not include sports fields within the school.*

- 1.6 How is "green spaces" integrated into the curriculum, if at all? Why do you think it is/isn't?
- 1.7 Have you heard about place-based education? Explain it.

*PBE is a teaching/learning concept that uses the "place" or environment as the basis for learning. Opposite of classroom-based learning. People also call it outdoor learning. It is more experiential. It allows children slightly for freedom within the learning process.*

- 1.8 Are you interested in this teaching method? Why?
- 1.9 Do you think this concept would benefit children? Or would engage children more? Why?
- 1.10 Do you think the current design of the school is adequate or equipped for Place-based education? Explain.

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### **Architectural response**

*(General introduction & follow up questions- Literature shows that concentration levels, mental capacity, moods etc. can be affected by types of spaces in one is placed in. Spaces better linked to the environment show positive responses.)*

### **General School Built Environment**

- 1.11 How do you feel about the current school environment? What are the spaces like?
- 1.12 Is there any particular space you may have had an experience in that you can tell me about? Spaces that evoked a particular feeling? Light-happy? Dark-dodgy?

### **Green spaces**

- 1.13 Would you like to teach science in the natural environment? Do you teach science in the environment?
- 1.14 What type of spaces do you think are necessary or relevant to your subject? E.g. vegetable garden, play space, separate recycle bin area.
- 1.15 Do you think that 'green spaces' would be more effective for teaching or learning if they were part of the classroom? Closer? With easier access? Visually? Why?
- 1.16 Is there anything else you would like tell me about with regards to the types of outdoor spaces provided/not provided in the school?

### **Classroom Design**

- 1.17 Do you like the design of the classrooms? Is there enough light? Is it too hot/cold? Is there any particular experience you can tell me about?
- 1.18 Do you think learners would respond better in class with a better design of the classroom? Why?
- 1.19 Is there anything you think the classroom lacks that is integral to learning, specifically to your subject?
- 1.20 Is there anything you would like to tell me about in terms of spaces that may be necessary for teaching/learning about the environment? Built or natural?

Thank you for your time. Please feel free to contact me should you wish to add any other information that could be beneficial to the research.

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