

Figure 1 Free to learn. By author (2019)

THE INFLUENCE OF CHILD SELF-DIRECTED LEARNING ON THE BUILT ENVIRONMENT



THE INFLUENCE OF CHILD SELF-DIRECTED LEARNING ON THE BUILT ENVIRONMENT:

Towards a primary school in Lubumbashi, Democratic Republic of Congo

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DECLARATION

I hereby declare that this dissertation is my own unaided work except where it has been otherwise acknowledged. It is being submitted to the School of the Built Environment and Development Studies, University of KwaZulu-Natal, Howard College campus, in partial fulfilment of the requirements towards the degree of Master of Architecture. This dissertation has not been submitted before for any degree or examination at any other university.

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DEDICATION

Ansante kwa mama yangu Isabelle Kalong Nawej.

Abstract

The contemporary architecture of learning environments in the city of Lubumbashi still supports a system of education that has been proven to limit passion and creativity in children. This system emerged during the first industrial revolution as Europe was adopting the process of mass production in manufacturing. The revolution came with a great demand for factory labour that contributed to transforming education into an act of predominantly transferring knowledge, hence creating a parallelism between teaching and factory production. Coupled with regional factors, the association of school with factories in Lubumbashi resulted in a type of places of learning with spatial qualities that do not account for the individual and the collective aspect of learning in children. Subsequently, formal, and restrictive spaces became the norm in primary schools such that children are not motivated about conventional schools.

Therefore, this work looks at alternative ways of designing primary schools by exploring the relationship between the pedagogy of child self-directed learning (CSDL) and the built environment, within the context of Lubumbashi. To achieve this aim, the research starts with the question of How child self-directed can influence the Built Environment

To understand the ontological relationship between education and built form, the research is primarily situated in an interpretive (constructivist) paradigm. Therefore, primary, and secondary data has been processed from an integral theory that includes the different aspect of human experience of the built environment. While experiential learning theory was applied to provide depth to the human experience, critical regionalism theory was employed to underline the contextual aspect school.

Hence, two case studies were analysed. The first school, which is in Lubumbashi, has been studied for the purpose of understanding contextual factors that influence the architecture of the learning environment. The second school, which is in Durban, helped empirically explore the relationship between child self-directed learning and the built environment.

Finally, this work demonstrates that the relationship between Child self-directed learning and the built environment reveals new spatial conditions that integrate the individual, the collective and the contextual aspect of leaning.

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PART ONE

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND AND MOTIVATION

"...as the interest in individual-based education continues to increase, so does the spatial complexity of school buildings...it is essential that the cramped pattern of thoughts still adhered to by school-builders should be abandoned in favour of a more varied, more changeable and, most of all, more open forms that incite greater concentration but also greater exchange, that gives a more expansive view of the world." (Hertzberger, 2008, pp. 8, 69)

The architecture of conventional places of learning is based on a formal type of education called the Prussian system. This system was established since 1819 in Germany mainly as a socioeconomic instrument to produce workers for the first industrial revolution, which foster an instructive education rather than creativity. (Gatto, 2009; Hertzberger, 2008; Dudek, 2005; Robinson, 2015; Khan, 2012).

The historian Mark Depeape (2014) notes that Belgium implemented the same system in the city of Lubumbashi, which is in the south of the Democratic Republic of Congo (DRC). The restrictive formal architecture confirms this observation 95% of schools within the city (WorldBank, 2005; Depeape & Hulstaert, 2014). Moreover, since the inception of the city of Lubumbashi between 1910 and 1922, the Catholic missionary Church has been a significant agent in providing a decent education by the standards of the first industrial revolution (Depeape & Hulstaert, 2014). Lastly, Mosweunyane (2013) and Kiaziku (2016) note that contemporary African students tend to rely heavily on authority within the context of education. These facts have been major causes of excessive formal built environments of schools in Lubumbashi.

Since the works of psychologists such as Jean Piaget (1966) and architects such as Herman Hertzberger (2008) and Dudek (2005) prove that the built environment has an impact on people, these architects, and more forward thinkers like Salman Khan (2012) and Christopher Day (2007) that the built environment of schools should incite children to direct their own learning, however, one should differentiate Self-directed Learning (SDL) from Self-learning (SL). While both learning methods allow learners to control their learning process, SL happens with no supervision, whereas SDL requires supervision (Brookfield, 1985). The relevance of SDL lies in the fact a certain level of structure is maintained in, which is needed in the education of children (Montessori, 1912; Garland, 2018; Day, 2007).

1.2 DEFINITION OF THE PROBLEM AND OBJECTIVES

1.2.1 Definition of the Problem



Figure 2 industrialisation of school. By Ronald Philips (2010)

Authors such as Salman Khan (2012) note that the spatial condition in conventional schools is too rigid which obstruct children's idiosyncratic ways of learning. Students whose interests are not represented in school find such places irrelevant (Hertzberger, 2008; Gatto, 2009), thus becoming passive in the learning process. This result in a lack of passion and creativity in children. Yet many revolutionary educationalists such as Sugata Mitra (2019) and as Sir Ken Robinson (2015) agree that children are naturally born with the ability to self-direct their learning process. However, the rigid environment in conventional schools in the city of Lubumbashi does not facilitate such a learning method (Dudek, 2005; Hertzberger, 2008; Khan, 2012).

1.2.2 Aims and Objectives

1.2.2.1 Aim

Considering the problem mentioned above, the aim of this research was, therefore, to explore the relationship between child self-directed learning, and the built environment within the context of Lubumbashi. The outcome of which will assist in designing a model of primary school based on such methods of learning.

1.2.2.2 Objectives

To manageably achieve the aim; the latter was dissected into the following objectives:

- Explore a chronological and conceptual development of child self-directed learning in relation to the built environment to understand far-reaching temporal causes of restrictive school design.
- Develop a critical understanding of the context of Lubumbashi, with due consideration to social, cultural, economic, and environmental aspects in relation to the learning environment at a primary school level.
- Study examples of built environments regarding the influence of pedagogy on the built environment to subtract design principles.
- Determine a building typology, architectural design principles, and a spatial configuration that are conducive to child self-directed learning within the context of Lubumbashi.
- •

1.3 SETTING OUT THE SCOPE

1.3.1 Delimitation of the Research Problem

The scope of this work is limited to exploring the relationship between child self-directed learning and the built form focusing on the spatial implications of the relationship. An in-depth exploration of the pedagogical aspect of child self- learning in primary education is an issue that has been left to professionals in the pedagogical field. This work explored other avenues in the design of places of learning that integrate the individual aspect of child learning process within a collaborative setting with due regard to the contextual factors. As such, only a partial and concise chronological development of education in the city of Lubumbashi and of European was included. The research leads to an architectural proposal which further explores the influence of child self-directed learning on the built environment.

1.3.2 Definition of Terms

- **Built Environment:** The collection of all physical human-made structures.
- **CBD**: Central Business District.
- **DRC**: Democratic Republic of Congo.
- Formal: strict and restrictive toward explorative and creative ways.
- General public: ordinary people and not people belonging to a group.
- **Initiative:** the ability to initiate a course of action independently.
- **Integral**: all-inclusive in terms of methods used.
- Learner: a person who is studies a subject (Oxford Learner's Dictionary, 2018)
- **Pupil:** (especially British English, becoming old-fashioned) a person who is being taught, especially a child in a school (Oxford Learner's Dictionary, 2018)
- Liberal: A moral or political view based on freedom and equality.
- **Natural Environment**: the existing physical and non-human-made feature from nature.
- **Pedagogist:** A person who studies theories of education; (also occasionally) a teacher (oxford dictionary, 2018).
- Secondary school: Another term for High school.
- Self-learning: learning done by oneself, without a teacher or instructor. (yourdictionary,2018)
- Self-directed learning (SDL): an instructional strategy where the students, with guidance from the teacher, decide what and how they will learn. It can be done individually or with group learning, but the overall concept is that students take ownership of their learning process (Garland, 2018)
- **Passive:** the state of being less responsive to, or interactive with, actions or initiatives from others.
- The missionary Catholic Church: A faction of the Roman Catholic Church that is generally sent in targeted geographical locations across the globe to disseminate the church faith through various means, including education.

1.3.3 Stating the Assumptions

Considering the problem of the restrictive built environment in schools, the researcher has logically assumed that primary school students and their community would appreciate the value of a school that integrate children's particularity and contextual factors.

1.3.4 Key Questions

Primary question:

To address the above-mentioned problem, the following question was posited: How can child self-directed learning influence the design of the built environment within the context of Lubumbashi?

Secondary questions:

- i. What development in understanding child self-directed learning and its built environment has been observed in the past?
- ii. What influence will contextual factors— cultural, economic, and environmental— have on the design of a primary school in Lubumbashi?
- iii. What does the study of an example of schools reveal about the relationship between pedagogy the built environment?
- iv. What typology, architectural design principles, and spatial configuration can be used to design a building supported by child self-directed learning?

1.3.5 Hypothesis

By integrating the multiple aspects of child experience in primary school, the built environment of such schools will be more inviting and explorative; hence this will stimulate creativity in students.

1.4 CONCEPTS AND THEORIES

1.4.1 Integral theory

Integral theory served as the main framework within which complementary or more specific theories and concepts are explored. This theory was developed by the American writer Kenneth Earl Wilber II in the 1970s. It is part of a postmodernist paradigm and strives to be inclusive of all the knowledge available today. Wilber (2013) states that throughout history, the following significant transformations can be identified: Agrarian; Industrial; and Informational. These technological benchmarks have been associated respectively with the following paradigms: Traditional Mythic; Modern Rational; and Postmodern Pluralistic (Wilber, 2013). Integral educators perceive human beings as complex systems that integrate a

physical and metaphysical aspect (Marshak, 2015). This research considers the implications of such aspects on the built environment of schools within the context of Lubumbashi.



Figure 3 AQAL diagram. By Ken Wilber (2013)

1.4.2 Experiential learning theory



Figure 4 Illustration of the learning pyramids. By: James Kelly (2012)

The experiential theory is relevant to this work for it integrates an aspect of learning that has often been undermined in traditional form of education. The theory explores methods of learning by doing and interacting with people. According to the pyramid of learning, also called the cone of learning, the human level of knowledge retention diminishes as learning activities become less active, less participatory, less initiative, and more passive. However, Valerie Strauss (2013) contends that many other factors influencing the retention level have been overlooked. These disagreements, concerning the learning environment and its built form, are discussed in the theoretical framework section.

1.4.3 Critical regionalism theory

Critical regionalism was used as it aims to maximize the usage of regional resources to achieve sustainable ways of production. The theory of Critical Regionalism developed by the architect and critic Kenneth Frampton was in response to the sterile modern method of production that

is devoid of contextual aspects. Frampton demonstrates how this approach is sustainable on many levels: social, environmental, and economic (Frampton, 2007).



Figure 5 Interpretation of sustainability from an individual perspective. Adapted by Author (2019)

1.4.4 Environmental literacy concept

"Environmental Literacy is the desired outcome of environmental education which strives to provide learners with: Sound scientific information; Skills for critical thinking; Creative and strategic problem solving; Decision-making" (OregonStateUniversity, 2014). This concept will be beneficial for the design of outdoor spaces.

1.4.5 application of theories

The architectural outcome of this dissertation shows that the quality of integral theory to articulate both the collective and the individual aspect of learning has led to the design of spaces with different level of privacy according to learning activities with different level of concentration. This will be explored more in the Analysis chapter.

1.5 RESEARCH METHODS AND MATERIALS

This work is conducted from an interpretive (constructivist) paradigm to interpret student's subjective experience of school.

2.7.1 Research methods

Since this study addresses the experience of a learning environment, a qualitative study was the appropriate research method to adopt because it gives an insight into individual experiences of the built environment of schools.

2.7.2 Sampling

Purposeful sampling served to study specific characteristics of two schools that were chosen as case studies. One school is in Lubumbashi, and the other school is in Durban. The school in Lubumbashi was studied to understand contextual factors that influence the architecture of learning environments, as indicated by Depeape and Hulstaert (2014). In comparison, the school in Durban was studied to empirically explore the relationship between child selfdirected learning and its built environment. Qualitative data was collected from the following:

• Students

This will help understand their personal experience of places of learning.

• Teachers

This will help to find out what they have observed about the experience of their student regarding places of learning.

• Parents

This will help to find out what they have observed about the learning experience of their children within a domestic context.

• Learning environment.

The learning environment was studied in the form an architectural analysis.

Below is an explanation of how and where data collection will happen:

2.7.3 primary data

Case studies

- *Imara School*: Having the generic architecture of schools found in Lubumbashi, Imara School serves as a subject for a study of the current learning environment in Lubumbashi. The case study comprised the followings: a site inventory and analysis of the learning environment. The analysis is continued in the chapter discussions and analysis
- *Ocean View Montessori School*: Located in Durban North, South Africa, the School formed a suitable case study for it was founded on child self-directed learning. The same process used in the previous case study was applied to this school.

• Semi-structured Interviews

This research instrument is preferred for it allows the respondent to freely respond to questions, hence increasing chances of providing honest qualitative data. Interviews will be tailored to different types of respondents.

• Ethnography

This method was chosen as well because the researcher received his primary education at Imara School.

Additional Sources of information:

The following people served as key informants:

- Mr Francis Matala Konga who is the manager of the site chosen for the architectural proposal assisted in acquiring documented information about the site.
- The school designer Derek Van Heerden was consulted to talk about the practical aspect of school design.

2.7.4 Secondary data

Literature review

Here are some of the sources of literature that was used:

- Literature from authors who have extensively written on the subject that was explored. The research included literature from authors like Mark Dudek (2000) and Herman Hertzberger (2008) for their exploration of the design of enabling learning spaces.
- Academic articles, journals and papers dealing with contemporary debates on the topic from protagonists and antagonists of child self-directed learning. This helped to identify current trains of thought and arguments on this subject.

• Precedent study

Precedent studies assisted in studying built environments based on child self-directed which was not physically accessible to the researcher. They also provided information that the case studies lack. Facilities such as the primary school in Gando by Francis Kere, and Next School in India, are studied to explore the relationship between the pedagogy of schools, the built environment, and their context.

Data Analysis

Individual behaviour in children compels this work to use a phenomenological analysis. Such analysis was preferred because it does not reduce the analysis to a Unitarian way of processing and understanding information. Moreover, using a comparative analysis in parallel with a phenomenological analysis helped to identify similarities in individuals, that can be useful in establishing more tailored and contextual design principles. Regarding the phenomenological analysis, a combination of descriptive and interpretative phenomenology philosophy will be used to analyse the collected data. Since descriptive phenomenology is free of the researcher's opinion, it assisted the researcher to not tamper with the respondent's point of views. However, as *integral theory* entails, the use of descriptive philosophy alone will limit the research as it would not take into consideration indirect subjective factors from the researcher often unknown to them (Wilber, 2013). Finally, interpretative philosophy was also used to interpret ethnographic data and to make sense of findings from other case studies.

1.6 CONCLUSION

In conclusion, looking at places of learning from a perspective that analyses multiple aspects of a child in school required this work to be structured in a way that deals with both conceptual and empirical data. Thus, this document is subdivided into two parts. The first part explores the relationship between child self-directed learning and the built environment through an academic research. The second part explores this theme through an architectural report of a design informed by the research. Moreover, the first part contains both conceptual and empirical data which are laid out as follow:

• Theoretical and conceptual framework

This section explores concepts and theories related to the relationship between the built environment and child self-directed learning (CSDL). The content explains the role of theorizing before explaining the relevance of all the theories that was explored.

• Literature review

This section looks at the work of authors that discuss the topic of the dissertation. Thus, it will shed some light on the perception of the topic and its evolvement over time and space, particularly in the Democratic Republic of Congo.

• Precedent study

Precedent studies were employed to study a built environment that explored concept like the ones discussed in this work.

• Case study

Like precedent studies, case studies explored the concepts discussed in this work but as primary data.

Analysis and discussion

This chapter forms an integrated discussion of both primary and secondary data.

Conclusion and recommendations
Finally, this section summarises the discussions and provide recommendations
regarding places of learning that need to be built based on child self-directed learning.

CHAPTER 2 THEORETICAL AND CONCEPTUAL FRAMEWORK



Figure 6 Architect and philosopher Imhotep. By Anthony Browder (2003)

2.1 INTRODUCTION

Throughout history, humans have often engaged in the activity of theorizing. Theorizing is a critical analysis of a particular subject using a chosen theory or an established paradigm, and from there begs the question as to why an individual should engage in such a tedious activity? While a lot of architectural professionals seem to ignore the importance of theorizing, the activity aims to provide a clear and comprehensive understanding of phenomena (Buchanan, 2012; Frampton, 2007). Subsequently, by studying significant theories, theorizing seeks to develop a critical mind that considers relevant factors in understanding phenomena or the issues they are trying to solve (Thorne, 200). Without theorizing, actions performed, or recommendations made on important subjects will be uninformed, unproductive or even worsen an existing problem (Nesbitt, 1996).

Theorizing forms a natural part of the research process in many fields. In the case of academic institutions such as the school of the built environment and development studies at UKZN, these problems are often of a social nature. Social science is comprised of intersubjective experiences, which refers to the knowledge shared by a group; therefore, the researcher will need a theoretical framework that allows a study of subjective experiences.

Great importance and priority should be given to the selection of a theory that accounts for the dynamic and interconnected aspects of the study. Therefore, Integral theory is chosen as the main theoretical framework. This theory presents a quasi-comprehensive perspective from which to investigate and address the issue of individual exclusivity in education through the built environment (Wilber, 2013). Integral theory integrates the individual aspect of learning within its collective context (Buchanan, 2012) , which subsequently begs the question; how can then the built environment supports such a relationship? David Kolb (2017) demonstrates that learning happens best when student experience the environment, as such, experiential theory will be used as a complementary theory to integral theory.

Finally, the critical regionalism theory is be employed, as the theory proposes to foster the contextualisation of modes of production in architecture. Importantly, as the word critical indicates, there must be a reasonable level of discernment in the inclusion of regional factors, and this, therefore, is where integral theory plays an important role that integrates such to overlooked aspects (Wilber, 2013).

2.2 INTEGRAL THEORY

2.2.1 Background

The theorist Kate Nesbitt (2007) and the philosopher Henri Lefebvre (1974) reveal that many theories are developed from a dualistic perspective. In some instance, such positions can be exclusive. For example, precursors of modern thinking such as the philosopher Plato believed in an idealistic truth which was considerably in conflict with Aristotle's philosophy depicts reality as a quasi-chaotic system striving to organise itself (Stace, 2010). Such philosophical clashes would later be revised upon the advent of post-modern movement (Buchanan, 2012). This inclusive movement was the aftermath of the modern movement lefts.

Subsequently, architects such as Venturi became some of the avant-gardists of the postmodern movement (Jenks, 2002). What modernists architects notably omitted is the multiple factors that influence the experience of built environments. For example, Mies van der Rohe's 'less is more' concept, does not account for enough societal dynamics, to that effect, Ken Wilber (2013) proposed Integral Theory to have a holistic perception of individuals within a context.



Figure 7 Oversimplification of home by Mies Van Der Rohe. By Victor Grigas (2013)

2.2.2 What is Integral theory?

Integral theory is a theory grounded in a postmodernist paradigm that strives to be inclusive of dispersed knowledge with diverse perspectives collected for a more holistic perception of reality (Wilber, 2013). Wilber (2013) adds that the AQAL diagram ensures that knowledge gathered from diverse perspectives is not randomly integrated.

2.4 The All Quadrant All Level (AQAL) diagrams explained



Figure 8 AQAL diagram and fields of studies. By Ken Wilber (2013)



Figure 9: An illustration of diverse discipline through the AQAL diagram, adapted by author (2019)

Wilber (2013) explains that the diagram in figure 6 is subdivided into four quadrants. While the top side of the figure is allocated to fields concerned with individual experience, the lower part of the diagram is allocated to fields preoccupied with collective experience. Lastly, while the left part of the diagram is concerned with internal part of either individual or collective experience, the right part of the diagram is oriented to external aspects of either the individual or the collective experience. Therefore, the following are observed:

The domain of subjective experience

Where the interior hemisphere (left) meets the individual hemisphere (up), there is the quadrant that deals with the domain of objective experience. These are experiences only encountered internally by individuals (Wilber, 2013; Esbjorn-Hargens, 2010). Esbjorn-Hargens (2009) points out that this quadrant includes phenomenological work such as the work of the French existentialist Jean Paul Sartre (1946) or the German existentialist Martin Heidegger (1927).



Figure 10 11 AQAL diagram (the quadrant of subjective experience). Adapted by Author (2019)

The domain of inter-subjective experience

In lower-left quadrant where the interior hemisphere meets the collective hemisphere, there is the realm of intersubjective experience, which refers to experience shared by a group. David long (2015) notes that this area deals with studies such as ethnography. Architects have often explored collective ethnographic perceptions for the design of public or iconic buildings, for instance, the Egyptian architect Imhotep used the shared belief of immortality among his people to design pyramids to reinforced and celebrate collective beliefs (Browder, 1992).



Figure 12 AQAL diagram (the quadrant of inter-subjective experience). Adapted by Author (2019)

The domain of objective experience

Where the individual hemisphere meets the exterior hemisphere, there is the realm of objective experience, which is defined as the experience encountered externally by individuals. Long (2015) notes that this quadrant (upper right) concerned with the aspect of the individual that can be exteriorly observed such as ergonomics or thermal comfort.

INDIVIDUAL



COLLECTIVE

Figure 13 AQAL diagram (the quadrant of objective experience). Adapted by Author (2019)

The domain of inter-objective experience

Where the collective hemisphere meets the exterior hemisphere, there is the realm of interobjectivity. This quadrant (lower right) is a network of systems such as political systems, economic systems, ecological systems, or the educational systems thus it is a domain of standard and universal conventions (Wilber, 2013; Esbjorn-Hargens, 2010; Buchanan, 2012).



Figure 14 AQAL diagram (the quadrant of inter-objective experience). Adapted by Author (2019)

2.2.5 Relationship within and between quadrants and their implications

Buchanan (2012) notes that because architecture is an interdisciplinary field, integrating the AQAL quadrants in the design process will produce a rich built environment.



Figure 15 AQAL diagram (relationships within and between quadrants). Adapted by Author (2019)

Wilber (2013) notes that these quadrants are interconnected. Therefore, the individual experience cannot be isolated from its societal context. For instance, a child might perform well in school because of support from the domestic environment. Alternatively, the design of schools can be influenced by the political system as in the case of school-based on the Prussian educational system (Gatto, 2009).

Long (2015) notes that this relationship can happen within a quadrant (intra-relationship) and extends to another quadrant (inter-relationship). For instance, in the inter-objective quadrant, the economic system of a country can exert pressure on the industrial system to reach a higher production of commodities (relationship within a quadrant). Under such pressure, this industry might prioritise production over the safety of the ecological system (Roncin, 2009). Consequently, polluted air jeopardises the health of students in a school and impact their productivity.

Based on the causal relationship between architecture and people as elaborated by the architect Tadao Ando (2012), it can be observed that the relationship between quadrants is like an equation involving different factors; the variation of one will affect the remainder. Therefore, the value of architecture is dependent on how designers establish the relationship between the subjective, the intersubjective, the objective and the inter-objective aspect of human experience of the built environment.

Consequently, this work explores the influence of Child self-directed learning on the Built environment by using a dialectic method that establishes a relationship between the collective and the individual aspect of places of learning.

2.3 EXPERIENTIAL LEARNING THEORY

2.3.1 Introductory note and definition



Figure 16 Kolb's cycle of experiential learning. By Karin Kirk (2018)

Experiential learning used through the lens of integral theory serves to integrates an aspect of learning through actions. According to the pyramid or cone of learning in fig 11, a person's level of retention diminishes when education very abstract (Strauss, 2013).

The Learning Pyramid



Figure 17 The cone of learning. By James Kelly (2012)

However, Sydney Strauss (2013) contend that the benefits of experiential learning are overvalued at the expense of other factors influencing the retention. Therefore, King (2009). Notes that the cone of learning should integrate the following factors:

- The age of the person who is learning.
- Psychological conditions.
- Environmental circumstances under which they are learning.

2.3.2 Architectural implications of experiential learning theory

The way space is configured, and the positioning of various elements denotes a method through which the designer can intentionally convey a message, via an architectural language, that invites children to be part of a learning experience by using their senses (Littlefield, 2012; Dudek, 2005; Hertzberger, 2008). Hence a child can learn a subject in their natural context and develop not only a mental memory but also a sensory one
2.3.3 Playing is a serious business!



Figure 18 illustration of play. By Kinjo Shiguru (2010)

Dr Gray (2011) notes that playing is an essential part of the learning process. While the traditional way of teaching rarely considers playing as a method of learning, Dr Transwick (2005) play motivates understanding to participate in the various activity. This view is supported by the research undertaken by the educationalist Sir Ken Robinson (2015). In the book 'the creative Mind' the author argues that school should focus more on exciting activities which incite creativity.

Moreover, the psychologist Jean Piaget (1966) notes that children are hyperactive and cannot learn from books only. Therefore, Integral theory aims to integrate individual experience in places of learning; however, the integration should include the collective or contextual aspect as well. For this reason, Critical regionalism are added as a complementary theory.

2.4 CRITICAL REGIONALISM

2.4.1 Background

The expansion of globalisation births a new mode of production characterized by global standards. Although this movement facilitated efficiency in construction, regional context had often been neglected, hence creating social, environmental, and economic problems such as the disconnect of architecture with cultural values or global warming caused by buildings emitting excessive carbon dioxide due to overreliance on mechanical ventilation as a result of poor building orientation. On this account, theorist Kenneth Frampton developed critical regionalism. Frampton (2007) advocates for a mode of production that responds to regional factors with due regards to environmental, and economic factors. Separately from the phenomenon of globalisation, many African cities have experienced an abrupt disconnect from local factors due to colonisation (Mosweunyane, 2013).

2.5 ENVIRONMENTAL LITERACY CONCEPT

Unlike adults, children do not spend much time engaged in too many intellectual activities, but rather, their actions are generally dynamic. As mentioned in the experiential learning theory section, children learn much by doing; hence, the environmental literacy concept aims to provide a system of environmental taxonomy that learners read through their senses to understand the environment (Garland, 2018). This taxonomy can then be reinterpreted and reimagine through their experience.

2.5 CONCLUSION

This work was developed from a research question that initiates an exploration of places of learning that are inclusive of children's experiences. In conclusion, the research of authors such Hertzberger (2008), Dudek (2005), Khan (2012) and many more suggest that places of learning should be looked at from an integral approach to foster exploration and creativity. This is because human experience has multiple aspects. Integral theory helps inclusively explore these aspects. The theory integrates other complementary theories that are relevant to the topic of this work. Some of these complementary theories are experiential learning theory and critical regionalism.

Experiential learning theory has been chosen for its integration of the natural environment to spaces of learning that encourages adaptive, creative, and more explorative ways of learning.

This theory can help develop an environmental taxonomy that accounts for children's individual characteristics within a collective context. Such contexts provide places that accommodate groups of individuals ranging from a small-scale group such as a classroom to a larger scale group such as a school or a community within a city. Therefore, the use of critical regionalism will help explore places of learning in connection with their surrounding communities.

Finally, a literature review is a necessary tool to explore points of view regarding theories and concepts discussed in this section, thus; the following chapter is a review of works on the topic of this research.

CHAPTER 3 LITERATURE REVIEW



Figure 19 Literature. By R.W. Emerson (2019)

3.0 INTRODUCTION



Figure 20 quality vs quantity. By T Williams (2008)

David Littlefield (2012) and Mark Dudek (2005) note that school developers often rush into completing the construction of schools without giving much thought into the appropriate spatial quality hence, many schools are often built in an outdated fashion. Dudek (2005) notes that the problem of the quality of spaces in schools needs to be addressed first. This raises a fundamental question: What is a school used for?

The contemporary definition of school implies that school is solely for educational purposes; however, the latter ought to be understood much deeper.

Stace (2010) explains that the word 'education' comes from the Latin word 'educere' which means 'to lead out of'. In ancient Rome, the term was used to make an inference to the concept of leading a child out of their childhood state into an adulthood state because children were not considered to have reached their full abilities (Brookfield, 1985; Garland, 2018). When pushed to its radical development, this concept focuses on adulthood at the expense of the merit of childhood. Even though this work does not subscribe to the complete Greek etymological meaning of the word education, it nevertheless supports the conceptual understanding that makes inference to leading a child from one place to another. Within the context of this research, 'education' is used to undernote the original Latin meaning which refers to leading a child from a place of unawareness to that of awareness or self-discovery as supported by Marshak (2015).

Moreover, the emphasis on educating children is on leading and not forcing a child in any specific or predetermined direction, which implies a certain level of autonomy from the child during their learning process. This perspective brings the word 'education' closer to the word

'learning'. Besides the etymological definition of the word education, there are also contemporary definitions of the word with an emphasis on social values.

This emphasis seems to transcend geographical and cultural boundaries; however, there are some nuances in the understanding of the word education, particular to the African context. Psychologist Dr Peter Gray (2011) postulates the first definition and presents a general understanding of education as the process of acquiring knowledge that is important for the survival of a society. At the same time, the second definition is elucidated by the African academic professor Abdou Moumouni and quoted by Mosweunyane (2013). In this definition, education is that which prepares a younger generation for integration into their society to maintain and improve cultural values (Mosweunyane, 2013).

Considering these nuanced definitions; education has multiple implications that can be placed in two categories (Hertzberger, 2008). The first category is that of individual implications. This category is crucial as one needs to discern the dormant potential of a child that should be awakened. The second category implies collective implications. In this category, the individual aspect is a complementary part of a whole (Aurobindu, 1998; Kamwangamalu, 2007; Mosweunyane, 2013).

In the aim of supporting this perspective on education, many educationalists such as Sugata Mitra (2019), Salman Khan (2013) and Sir Ken Robinson (2015) share parallel ideas with architects such as Hertzberger (2008), Christopher Day (2007) and Mark Dudek. This perspective on education is conducive to better environmental conditions to support child learning processes. What the authors above agree on is the idea of moving from formal approaches of learning to more flexible and individually tailored approaches such as Child Self-Directed Learning (CSDL); however, such ideas need to be concretised, and that is where architecture immerge.

To illustrate this point, the founder of Next school, the educationalist Parmeet Shah (2018) made an interesting analogy between schools and computers. Shah explains that when computer manufacturers upgrade their product, they do not upgrade only the operating system but also the hardware, lest the new system underperforms due to inadequate physical support; the same principle applies to education. Both the educational system and its supportive built environment need to be improved for better results in the learning process.

The impact of this pedagogic paradigm shift on the built environment will constitute the focus of the literature review. Thus, the latter is subdivided into three major parts which are

three different perspectives from which to look at the relationship between CSDL and the built environment. The first part is a chronological perspective; the second part is a thematic or conceptual perspective, and the third part is a Contextual perspective.

The chronological perspective will provide historical background and development of the concept of learning at different times. The thematic perspective will explore the conceptual ramifications of CSDL and its implications on the built environment. Finally, the Contextual perspective will Contextualise, both previous views, geographically and socially to understand the current state of places of learning in Lubumbashi

3.1 A CHRONOLOGICAL EVOLUTION OF CHILD SELF DIRECTED LEARNING IN RELATION TO ITS BUILT ENVIRONMENT AND THE PROBLEM OF FORMAL SCHOOLS.



3.1.1 Education in places where life happens

Figure 21 An illustration of a child apprenticeship in a hunter gatherer society. By C. Agostino (2009)

Dr Gray (2008), notes that in ancient times, before the popularisation of conventional schools, children learned by self-directed exploration, and by self-directed play. He adds that this was mainly observed in hunter-gatherer bands. Members of such bands, Gray extrapolates, did not operate based on a structured system but by consensus concerning communal issues, such that the same perception of life was extended to the education of their children.

Furthermore, because hunter-gatherer bands lived a nomad life, their children must have learned valuable lessons about the ways of life of their societies as they moved from one place to another. Thus, as anthropological research by John Lancy (2010) indicates, there were no specific spaces allocated for education - education happened everywhere.

Consequently, it is logical for Garry Hewlett (2016) to note that the education children from hunter-gather received was practical and closely related to their regional context. Based on the work 'the eyes of the skin' by the architect Juhani Pllasmaa (2005), one can deduce that the natural environment within which children played made it possible to explore all the natural senses. On the same note, Hall (1987) explains that perception of the physical environment does not happen as a simple collection of all the senses, but as a synchronic event in which all the natural senses work mutually and simultaneously to perceive reality.

The educationalist Kalala Omotunde (2007)) notes that even in Ancient Egypt, the oldest civilisation, children did not receive formal education except for a few children. Anthony Browder(1992) adds that children who did not receive formal education were nevertheless well-informed in terms of empirical knowledge for they spent much time playing in and exploring their physical environment. Furthermore, the psychologist Dr Jeffery Trawick-Smith (2013) reveals that uncontrolled environment such as nature leaves room for creativity in children's play. This logic is in line with Experiential theory which supports learning by doing. On the same notes, Hertzberger (2008) states that environments such as cities leave room for surprise and discovery, which brings forth innovative ideas. However, learning in places where life happen disappeared as societies developed into a more controlled environment.

3.1.2 The impact of formal education on the built environment

Joseph Korterski (2005) reveals that in the European Middle Ages, the power the Roman Catholic Church (RCC) benefited gave the institution control over the type of education that was to be considered acceptable. Salman Khan (2012) notes that medieval education was subdivided into three categories. The first and foremost category was the education of religious

leaders as the focus was mostly on spiritual matters. The second category was an education in chivalry, and lastly an education in craftsmanship. Nevertheless, most people were not formally educated. Cordasco (1963) also notes that this educational system was characterised by an emphasis on following rules grounded in Christian values and that the human body was to be denied if one had to obtain a better life after death. Therefore, Pope Benedict I adopted a monastery lifestyle to the education of Christian monks (Ferzoco, 2000).

Since religious education was the central, freedom was discouraged. This marked the orientation towards formal education in Europe. During this period, there was a disconnect between monastery formal education and life in the city (Cordasco, 1963). The sense of sight and hearing seemed to have been the most prominent senses in mediaeval education as these senses were useful for religious literature. Education became more of a passive activity that happens indoors (Gray, 2008) so it is not surprising that the built environment that supports this form of education occurs in secluded monasteries, disconnected from the physical experience of the city. This education encouraged a certain level of detachment from physical senses through an austere living and the denial of physical pleasure.



Figure 22 Holy trinity Monastery. By Fernando Diaz (2007).

Subsequently, members of the Roman Catholic Church such as Peters Abelard and Thomas Aquinas attempted to reconcile religious and secular affairs. From there, catholic education adopted the concept 'mens sana in corpore Sano' which means: a healthy mind in a healthy body (Cordasco, 1963). One of the major architectural implications of such a concept was that the explorative and multisensory aspect of the built environment was recovered in the learning process (Ferzoco, 2000; Khan, 2012). Outdoor activities such as excursions, sport etc. were to be integrated into places of learning. In addition, sports facilities and artistic centres were being integrated into schools; however, control over the student's path of learning remained in the hands of educators (Ferzoco, 2000).



Figure 23 An adaptation of the Vitruvian Man to illustrate a holistic development of the human being (mind, body, spirit). Unknown Author

Later, in the industrial age, formalisation of education was even more widespread and crystallised through the built environment with the advent of the Prussian model of education which was established on the principles of the first industrial revolution based on mass production which led to mass education (Gatto, 2009). Salman Khan (2012), the founder of khan academy, notes that the aim was to produce a large workforce to work in factories to maximize the quantity of the production of items. For efficiency, every item on the production line had to be controlled. This ideology swept the learning environment such that students were treated has items on a production line. Although the Prussian model of education had some socio-economic and egalitarian advantages such as free and equal education, such achievements were reached at the expense of individual authenticity (Khan, 2012).



Figure 24 An illustration of a Class based on a Prussian system of education. By Gatto (2009)

Although this model was ground-breaking in the European eighteenth century as an imminent need for labour in factories imposed, new findings and the change of times have revealed that quality of education is the biggest problem (Gatto, 2009; Khan, 2012; Hertzberger, 2008; Robinson, 2016). The problem with the Prussian model of schools is that activities of learning carry the same connotation as that of work as a mandatory duty thus. In addition, motivation

for learning has diminished, and one does not even have to get to the curriculum of a school to realise this problem since the built environment conveys this message first (Dudek, 2005; Day, 2007; Hertzberger, 2008).

The built environment conveys a functional message about the way it ought to be experienced by either whispering or shouting, depending on the overtness of a design (Simitch, Adre and Warke, Val, 2014); therefore, formal school architecture discourages the student from exploring their different skills.

Although certain aspects of formal education such as corporal discipline have changed, currently, schools are fundamentally established on principles of the first industrial revolution, particularly in Africa as the quantitative challenge to education is still being resolved (Depeape & Hulstaert, 2014; Lagae, 2014; WorldBank, 2005). If Dr Maria Montessori, perceived that there is a need for a better system of education and better-built environment, in 1909, so how much of truth is this observation is today? Moreover, Khan (2012) points out that in the fourth industrial revolution, students do not only learn in school but from home as well. This change propels schools to revise the nature of their places of learning. How then can architecture address such new relationships?



Figure 25 Home-based learning. By C. Sequoia (2016)

As a result of the link between school and the domestic environment, Khan (2012) notes that school is not the exclusive domain of learning anymore. The evolution of the internet has ensured that an individual can learn a subject like mathematics relatively easily from the comfort of their home; therefore, the domestic spaces and the academic space are now more than ever equally important.

Moreover, virtual space emerged with the advent of the fourth industrial revolution (Luckan, 2016; Dudek, 2005). Modern-day school designers now need to grapple not only with the relationship between domestic and academic spaces but also with their relationship to the virtual space. Although space can be said to be intangible through natural senses, architectural space is nevertheless less intangible compared to virtual space. Exploring the relationship between the two with due regard to its service to child learning is a complex endeavour that cannot be comprehensively covered in this work.



Uninspiring spaces

Figure 26 Why is school so boring? Daniel Denvir (2015)

Hertzberger (2008) notes that formal school oversimplifies factors that influence places of learning; thus, creating a disconnect between building and users. The disconnect results in a situation where places of learning suffer the followings:

- A negligence of the multiple aspects of individuals.
- A disconnect between the individual and the collective aspect of learning.

- A separation of the school from home.
- A separation of school from the social context.

In the first and the second situation, in which the individual and collective aspect are neglected, Mark Dudek (2005) And Hertzberger (2008) note that lecturing or teaching has become the primary way of educating as opposed to learning. This has undoubtedly influenced the way the built environment has been designed, particularly the classroom. Hertzberger (2008) shows how a classroom, the focus is given to the teacher by directing all furniture towards the front whereas the focus should be on students since they are the ones that are being educated.

In the third situation, the isolation of the academic environment from the domestic environment is not in consonance with integral theory because the child is the common element between school and home. In the fourth situation, the design of places of learning barely considers the social context; thus, children experience a confusing contrast between places of learning and the city. With this pervasive isolation of school from significant aspects of students' lives, it is no surprise that Khan (2012) finds commonalities between school design and institutions like prisons. Indeed, places like prisons are the only places that are designed to isolate people from society; As such Hertzberger (2008) points out that the tendency to control everything that happens in school, even the creative process, is intimidating to younger students. Thus, establishing a relationship between learning and space by suggesting that the mind ought to be a network of connections rather than an entity with limited storage space, for one never stops learning.



PRISON

SCHOOL

Figure 27 Similarities between conventional school and prison. Scot Schmidt (2013)

Hertzberger (2008) further elucidates that since mental space is expansive space for learning should also extend beyond the context of classrooms and school boundaries into the city. Moreover, with the advent of the internet, the learning space expands to the rest of the world (Khan, 2012). This integral perspective on the built environment of places of learning is what the next section of this chapter will explore

3.2 AN INTEGRATED APPROACH TO LEARNING AND THE BUILT ENVIRONMENT

3.2.1 Background

"A stimulating environment is an environment that appeals to you, that provokes you and stimulate you to act." (Hertzberger, 2008, p. 71).

What is school good for? Can children not learn outside of school? These are questions that challenge the validity of conventional school. As shown in the preceding section, the word education can bear different meanings. For instance, in Africa, as noted by Mosweunyane (2013), education is closely related to preparing children to fit into society. In this case, education has a collective value that needs to account for in the design of places of learning, while in other instances education is about revealing potentials that lay dormant inside children (Mitra, 2019; Robinson, 2015). How can the two approaches to education be reconciled? Continuation of such a quest will require a certain level of discernment: one needs to perceive how elements of each approach can come together to form a more robust and integral system.

3.2.2 Individual space and collective space

The first issue related to places of learning raised in the section above is the alienation of the individual aspect of the learning from its collective context. The French philosopher Henry Lefebvre (1974) states that life is full of dualities which create a dialogue between two seemingly contradictory entities. Furthermore, Hertzberger's remark that education is not just about an individual adapting to an environment but the surrounding adapting to the individual as well illustrates one of such dialectic dualities (Hertzberger, 2008).

The dialectic relationship between the individual aspect of education and its collective part can construct a complementary condition which can be translated in spatial terms. Hertzberger's architectural translation of the dialectic mentioned above leads to individual spaces and collective spaces articulated according to a different need; thus, the individual aspect presents a phenomenological sensitive to subjective experiences, while the collective aspect brings a sociological aspect that accounts for shared experiences. How then does the individual relate to the collective?

Relationship between the collective and the individual aspect of learning and its influence on the built environment

The psychologist Dr Brian Little (2015) states that based on personalities, individuals can mainly be categorised as introvert and extrovert. The introvert, Dr Little explains, spends most of the time in personal spaces to get mentally stimulated whereas, the extrovert tends to spend most of the time in social spaces to get mentally stimulated (Little, 2015). The researcher thus concludes that extroverts are more collective spaces, while introverts are predominantly in individual spaces (Dudek, 2005; Day, 2007; Little, 2015).



Figure 28 Example of Introvert and extrovert space. By Mohammadreza Bemanian (201)

Moreover, Jane A. G. Kise (2014) shows that these two personality types can be elaborated in many other personalities, hence asserting that individuals are complex beings. Therefore, Sir Ken Robinson (2015) demonstrates that when these complex individualities blossom, creativity emerges. Nevertheless, for this to happen, individuals need to be in the right environment.

Collective space often has characteristics which conflict with the individual space. Although the latter might require quietness and serenity, the former imposes loudness, restless interactions and so on. This conflict creates a tension that yet leads to a dialogue between the two learning spaces.

The spatial condition a school needs will need to articulate the two spaces with no infringement on privacy, concentration and so on. The ontological Ubuntu concept clarifies the importance of such a dialectic existence. The saying 'I am because you are' demonstrates

that although the individual is recognised as an entity on its own, it belongs to the collective (Kamwangamalu, 2007). Besides, Maslow's triangle of human needs shows that belonging is a precursor to creativity (King, 2009). The hierarchy of needs indicates that places of learning should prioritise a sense of belonging in learners by adapting the environment to their needs and by facilitating their Self-directedness.



Figure 29 Hierarchy of needs. Vipul Rastogi (2015)

Furthermore, an argument can be made based on the seminal work of psychologist Jean Piaget (1966) that younger students in their preoperational stage of development may lack self-reflectiveness qualities needed for self-directness. While this concern is valid, developmental stages in children can vary from one individual to another, regardless of age and gender but rather based on different factor ranging from their personality's environments (Brookfield, 1985; Garland, 2018; Lancy, 2010; Piaget, 1966). On the same note, Montessori posits that even though younger children lack self-reflectiveness, they can nevertheless learn such qualities by interacting with older students (Hertzberger, 2008).



Figure 30 incidental learning between children of different ages. T Huston (2016)

Luckan (2016) refers to this learning as incidental learning and suggests that architects should create interactive spaces for this purpose. This type of learning can also happen on a subconscious level when one happens to be in a collective space with multiple human interactions for collective space has the potential to stimulate students to freely move from one point of interest to another (Hertzberger, 2008; Day, 2007; Luckan, 2016; Dudek, 2005).

Luckan (2016) also adds that places such as cities provide space for incidental learning. For this reason, Hertzberger (2008) notes that a school can function as a city. According to the

urban theorist Kevin Lynch (1960), cities are often articulated in a way that spatial quality ranges from public spaces to private spaces. Furthermore, Francis Ching (2015) mentions in the book Form, Space and Order that centralised spaces can function as public gathering around which less pronounced private spaces are articulated. Likewise, Hertzberger's analysis of a Montessori school in Delft illustrates Ching's point about how a centralised space functions such that the school has a centralised hall around which classrooms are developed (Hertzberger, 2008). Furthermore, Hertzberger (2008) proposes that a school should not only function as a city but also needs to be connected to the latter to expose children to an environment that is full of knowledge and is empirically constructed (Hertzberger, 2008). This addresses the problem of the separation of the school from society.



Figure 31 Integration of the academic system with the domestic system and the social system. By Joel Nitzberg (2012)

3.2.1 The relationship between school and home



Understanding the implications of a home

Figure 32 The warmth of a home. By Kim Sargent (2004)

Hertzberger (2008) notes that most conventional schools are unattractive because they do not have the same characteristics as a home. No wonder why in everyday usage of words, people make several positive inferences to home. For this reason, the architect Christian Norberg-Schulz (1971) notes that the word dwelling is used in the domestic context as to emphasis the act of remaining in a comfortable environment. Interestingly, the word to remain in the German language originated from the word to build; thus, the act of building is not a process with a starting and ending point but a lifelong process. This is to say that the design of a house is not completed by an architect or professional, and until the house is occupied, it is not yet a home. As a result, Lefebvre (1974) notes that space, as proposed by architects, can turn out to be more than, or even completely different, from the original design.

In contrast, anthropological work by Hewlett (2016) shows that for one to remain in a place, they first must trust that the place is safe, both physically and psychologically. Norberg-Schulz (1971) points out that a welcoming place does not just have characteristics that are appropriate to the host of the place but should anticipate and address the needs of guests as

well. This activity occurs by perceiving the environment from the point of view of the guest. Yet Hertzberger (2008) notes that students often feel like strangers in classrooms where the teachers function as the host rather than being given a sense of ownership of the classroom space hence the following pages will address the integration of domestic spatial quality in school.

A home-based school: relationship between home and school



Figure 33 Learning from a domestic environment. By W. Anna (2017).

If, as shown above, home is where everyone wants to be, a question should arise as to why conventional schools do not look like a home. Much like a home, a school need to make students feel safe physically and psychologically, and this is the starting point in inciting a passion for schools in students (Montessori, 1912).

As noted above, Hertzberger (2008, p. 71) states that in conventional schools, students are like visitors in classrooms where teachers are in charge. Although it is important to have adult supervision, this situation is more likely to intimidate students. Hertzberger (2008), states that the need to have a welcoming place to fall back on, that provides safety or protection, is a biological need animal have had for a long time. Disregarding such needs acts against nature and creates an unproductive tension between students and the built environment in school.

However, this is not the only factor that threatens a harmonious relationship between students and the built environment in places of learning; the internet, although necessary for facilitating access to information, impedes both the interaction between humans and the built environment and the interaction between humans (Hertzberger, 2008; Dudek, 2005). This is crucial for collaborative work in school. Therefore, Hertzberger (2008) asks whether a school can compete with the world of the internet that is capable of capturing people's attention in an instant.

School in the age of the internet

Figure 34 How do we experience virtual space? By S. Roman (20016)

"We need to look for a form of learning space with a wider range of experience as is found in the city and in the world of internet." (Hertzberger, 2008, p. 69)

Hertzberger (2008) suggest that school should be more flexible to adapt to the age of the internet where everything is volatile and constantly changing. Nevertheless, he does not mean that the structure of a school itself should be changing; on the contrary, the structure of the school should be the one thing which must stay stable as a datum to all other elements which can vary according to time and circumstances (Dudek, 2005; Hertzberger, 2008; Day, 2007).

Furthermore, as shown above, Salman Khan (2012) notes that the internet is not just changing the intrinsic organisation of the school, but also its relationship to the domestic environment. Because the internet has made access to knowledge possible from home, school cannot just be a place of instruction. What is then particular about school? Many authors (Day, 2007; Mitra, 2015 Dudek, 2005; Hertzberger, 2008; Alexander 1977) agree that places of learning

can work as cities with a 'marketplaces' where knowledge, which can be acquired from elsewhere, is exchanged and critically processed. So, yes, school can compete with the internet, but only by providing something original that the internet cannot: a physical experience. Contrary to the immaterial world of the internet, the built environment can provide support for such experiences (Hertzberger, 2008; Robinson 2015).

School as a community

In the book, a pattern language, Christopher Alexander (1977, p. 233) compares places of learning to a marketplace. Herman Hertzberger (2008, pp. 112-201) also create a parallelism between school and city. All these comparisons denote that places of learning are not meant to function in an enclosed fashion as they do today. Similarly, Maria Montessori (1912) states that Schools are intended to prepare students for life. Students need to be exposed to an environment like found in an urban environment to have a better understanding of social life. Today, this view has even stronger evidence from professionals in different disciplines, such as psychology, anthropology, and education (Garland, 2018; Smith-Trasick, 2013; Gatto, 2009). While Kise (2014) argues that such an environment can distract a student's learning processes, Gray (2011) points out that such conditions are an opportunity for children to learn about conflict resolution. With reference too Alexander's parallelism between a marketplace and places of learning, such spaces function as space within which an exchange of knowledge can happen; thus, for a school to act as a city, it would need an architectural organisation like that of a city (Hertzberger, 2008).

Based on the parallelism between school and city, Hertzberger proposes a model of spatial condition that considers connections between different spaces according to functionality. The researcher presents this idea in buildings such as the Montessori in Delft which will be studied in the case study section.

Classroom articulation

The absence of an experiential learning approach led to a spatial organisation in which students' sit in classrooms that are designed with the primary focus on the teacher. Integral learning school activities must transcend the boundaries of a classroom and extended to the outdoor space, even one with naturally untamed landscape for exploration (Aurobindu, 1998;

Day, 2007; Dudek, 2005; Hertzberger, 2008). Moreover, Dudek (2005) notes that the school building is a third teacher along with parents and teachers as they all have the potential to stimulate passion in children. For instance, school designers can provide outdoor spaces for students to learn lessons through enjoyable activities such as gardening. There is so much that can be learned by extending the classroom beyond four walls hence offering many options for practical exploration to accommodate diverse individual needs. Furthermore, experiential theory demonstrates that learner's retention increases with practice.

However, the classroom space defined by walls is still important. Such spaces provide shelter, physical protection against elements and psychological security against overexposure to other individuals, which is particularly important for children with high introverted tendencies (Kise, 2014; Smith-Trasick, 2013; Hertzberger, 2008; Little, 2015).



Figure 35 Spatial conditions for learning. By Herman Hertzberger (2008)

What about standards? The realm of inter-objective experience in places of learning

Apart from the individual and collective aspect of education, as the AQAL quadrant suggests, there is the standardisation aspect of places of learning that should be considered (Buchanan, 2012). The content of such aspects is often internationally acknowledged and fall under the domain of objectivity and inter-objectivity (Wilber, 2013). For instance, hygienic norms, prevention against hazardous conditions and ecological rules are issues to be addressed regardless of contexts. Such aspects are often of global concern. As such, school building standards regarding ergonomics, building services and so on have been explored by researchers such as David Littlefield (2012) and Ernst Neufert (2019). Nevertheless, different regions often have some variation in standards that regulate the construction of schools.

3.3 THE IMPACT OF REGIONAL FACTORS ON PLACES OF LEARNING: A CASE OF LUBUMBASHI

3.3.1 Background

"The phenomenon of universalization while being an advancement.... constitutes a sort of subtle destruction, not only of traditional culture which might be an irreparable wrong, but also of the creative nucleus of great civilisations and culture so that the nucleus is based on that which we interpret as life..." (Ricoeur, 1961)

One need to note that the word 'culture' in Ricoeur's view does not mean static and vernacular exclusively. Still, it connotes a dynamic way of life that incidentally happens according to the need of a region (Frampton, 2007). Furthermore, while race is a static characteristic of a group, culture is a dimensional entity subject to change (Chin Lin, 2008). The etymological meaning of culture implies a constant development; like in its derivative word 'cultivate', it is about sustaining and maintaining in good shape what is expending. 'Culture' is then perceived as an evolving collection of modes of existence and is particular to a region. This dynamic perspective on 'culture' creates a relationship between a city and a Self-Directed Learning (SDL) based schools, as both have a constructive approach.

Within this, a relationship Hertzberger explains that school functions as a micro-city and the city functions as a macro school (Hertzberger, 2008); hence, the two can also mutually influence each other. First, the city shapes the type of school it requires. The primary school in Ganado designed by Francis Kere, which will be analysed in detail in the section 'precedent study', is a prime example of this case. Second, the school shapes the city since

the latter can constantly and critically revise the shape of the city to meet societal needs. Ricoeur notes that such events can come with the risk of suppressing or the opportunity to optimise cultural values, depending on how well constructive judgement.

The city of Lubumbashi has not benefited much from this potential dynamic relationship with the school. Decease's observation indicates that the relationship that exists between school and the city of Lubumbashi is limited and static for little has changed since the implementation of conventional schools in the city in the late nineteenth century. The fundamental philosophy behind education has created unproductive and unresolved contradictions with the regional culture (Depeape & Hulstaert, 2014). Again, the word 'culture' has more to do with relevance than a mere historical heritage. However, Depeape notes that people's resilience in sustaining the existence of school in Lubumbashi, despite socio-political and economic challenges, could be part of making or developing regional culture (Depeape & Hulstaert, 2014). Indeed, such modes of survival will constitute an element of the local culture; however, this is insufficient as it mostly addresses a quantitative problem (World Bank, 2005).

To dissect the level of relevance of the current place of learning in the region of Lubumbashi, one needs to understand the contextual background of the city of Lubumbashi. Understanding such background will be the focus of the following section.

Geographical context

Lubumbashi, formerly called Elisabeth Ville, is an African city located in the southern part of the Democratic Republic of Congo (DRC). The city is the economic capital, the second-largest city of the country and is situated 110 180 km northwest of Ndola, Zambia. Belgian colonists created the city of Lubumbashi in 1910 because of the large reserve of copper.



Figure 36 Lubumbashi location. From World maps (2019)



Figure 37 Extent of Lubumbashi. Google map adapted by author (2019)



Figure 38 Arteries in Lubumbashi. From HB Sketches (2019)



Figure 39 Areal view of Lubumbashi. By Kasungu Goy (2018)



Figure 40 Architectural heritage of Lubumbashi. By M Balaka (2009)

3.3.1 The vestige of a civilisation: socio-historical context

Lubumbashi is predominantly occupied by Africans whose culture need to be understood life to contextualise all that has been discussed in the sections above. African wisdom and philosophy were generally stored in proverbs; particularly because during the pre-colonial period, the Bantu societies did not transfer Knowledge in writing but by word of mouth (Kiaziku, 2007).

Precolonial time and African Philosophy

'It takes a village to raise a child'

'A child, one does not instruct on return, one instructs them when going'

KalimaQuotes (2018)

The above African proverbs are a quintessential depiction of the African perspective on education and the relationship between a child as an individual and society. During precolonial time, Congolese children benefited from the value of such proverbs through everyday survival activities such as fishing. Such children would have had opportunities to observe, more often than the modern child, natural surroundings. Moreover, when children reach the teenage period, they had to go through an initiation rite as a way of maturing. This was a form of formal African education (Mosweunyane, 2013; Hewlett, 2016; Mosweunyane, 2013).

The individual in society

'It takes a village to raise a child'

KalimaQuotes (2018)

This African proverb shared from West African counties, throughout central Africa up to sub-Saharan Africa, has often been part of the backbone of African education. The concept brings much emphasis on the context within which the child is raised (Kiaziku, 2007). Proverbs, like the gives an insight into the concept of raising a child as an individual within an African cultural context. The concept of a community participating in the raising of a child is certainly not exclusive to Africa; nevertheless, it is inherently connected to the African Ubuntu concept (Louw, 2006; Kamwangamalu, 2007). It can then be safely postulated that in the Congolese cultural heritage, the complementary duality between individual and collective entity was important and would have been handed to the next generation. Such an act would have been a form of education, therefore. However, does this perception still exist today? Literature reviews show that the situation is different.

The impact of the first encounter between precolonial Congolese and Europeans on the education.

The forceful assimilation of Congolese to Belgian colonists was an abrupt clash between the local culture and the western culture (Depeape & Hulstaert, 2014). Frampton demonstrates that universal culture and local culture are in a delicate balance because both are important for an integral mode of operating in the current age. Reybrouck (2008) notes the balance existed since 1885, which marked the start of a drastic change of culture for many Congolese due to colonisation of DRC. Reybrouck (2008) adds that to convert some Congolese to the Christian faith, catholic missionaries in the DRC would uproot many from their social context and infuse them in a completely strange Western and Christian context. This radical approach adopted by catholic missionaries was, however, implemented at the expense of the integrity of the local culture, especially cultural aspects with values such as the acute sense of community (Mosweunyane, 2013; Kamwangamalu, 2007).

Moreover, Depeape and Hulstaert (2014) note that the former Congo-Belgian government used education as an instrument of power and control (Depeape & Hulstaert, 2014). Nevertheless, the same education became an instrument of to achieve an arguable independence from the imperial Belgium thus Depeape notes that: "...for this liberation, Congo initially put its hope in a completely Europeanised education system ...But by accepting a Western-style education system-and thus, more or less the continuation of the colonial elitist education-based on social mobility, Congo also accepted a long term financial, cultural and human resource dependency..." (Depeape & Hulstaert, 2014, p. 17).

3.3.2 Locked in a Matrix: The aftermath of the extremes of formal schools in Lubumbashi

When DRC received its independence in 1960, the new nation did not have enough intellectuals to revise and contextualize education and its built environment. The latter had remained in the original form until an attempt by the former president of the DRC (formerly

called Zaire) was made to render education authentic and relevant to the country. This was part of what was supposed to be a bigger movement called 'Retour à l'Authenticité' (Lagae, 2014).

The real intention behind the so-called movement was unclear for reasons that will be explained. Mobutu, the former president of DRC points out that the 'retour a l'Authenticité' was for people to embrace and celebrate their cultural values according to their origins. Like the argument, the Theorist Kenneth Frampton advances about critical regionalism, 'retour a l'Authenticité' was meant to be critical and apply discernment in its implementation. However, although such a movement appeared to be promising in theory, its implementation regarding school was a political distraction, and the revision of the educational system and its built environment, which was meant to achieve the desired authenticity was superficial (Depeape & Hulstaert, 2014). The implementation was limited only to a change of some reading books, instead of a change of philosophy on which school were designed. For instance, Depeape notes that during the colonial period: "…the DR Congo had opted an education suitable for industrialised countries while 80% of the population was employed in agriculture".

Worse still, European schools on which Africa schools were moulded, have been changing their pedagogical system and by extension, the built environment, since the 1970's while African schools still consider access to formal education as a form of luxurious development (Depeape & Hulstaert, 2014; Dudek, 2005). One of the reasons European formal education became accepted in Africa as if it was part of African culture is because, over time, African were inclined to respect rules set by authority (Brookfield, 1985). However, this was a miss adaptation of an African paradigm as authority in Africa was assumed to advance conventional norms and rules relevant to the African context. Indeed, there is a place for rules and structure; nevertheless, excessive, and misplaced control and instructions in school tend to kill creativity.

Incongruity between local cultural heritage and its built environment

A conflict caused by a collision, rather than a harmonious fusion, of two cultures, appears to be the heritage students share when they first experience school in Lubumbashi (Depeape & Hulstaert, 2014). One of the aftermaths of such a situation can be observed in the way people living in Lubumbashi attempt to use built environments of schools. The dialectic between the individual and the collective is seldom addressed in schools yet, as shown above, African

culture has a strong notion of collective life. For instance, the word 'collaboration' in many schools tend to bear negative connotations like cheating; but this is because interactive collaboration does not happen enough in Congolese schools. Most students spend time on static desks oriented towards the teacher, who is perceived as an instructor. Inside regular classrooms, the teacher sits, or stand elevated on a pedestal as if to infer that the classroom is the teacher's domain and student are visitors. Consequently, students develop a sentiment that they are 'at the mercy of a teacher' hence running the risk of passively engaging in school activities to gain the teacher's favour (Gatto, 2009).



Figure 41 Classroom in1910 Lubumbashi. unknown photographer



Figure 42 Classroom in 2019 Lubumbashi. From Salama school (2019)

Urban re-adaptation of the built environment versus the usage of the built environment in School

Another aftermath of cultural clashes in Lubumbashi is the re-adaptation of the initial function of the buildings erected during colonial times. This case is familiar to many African cities in which the built environment is often not used in the way initial designers planned. Such re-adaptations can be a positive societal phenomenon when done to recontextualise buildings. Therefore, if the construction of the city of Lubumbashi during colonial time is seen as the production of urban space with no consultation of current users, re-adaptation of such space is then a necessary reproduction of space to suit the need of the present-day population. Inside schools, such constructivist phenomenon has not been given space to develop. However, readapting a design for another purpose is not enough, for in many aspects such designs are reminiscent of an irrelevant function. There is a need for a new architecture.

3.4 CONCLUSION

In summary, this literature review aims to understand the relationship between pedagogy and the built environment by looking at the relationship through subsequent perspective: historical perspective, a conceptual perspective, and a contextual perspective. Literature review reveals that instinctive qualities in child learning process found in earlier societies such as hunter-gatherer bands encouraged a more explorative hence creative learning process. However, as European societies became more structured, freedom in the learning process disappeared thus limiting conventional education indoor and diminishing opportunity for further exploration in child learning processes (Dudek, 2005; Hertzberger, 2008; Graves, 2007).

This situation, as noted by Salman Khan reached its culminating point with the advent of the first industrial revolution on which basis the Prussian system of education was established. Therefore, the built environment of school still reflects ideologies of the first industrial revolution which treated student like items on a factory assembly line; thus forward thinkers such as Hertzberger (2008); Dudek(2005), Mitra(2019) and Khan(2013) suggest that places of learning should migrate away from formal spatial configuration to more articulate thus explorative spatial quality.

To achieve such, the problem was dissected into the following:

- The negligence of the individual aspect of leaning in the spatial layout of school.
- The disconnect between the individual and the collective aspect of school.
- The separation of school and home.
- The separation of school and city.

As a result of addressing the above problems, the researcher supports the argument that places should have a spatial quality that encourages individual expression and collaborative activities with regards to contextual factors.

CHAPTER 4 PRECEDENTS STUDY



Figure 43 Study of a spatial configuration of classroom. By Author (2019)
4.1 INTRODUCTION

Precedent studies are a continuation of the literature review based on existing examples. Some precedent studies have been chosen to explore the individual aspect of places of learning with due regards to the phenomenological experiences, while others have been chosen for contextual purposes; thus each precedent study will offer an analytical explanation the built environment explaining successful aspect of the building while considering what can be improved. As such, Next school was selected to study the individual aspects of school while the primary school in Ganado will serve to investigate ways of contextualising schools. However, both precedent studies lack a spacial articulation for a school-based on child selfdirected learning; thus, Montessori school in Delft will also be studied to analyse as a compliment.

4.2 NEXT SCHOOL, Mumbai, India.

4.2.1 Background

"It is our vision that all students live lives of their own design, supported by caring mentors and equitable opportunities to achieve their greatest potential. We move forward prepared to activate the power of schools, systems, and education through student-directed, real-world learning" (Bigpicture, 2019)

At next school learning is based on a model of education that personalize education for each student and foster project-based learning because only 20% is the estimated level of student attention when learning happens through lecturing. The motto of the school is 'One child at the time', hence prioritizing the quality of education (Khan, 2013).

Location

The school is in the region of Umland, which is situated in the Indian City Mumbai. This school sit within a serene environment near a botanic park



Figure 44. Next school location. From google Maps (2019)

4.2.2 The built environment

Spatial Articulation

The figure below illustrates how the primary school is organised along a central interactive space called the hub where students from different classes(advisories) exchange knowledge. Advisories are located at each side of a corridor that leads into a quitter space called quiet common. This space, located to the west, functions as a quiet library where students can read in silence away from the overstimulating hub. While the hub is suitable for collaborative activities, the quiet common works best for individual learning such as reading. The idea behind this articulation is to recognise the complementarity between individual and collective spaces.



Figure 45 Next school spatial organisation. Adapted and drawn by Author2019)

Circulation

While circulation works successfully in linking the quiet common to the loud common, the journey through corridors lacks an experiential quality. For instance, corridors could have served as an articulated path with different points of interest where students could engage in diverse activities (see figure below).



Figure 46 Proposed modifications to Next school spatial organisation. Adapted and drawn by Author (2019)

Acoustic challenges

To address the problem of noise, first, the hub is distanced twenty-four meters away from the quiet common, second, the number of walls and the volume of space separating the two places curb noises even more. Lastly, walls are covered with absorbent materials which add another layer of noise reduction. Such absorbent materials have profusely been used in advisories to control noise from the hub or from adjacent rooms.



Figure 47 Next school spatial organisation. Adapted and drawn by Author (2019)

View, connections, and acoustics.



Figure 48 View and room connection at Next school. Next school (2019)

The articulation of space into individual and collective areas can cause acoustic challenges if not done properly. For instance, individual space requires a certain level of seclusion yet without compromising surveillance; thus, an architectural element such as glass which functions as a barrier while maintaining visual connection could be used for this purpose. This contributes to moving away from the rigidity of conventional schools hence adding a collective layer to the fabric of a classroom. Furthermore, such material simultaneously soundproof and connect indoor and outdoor spaces. Having said that, glass has been overused to an extent where the designer of Next school had to introduce artificial ventilation. This remedial aspect could have been avoided by designing the building with enough thermal mass.



Figure 49 excess of glass at Next school. Next school (2019)

Adaptability

The director of Next school Ramniklal Shah (2016) notes that the school incorporates spaces that function as workshops where interaction can happen but flexible enough to accommodate individual activities. While next school explores revolutionary ways of learning, old ways of learning where children are seated around an elderly figure are still recognized as important (Shah, 2016). Therefore, Advisories had to be flexible to accommodate different spatial configurations.



Figure 50 Individual mode (left) and collective mode (right) at next school. By Shah (2016)

The Individual mode is appropriate for concentration and individual work, while the collective mode is suitable for collaboration. However, the lack of spatial articulation in advisories does not permit the individual and the collective mode to coexist simultaneously.



Figure 51 presentation mode (left) and teaching mode (right) at next school. By Shah (2016)

Teaching mode is rarely used as this implies instructing students; nevertheless, the value of this mode notes Dudeck (2005) is that it increases the percentage of the interaction between student and teacher. However, if a classroom has one teacher, the task of teaching might be challenging. Therefore, advisories were designeded in a way that two classrooms can be consolidated into one to benefit from a maximum of assistance when necessary. In such cases, the walls separating two advisories can be folded back to create only one big advisory.



Figure 52 Adaptability of advisories (classrooms). By author (2019)



Figure 53 Adaptability of advisories (single advisory). Next School (2016), Adaptation by Author (2019)



Figure 54 Adaptability of advisories (consolidated advisories). Next School (2016), Adaptation by Author (2019)

Flexibility does not just apply to classrooms but is also found at an individual scale. The choice of furniture had responded to this criterion. Ergonomic chairs are used in classrooms to adapt to different size of students and provide a good posture.



Figure 55 Ergonomics at Next school. Next school (2019)

Summary

While Next school provide an appropriate pedagogy, the built environment of the school needs more articulation and environmental a design to enhance the child-centred approach within an appropriate environment. Furthermore, the school could consider shaping and integrating the immediate landscape to extend learning beyond the indoor environment to account for a more experimental, thus explorative way of learning which integrate nature community. Concerning the integration of community, the precedent study in Gando is a better example.

4.3 A SCHOOL IN GANDO

4.3.1 Background

The school in Gando is a good example of how a school can function as a social catalyst. From the inception to the completion of the school building, the community was involved in the project; hence the school became an object of pride. The school is the product of an investment by the Gando community investment in a child named Francis Kere, who was funded to study in Germany. After completing his degree in architecture, Francis Kere designed a school for the Gando community.

location

Gando is an African village located in Burkina Faso at the periphery of the capital city Ouagadougou.

The setting is characterised by a hot climate with Sub-Saharan Wind and a soil rich in clay.



Figure 56Burkina Faso. From Africa Junior (2019)



Figure 57 Gando location. From Dezeen (2017)

4.3.2Analysis

Proposed Master plan of the project

The master plan below was developed after the architect had constructed the first wing of the school when there was a need to extend the school. The architect adopted a participatory approach which was efficient in addressing the needs of the community. The impact of the project extends beyond the school parameters to the community such that the school became a social catalyst.



Figure 58 Subsequent proposed master plan. Francis Kere (2009)



Figure 59 School in Gando. Photography by Omar Tegan (2015)

Existing built form

The connection between the school in Gando and the community is visible from inception to occupation. While many projects tend to focus on leveraging local material only as a sustainable strategy, they often miss the opportunity to leverage more local labour; Francis Kere, however, used labour from the community as an asset in the construction the school. The architect choice resulted in a partnership with the community whose contribution of local construction technics was refined with Kere's modern expertise. The integration of the two resources produced sustainable buildings.



Figure 60 Community participation in the design of the school in Gando. Photography by Erick-Jan (2017)

Social sustainability

The social relevance of the school lies in the fact that the community benefit from services such as water supply. Moreover, the implication of community participation in the project creates a sense of pride and ownership.



Figure 61 Community participation in the design of the school in Gando (image2). From Dezeen (2017)

The participatory construction process of the school was not perceived as mere efficiency but became a social and a metaphysical, with the inclusions of elements such as music and dance. From a modern perspective, one might find no relation between such elements such as dance and the construction of a building. However, from an integral perspective, having a musician beating the drum on a construction site illustrates the relationship between the act of building and modes of being in the world.



Figure 62 integration of music in the construction process. Image from Dezeen (2017)

The library as a social space

Although the initial reason for which the library was designed was as reading space for students who could not effort to buy books, the facility also functions a space where elderly figures -who are considered as books in the many African cultures- can participate in the education of children (Mosweunyane, 2013). Subsequently, the architectural form of the library was designed in a distinguished manner such that the building is easily perceptible.



Figure 63 distinctive articulation of the Library. Design by Francis Kere (2006). Adaptation by Author

To improve the sense of ownership of the library as a communal good, the architect used sections of clay pot from the village to symbolise the participation of different households.



Figure 64 Contribution of households in the project. Photography by Erick-Jan (2017)



Figure 65 Library ceiling. Photography by Erick-Jan (2017)

Economic sustainability and environmental sustainability

The availability of labour and the usage of local materials helped reduces the cost of the project. Moreover, the use of clay rates the building as low maintenance and environmentally sustainable such that the energy consumption has almost a zero carbon footprint. Furthermore, the building has also been designed based on passive cooling principles: the elongated form benefits from cross ventilation which is needed in hot climates. Finally, the corrugated sheet is floating above a perforated ceiling to admit air that cools classrooms.



Figure 66 Ventilation strategies. Francis Kere (2006)

Summary

The Gando school is not an appropriate example in terms of the influence of pedagogy on the built environment; however, the school provides lessons regarding the integration of the society into a learning environment. Confirming what Hertzberger postulated: a community is also an extension of school and vice versa (Hertzberger, 2008).

4.4 MONTESSORI SCHOOL IN DELFT

4.4.1 Background

The design of Delft Montessori school was initiated as an exploratory project in 1960 and aimed to migrate from a rigid and formal approach to an explorative approach to school. This was sponsored by a group of professor's wives who were willing to adopt the Montessori Method (Hertzberger, 2008). Holding a Montessori education himself, the architect Herman Hertzberger who designed the school translated the requirements of the client into ground-breaking spatial terms. While the project is not contextually relevant, Delft school is full of design principles are nevertheless essential to school-based on child self-directed learning (CSDL).

Location



Figure 67 Location of Delft. MapQuest (2019)



Figure 68 Location Montessori School in Delft. From Google Maps (2019)

The school is in a serene residential area surrounded by trees and situated in the city of Delft, Netherland. Trees function as a soft boundary hence, simultaneously secluding and connecting the school to the public.



Figure 69 Vegetation at Montessori School in Delft. From Google Maps (2019)



Figure 70 A Outside Montessori School in Delft. Hertzberger (2008)

4.4.2 Spatial articulation

Legend



Articulated classrooms



Corridor circulation



Nooks or niches

corridors



Connection of nooks and niches to



Toilets



Figure 71 Hertzberger's plan of the Montessori School in Delft. Adaptation by Author (2019)

The school was designed as a dynamic street along which houses are developed. The wide communal corridor functions as an interactive street where people gather, while classrooms function as houses fronting a street such that, even if classrooms are individual entities, learning connection to the rest of the school is still maintained. The main entrance to the school gives access to the central corridor with a view of virtually all the classrooms, hence creating a connection between classrooms. The corridor is articulated into semi-secluded nooks that give students a sense of undiscovered ground to be explored. The manipulation of light enhances this creating pocket of shaded spaces which generate a sense of mystery to incite the imagination of children.



Figure 72 Street activities. By Gill Florence (2007)



Figure 73 Corridor activities at the Montessori School in Delft. By Herman Hertzberger (2008)

Articulation of classrooms

Hertzberger (2008) notes that corridor at Delft Montessori school act as the exterior part of the classroom while the latter functions as a private domestic space such that teachers and the children decide together how to organise their classroom. To achieve a flexible spatial condition which accounts for different type activities, the architect used the concept of a snail

shell which develops from an enclosed form to an open one. Similarly, space has a gradience of privacy from individual space to collective space. Additionally, to enhance spatial flexibility, the architect articulated classrooms into different types of space, from a central and large space where collaboration work happens to smaller spaces for students to engage in activities that require concentration.

Legend



Figure 74 Hertzberger's Section of a Classroom at the Montessori School in Delft. Adaptation by Author (2019)



Figure 75 Intimate spaces for individual work of the Montessori School in Delft. By Herman Hertzberger (2008)

Since the school encourages students to take part in decision making, they get to learn about being responsible for the immediate environment (Dudek, 2005; Hertzberger, 2008; Day, 2007). To enhance the sense of responsibility in children, Hertzberger (2008) added toilets in each classroom.

Phases of the project



Figure 76 Phases of the Montessori School in Delft. By Herman Hertzberger (2008)

Current layout

Legend

Corridor circulation





Figure 77 Hertzberger's plan of the Montessori School in Delft (phase 4). Adaptation by Author (2019)

4.5 CONCLUSION

The exploration of the problem of the restrictive built environment in formal school through examples of existing buildings paints a picture of the type of spaces needed for a child selfdirected learning based school. The research problem highlights that formal space does not facilitate better learning the research, therefore, aimed to explore alternative ways of designing places of learning by positing the question of how child self-directed learning (CSDL) can influence the built environment. Through the process of exploring this relationship, the research looked at precedent studies to paint a picture of the type of spatial quality and built form required for CSDL. Therefore, the precedent study includes three schools: Next school, a school in Gando by Francis Kere and a School in Delft by Herman Hertzberger.

While next school has a strong philosophy that fosters individual development, the built environment of the school needs more spatial articulation, an environmental approach and social integration. As for the school in Gando, the built environment and the construction process included the community of the village and accounted for sustainable strategies. Although the school in Gando is in a rural area, the design approach of the place of learning can apply to an urban area to break the separation between school and society. However, the school in Gando is based on a formal system of education that does not enhance exploration; thus, the research studied the Montessori school in Delft which presented a spatial quality that leans towards CSDL based schools. The design includes spaces that are articulated to respond to the multiple factors of human experience.

Having said that, precedent studies are still secondary data; thus, presenting examples of buildings with primary data will add an empirical aspect to the research that validates even more findings. Hence the subsequent chapter will present two case studies.

CHAPTER 5 CASE STUDIES:



Figure 78 Analytical diagrams for gradience of privacy. By Author (2019)

5.1 INTRODUCTION

The case studies are complementary to the literature review to explore the main argument of this work based on first-hand empirical data. Thus, together with the literature review and precedent studies, they provide a more robust and valid argument.

Two case studies were selected each for a different purpose. The first case study, Imara School, is in the city of Lubumbashi, which is in the Democratic Republic of Congo (DRC). Imara School will serve to investigate the formal model of schools in Lubumbashi by looking at how formal pedagogy influence the built environment over the past years. The second case study, Ocean View Montessori School (OVM School), is in Durban, which is in South Africa. This school will empirically explore the relationship between Child Self Directed Learning (CSDL) and the built environment.

The relationships in both schools determine the type of experience students have in the two scenarios. Therefore, a qualitative research method is used to understand the experience of the learning environment. However, the collection and analysis of data were challenged by limited time and practical reasons. One such reason is that the researcher did not conduct a comprehensive ethnographic research; nevertheless, in the case of Imara school, the researcher had a daily experience as a primary and secondary school student of the learning environment for seventeen-years. Since upon observation, little has changed in the school, the experience of the researcher was of great use. At OVM School, the researcher's graphical recording technics that simplified the recording of data from students.

This chapter initiates the analysis and discussion of collected data from a constructivist paradigm, while the subsequent section, Analysis and Discussion, will analyse both primary and secondary data.

5.2 IMARA PRIMARY SCHOOL

5.2.1 Justification of case study

Imara School was chosen for the school represents a prototypical model of a decent school in Lubumbashi (Depeape & Hulstaert, 2014). The school shows indexes of the aftermath of factors that kept the built environment formal over the past years.

The following criteria make Imara school a suitable case study to understand the influence of formal education on the built environment:

- The school has a strong emphasis on discipline.
- The Catholic Church runs the school. This criterion is important because the Roman Catholic Church (RCC) has a good reputation for ensuring a decent quality of education by modern standard.
- The school has been in existence for more than 100 years. This condition shows the evolution or the lack thereof of Imara School over the past years.
- Finally, the school can be geographically accessible.

5.2.2 Location

The school is in the city of Lubumbashi, the Democratic Republic of Congo. This is a catholic school for boys situated in a residential area about 800 meters away from the central business district (CBD). Adjacent to the school and across a road is a school for girls run by the RCC as well.



Figure 79 Location of Imara School in Lubumbashi. From Google Maps (2019)



Figure 80 Location of Imara School in Lubumbashi (immediate physical context). From Google Maps (2019)



Figure 81 Secondary Entrance of Imara school (next to the Chapel). Photography by Kaleng Mutomb (2014)



5.2.3 Historical and social context of the school

Figure 82 Lubumbashi. Kalanga (2019)

The city of Lubumbashi was established between 1910 and 1922. The numbers of settlers rapidly grew due to mining activities in the region. As a result, the government welcomed the catholic missionary church to provide formal education for the growing population. Therefore, the first formal schools to be established in DRC were run by the catholic missionary church. Thus, Imara School was built as one of the first catholic school in the DRC (Reybrouck, 2010; Depeape & Hulstaert, 2014; Lagae, 2014). As for locals, Depeape (2014) notes that the initial aim of such schools was to assimilate the Congolese population to a new lifestyle of the Belgian colony. Consequently, education was perceived as a matter of instruction rather than fostering exploration (Depeape & Hulstaert, 2014).

5.2.4 Empirical data

"What the eye sees is much more significant for it influences the dynamics of the soul on a unconscious level..." (Day, 2007, p. 273)

The school has a strong formal character expressed through an architecture of long rectilinear blocks of buildings that contain repetitive spaces.



Figure 83 Aerial view of Imara School. By D. Crivitz (1962)

1 – Entrance, 2- Bicycle parking space, 3 - Primary school courtyard, 4 - Site of the old Chapel, 5 - cine College and the basketball court, 6 – Gymnasium, 7 - Swimming pool,
8 - Garden of the Fathers and their apartments, 9 – Study room (boarding school), 10 – chapel,
11 - Dormitory of boarding school, 12 – Refectory, 13 - court of Humanities, 14 - Radio College, 15 Marie-José Institute), 16- 'Parc de la Ville'



Figure 84 Aerial View of Imara school. From Congo Aerocon (2019)

1 – Entrance, 2-Student waiting, 3 - Primary school courtyard, 4 - Football field
(extended in the whole court), 5 - cine College and the basketball court, 6 –
Gymnasium, 7 - Swimming pool, 8 - Garden of the Fathers and their apartments, 9 –
Secondary school classrooms, 10 –chapel, 11 - Dormitory of boarding school, 12 –
Refectory, 13 - court of Humanities, 14 - Radio College, 15 Twendeleye Girl School
(formerly known as Marie-José Institute), 16- 'Parc de la Ville'

Even though the Catholic Church has often invested a considerable amount of money to upgrade education, Imara school still has essentially the same spatial condition it had more than eighty years ago (Cordasco, 1963; Depeape & Hulstaert, 2014). The school still has its formal aspect has shown in the figures above.

Spatial impact formalisation of the school



Figure 85 Drawing of Imara school architectural basic forms. By Author (2019)

Imara school sill has an excessively controlled environment characterised by mainly two formal adjacent rectangular forms that provide spaces for the primary school and the secondary school. Each part of the school has a central courtyard along which adjacent classrooms are placed and aligned by a narrow rectilinear corridor on every side with a central space to accommodate sporting or recreational activities. Like in most Prussian based schools, classrooms are stuffed with desks oriented towards a chalkboard where the teacher sits. As discussed in the previous pages, this configuration means that the pedagogical approach is teacher-centred.



Figure 86 Classroom at Imara School. By M Kabengele (2013)



Figure 87 Long and confined corridors at Imara school. By author (2019)



Figure 88 sketch of the typical spatial quality at Imara School (section). By author (2019)



Figure 89 sketch of the typical spatial quality at Imara School (plan). By author (2019)

Both the primary school and the secondary school are designed with classroom connected by long monotonous corridors which extend around a courtyard and only wide enough to function as a circulation space. These corridors lose the opportunity to be efficiently activated with lingering spaces. Nonetheless, as inferred by Lefebvre (1974), humans find ways to reuse a restrictive environment in a way that accommodate their needs. Therefore, it is logical that sometimes a piece of furniture can be found in a corridor to define, though with difficulties, as a space for social interaction.

A shown in the illustrations, the primary school courtyard act as a space for recreation or sport with classrooms surround. Learning happens mostly in these classrooms with a desk of the same size regardless of the size of students.

Social spaces in school

Although Imara school has space for successful social activities such as sports events, the theatre hall misses the opportunity to architecturally connect the school to the community such that this creates a transitional space between the immediate context and the school. The hall is secluded from the public except for exclusive events like weddings which are not meant to create a connection between the school and the community.





Figure 90 The lack of connection to the immediate context. By Author (2019)

While sports fields also serve as social spaces, they are nevertheless completely out of sight to the public. A visual connection could be a one among many strategies to establish the relationship between school and city.



Figure 91 Sport facilities at Imara School. By author (2019)
Environmental awareness



Figure 92 Recently cultivated garden by the entrance of Imara School. By author 2019

Given the pressurizing issue of global warming, the school is integrating plants to create awareness about the issue. This approach also serves as a practical didactic method.

5.2.5 Semi-structured interview with the principal and the renovation engineer at Imara primary school

Interviewer: Anthony Kashit

Participant:

- principal: Fr Salumu
- Engineer: Serge Kabey

Interview with Fr Salumu

Opening: Explanation of the purpose of the interview to Fr Salumu

Q1. What is your role at Imara School?

Fr Salumu:

I oversee all the activities at the primary school level. I am also involved in the metric commission that deliberate on student who should pass based on their academic performance.

Q2. What do you think about the built environment of the school?

Fr Salumu:

I think this is a good school but a little bit older. Therefore, the engineer I put you in contact with is working on renovating dilapidated sections of the school.

Q3: If you had to improve the school what would you add?

Fr Salumu:

I think the main challenge is to modernise the school. We are also trying to create an awareness on climate change by planting as much plants as we can. Therefore, we have been planting a garden at the school entrance.

Interviewer: What is your view on physical exercise in school and do you have an appropriate facility for it?

Fr Salumu:

The education provided by the RCC has always considered all the aspects of a human being. While religion take care of the spirit sport is essential for both mind and body. Yes, we do have facilities for Physical exercise that serves sometime the community as well.

Closing

• Explanation of future actions regarding the analysis of the collected data.

Interview with Serge Kabey the construction engineer,

Opening: Explanation of the purpose of the interview to Serge Kabey

Q1: I had an opportunity to speak with Father Salumu he told me that you oversee renovations of the Imara school, what are the major area that need renovations?

Serge Kabey:

Yes, the school is old and failing. Things like carpentry, roofs and ceilings need some renovations.

Q2: What are future projects for the school:

We are developing a new school since this one has reached its maximum capacity.

Interviewer: Is the new school going to have the same spatial quality as Imara school?

Yes, it is going to function in the same way. It is just in a different location.

Interviewer: Can you provide me with architectural drawing of the school?

I doubt I can find them.

5.3 OCEAN VIEW MONTESSORI SCHOOL-DURBAN DURBAN, SOUTH AFRICA

5.3.1 Justification of case study

The study of Ocean View Montessori School (OVM School) is appropriate for the school is based on a model of education that foster children's involvement in the learning process. Moreover, since the school uses a building that was initially a house, this would help to explore the relationship between the academic and the domestic environment. Finally, the school is geographically accessible.

5.3.2 Location

The school is in Durban North, South Africa. The location has a good, serene quality which is valuable for concentration work. It is also located near a botanic garden. The latter has the potential to be used as a didactic environment.



Figure 93 Ocean view school location. From Google Maps (2019)



Figure 94 Immediate context of Ocean view Montessori school. From Google Maps (2019)

5.3.3 Historical and social context of case study

Maria Montessori, the founder of the Montessori Method of education, believed that true freedom is found within an ordered framework. She defines freedom not as the ability to do whatever one wants, for one may want to do harms their neighbour, but as the ability to be able "…to do what you are called to do." (Montessori, 1912, p. 45). It is based on such a philosophy that the Ocean View Montessori school has been developed.

5.3.4 Empirical data

The environment of the school



Figure 95 spatial diagram of Ocean view Montessori school. By author (2019)

The entrance to the school has been carefully kept on the less busy street, which is safe for children. At the east, dense trees serve as a noise buffer from a busy road and are strategically placed so that a visual connection between classrooms, the Japanese garden down the slope and the Indian Ocean further east, is not interrupted. Such views enhance the learning experience and stimulate student's awareness of their environment (Day, 2007).



Figure 96 Sketch of Ocean view Montessori school. By author (2019)

Legend



The school articulation

The school has a classroom composed of children from three to six year old (on the ground floor) and a classroom of six to nine-year-old on the first floor. A corridor along which toilets are found on the west side and a classroom on the east side leads into a transition space that students may use independently from activities happening in the classrooms. Sometimes such spaces serve as lingering space. This space, though small, serves as a bridging space between the two classrooms. The same space was used for focus group while classroom activities were carried out. In each classroom, furniture is organised in clusters to allow collaboration and freedom in the learning process.



Figure 97 section of Ocean view Montessori school. By author (2019)



Figure 98 3-6 year old Classroom (top), Staircase connecting the two levels (bottom left), corridor leading into the transition space (bottom middle), transition space (bottom right). Ocean view Montessori school. By author (2019)

Teacher A notes that while discipline is encouraged, controlling children process of learning is not useful to their creative mind. Therefore, a cluster organisation of furniture is meant to remove all association with instructive ways of leaning and enhanced divergent thinking which leads to creativity (Sir Robinson, 2015). In line with Christopher Day's argument on safety for younger children, the toddler space has been treated as to provide space with a more intimate experience; a serene character and surveillance while the rest the spaces are in immediate contact with more public spaces within the school (Day, 2007, pp. 11-17).

Outdoor

Despite the school's policy of encouraging children to learn through play, there is a limited amount of space for children to freely outdoor play. As if this was not challenging enough, the driveway inside the school compound and the parking space takes much space that is needed for children outdoor activities.



Figure 99 Outdoor space at Ocean view Montessori school. Josh Singh (2014)

The school context

Although the context within which the school is located has didactic value, the school does not have much interaction with the immediate surrounding. One might assume that a lack of space causes this; nonetheless, the interview with teacher B shows that the school has settled for this concession for safety reasons.

Acoustic challenges

Since the school does not have space for activities such as drama lessons, students engage in such loud exercises from the classrooms; thus, there is occasionally acoustical problems, particularly when some students need to engage in concentration work. Even the transition space is not spacious or soundproofed enough to solve this problem

5.3.4 Focus group with teachers and a parent at ocean view primary school

Interviewer: Anthony Kashit

Participants: teacher A, teacher B and teacher (parent) C

Opening: Explanation of the purpose of the focus group.

Transition

The researcher familiarizes himself with the two participants by asking their true name, which is not revealed for anonymity purposes. Teacher A and teacher B both are female teachers in the class of 6-9 years old. Teacher C is also a female teacher, but she teaches a class of 3-6 years old.

Note: since teacher C is also the mother of a student, she has been interviewed mostly as a parent.

Q1. What is your role as a teacher?

Teacher A: Our role is to assist children to develop their potential by giving them the freedom to explore their passion. We only guide them in their interests. We don't actively stand in front of the chalkboard to teach. It is more an indirect method of teaching... our philosophy is to follows the child passion. For example, if a child has an interest in insect, we will centre most of his or her learning on insects. We first use tangible materials to teach the child before moving to abstract aspects of a subject. Nothing is forced on a child.

Q2. What can you tell me about your students regarding their experience of Montessori school? What do you think about your school building and its places?

Teacher A:

Most students are excited to be here. The area is very nice for a school because it is quiet. Although the place is small, we generally manage to do what we need.

Q3. If you had more space, would you still mix student of different ages?

Teacher A: Absolutely. We group them because of our philosophy. We believe that children can learn from each other. As Maria Montessori once pointed out, older children can teach younger children. And by doing that they also learn... That's why we have what you could consider grade 1 children, grade 2 children and grade 3 children put together upstairs. These are children from 6-9 years old. Downstairs, we have a foundation class from 3-6 years old. But each learn at their own pace.

Q4. Is the school-built environment efficient enough? Would you improve it?

Teacher A: We think it is. (Teacher B agrees)

Q5. If you had to improve the school what would you add?

Teacher A: We would add more space outside for children to run. We could also appreciate large doors on each side of a classroom to connect to the space outside. We need more soft surfaces.

Teacher B: We can also work outside with children.

Q6. Do you have any acoustic challenges since some of your drama and dance rehearsals are happening in classrooms?

Teacher A: yes, but not always.

Q7. Would use an additional space for activities such as drama and dance?

Teacher B: Yes, that will be better and such spaces require enough room for movements.

Q8. What is your view Physical exercise, and do you provide space for it?

Teacher A: Physical exercise or sport is an important part of the education. We believe in a holistic development of a child.

Interviewer: Do you involve communities in school?

Teacher A: We organise events with parents. But safety is the main issue with strangers since we are dealing with children.

Closing

• Explanation of future actions regarding the analysis of the collected data.

Semi-structured interview schedule with parent C

The same process used for the interview with teachers was used for the interview with parent C.

Q1. How is this place of learning in relation to your child personality?

My child is a very curious kid, but when he was in a conventional school, I realise that something had changed: his curious attitude was gone. But since I put him in a Montessori school, he is always asking question trying to figure out things. He performs way better than he did in a conventional school.

Q2. What is your child's favorite space at home?

The kitchen is his favourite. He spends time trying recipes.

Q3. Does he get the same liberty in school?

Yes, there is always space for that. As you can see, we have sinks where children can do their experimentation. They can use playdough and many more stuffs.

Q3. What quality of space make, design elements etc.... makes your child feel at home?

I think just a welcoming place.

Closing

• Explanation of future action

Focus group with students

Interviewer: Anthony Kashit

Opening

Explanation of the purpose of the focus group to three participants: student A (age 7); student (B age 8) and student C (age 9.). The focus group is explained as a fun exercise involving drawings that illustrates what students like and dislike about their places of learning. Students were told that they are free to answer either verbally or in writing or even by drawing their own interpretation of their experiences of school and home.

. They were excited about this method of interacting. The environment was also set in a very homely fashion: two sofas with few little chairs and space to sit on the floor.

This is was done to make children feel comfortable enough to provide honest responses.

1. Students were told that the activity would take no more than 20 minutes.

Transition

- The researcher familiarizes himself with the three participating students by asking their names and few questions about their personalities.
- Note: their names will not be revealed for anonymity purposes.

Body of the interview

Q 1. What do you think about your school building? Are there places at school or at home that you like and places that you do not like?

Student C: I like to be in the playing area. And you? (question addressed to student A)?

Student A: I like to play football.

Student B: I think I will draw a mention.

Q2. Do you think school is like a mention?

Student B (**smiling widely**): Yes, with many rooms. And I like school because I don't have one brother but many brothers.

Students C: I like to go to the toddler's section and watch them.

Q3, And you A?

Student A: I like the chalkboard corner so that I can draw.

Q4. Can you draw for us A, in fact why don't we all draw on this page together?



Figure 100 interpretation of comfortable spaces. By Students A, B and C and the Author (2019)



Figure 101 Student A's interpretation of a comfortable space. By Student A



Figure 102 Student C's interpretation of a comfortable space. By Student C (2019)

What can be notice here is how younger student (student A) t look up to older student (student C). Nevertheless, each have their different interest. Even in the case of student at trying to mimic Student C's drawings. One can still see that student had was more interested about small animal such as bird that older people adults are not aware of.



Figure 103 Student B's interpretation of a comfortable space. By Student B (2019)

Student B had a very home approach to places. Using word such as mansion, parking for my parents' cars etc. Finally, all these drawing had a no separation between play learning and home life. Everything was integrated in one environment.

CONCLUSION

Conclusion

In conclusion, the type of education Imara School represent has a slightly integrated approach than most schools in Lubumbashi because it includes extracurricular activities such as sport. Nevertheless, the school has some fundamental pedagogical challenges which influence the built environment. Imara School, like many other Catholic school in Lubumbashi stand out as schools of relatively better quality because many privatized schools are built mainly as commercial enterprises and in some of these school is an acute lack of discipline that tannish the reputation of regular private schools.

However, the built environment of a school can only be as good as their philosophy (Dudek, 2005, p. 41) The very same thing that owes Imara School a good reputation is its downfall: the extreme formalisation of their school. Conversely, the Montessori Method of education, as shown in the Ocean View Montessori School case study, despite its catholic origins. However, although Ocean view school has a pedagogy that encourages exploration, this school faces spatial challenges due to the repurposing of the building. Moreover, the outdoor environment has limited exploratory areas. There is a need for more space for kids to play and engage with nature.



Figure 104 exploration of an alternative spatial quality of a school By Author (2019)

6.1 INTRODUCTION

This chapter analyses and discusses both primary and secondary data gathered to address the following main research question:

How can child self-directed learning influence the built environment within the context of Lubumbashi?

When addressing this question, one needs to analyse the multiple aspects of a child that affect their experience of places of learning. Thus, this work uses phenomenological and a comparative analysis method. The phenomenological analysis is comprised of an interpretative analysis and a descriptive analysis. The interpretative analysis helps to understand research data from the perspective of student's experience of the school's built environment.

The descriptive analysis allows the researcher to look at data as it appears to the researcher. Moreover, data will also be analysed from a limited positivist paradigm to balance the interpretation of subjective experience with an objective or scientific perspective. Finally, the comparative research method will serve to establish parallelisms and differences between approaches presented in the data. By looking at all these analytical methods in a complementary way, this work achieves a more integral analysis.

In the process of addressing the research question, primary and secondary data reveals the following problem about schools in Lubumbashi:

- The negligence of the individual aspect of leaning in the spatial layout of school.
- The disconnect between the individual and the collective aspect of school.
- The separation of school and home.
- The separation of school and city.

This section will analyse the above issues within the context of Lubumbashi using primary and secondary data.

6.2. THE RELATIONSHIP BETWEEN THE INDIVIDUAL AND THE COLLECTIVE ASPECT OF LEARNING.

Lubumbashi has maintained and builds formal schools despite their negative effects on children and their communities. Why is it so? Literature review and the Imara case study reveals that the followings factors have contributed to this observation:

- A historical transfer of a formal education from the Belgian to Congolese.
- The focus on quantitative issues rather than qualitative issues.
- A tendency to rely on authority in the learning process.

6.2.1. The influence of formal education on school spatial layout

The colonisation of the DRC by the Belgium contributed to the formalisation of Schools in the City of Lubumbashi. Since Belgian schools were influenced by the first industrial revolution ideologies (Khan, 2012), attention to individual needs in school was neglected. Therefore, these repercussions are seen in schools located in Lubumbashi. Moreover, the perception of the learning space as an environment that needs to be uniform to facilitate control hinders any distinctive articulation of its built form (Depeape & Hulstaert, 2014). Such perception is still popular in Lubumbashi as indicated by the following is an analysis of the interview the principal of Imara school.



Figure 105 Row of uniformized classrooms By Kayongo (2015)

Analysis of the interview with the principal of Imara School

• Information about the principal of Imara School

Besides being the principal at Imara primary school, Fr Salumu is a Congolese priest within the Roman Catholics Church (RCC). As shown in the literature review, the Roman Catholic has always been observant of discipline (Ferzoco, 2000). Consequently, Fr Salumu is more likely to insist on the virtue of discipline.

• The subject of the interview: Education and its built environment.

Education is a subject that the RCC takes seriously. Since the Middle Ages, the RCC has often perceived education as a way of transferring knowledge (Cordasco, 1963; Depeape & Hulstaert, 2014). In line with this perception, Fr Salumu encourages learning spaces that is conducive for control over students. Having said that, not all catholic schools are formal. For instance, the Montessori education which comes from a catholic background gives more freedom to children. Therefore, it appears that the congregation is not the sole factor that renders education formal; economic, political, and customary factors play an important role as well.

6.2.2 Economic impact on the design of schools: Focus on a quantitative aspect of school

A report by the World Bank reveals that school developers, seventy per cent of which are businessmen, perpetuate a formal learning environment because the latter has been tested (WorldBank, 2005). Subsequently, Mosweunyane(2013) argues that school owners prioritize achieving higher revenues than addressing the qualitative problem. Moreover, Depeape(2014) indicates that over the past fifteen years, many schools have been built in Lubumbashi to mostly respond to a pressing quantitative problem. As a result of the negligence of quality in school design, the individual aspect is seldom recognised. Even when a school is perceived to be of good quality, it is still built to support a revolute pedagogy (UNICEF2019). No wonder why the interview with the construction engineer in charge of maintenance at Imara school reveals that there is no future intention to change the formal character of the school.



Figure 106 Typical seating organisation in a Class at Imara School. By author (2019)

In contrast with Imara school, Ocean View Montessori school encourages individual attention through a spatial organisation that prompt children to communicate with classmates of different age and gender. However, the spatial quality of this school does not enhance the complementarity between collective and individual spaces as classrooms are made from an open plan space with insufficient articulation for children to alternate between collective and individual spaces. On this spatial aspect, the Delft Montessori School has an appropriate approach as the school classrooms work as individual entities with spaces for collaboration and concentration work.



Figure 107 Spatial quality at Ocean View Montessori School. By author (2019)





62.3 Student excessive reliance on authority.

Mosweunyane (2013) notes that respect of authority is important in African culture. However, students at times, do not distinguish such a virtue from the tendency to be overly dependent on teachers. In such instances, learners show less initiative. Moreover, Mitra (2019) and Piaget (1963) reveal that children can self-direct their learning process without adult instructions; thus, they only require supervision. Therefore, Professor Christopher Day (2007) argues that spatial quality in school should provide conditions which stimulate children to play independently even when they are being under surveillance. Day (2007) adds that spaces such as courtyard with a shrub high enough for children to feel a sense of privacy, and low enough for the teacher to have a look at the children can achieve such spatial conditions. Likewise, Hertzberger (2008) notes that space articulated in this manner has an implicit character that gives a sense of privacy and fantasy to children in a way that establishes a link between the world of imagination and reality.

SPACE FOR CHILDREN TO FEEL A SENSE

<text>

Figure 109 Courtyard for play. By Christian Campbell (2019)

Unlike the spatial quality in figure 96, Imara School has a two large unarticulated courtyard, thus providing no sense of mystery to be discovered. Dudek (2005) notes that such architectural language limits the possibility of inspiring new idea in children. Accordingly, Hertzberger (2008) recommend a spatial condition that can facilitate a deviation from uniformity to foster innovative thinking. Imara Beside Imara School, Delft Montessori School and Ocean View Montessori School lack this outdoor spatial quality. However, Day (2008) and the psychologist Dr Gray (2011) emphasise the importance of outdoor spaces as

they are an extension and a concrete aspect of classrooms. In the same way, Classroom extends to the domestic environment (Mitra, 2019).

6.3 THE SEPARATION OF SCHOOL AND HOME

The literature review section shows that humans prefer to spend time in places that resemble a domestic environment. Yet, the architect Peter Buchanan (2012) notes that most contemporary buildings do not integrate domestic architectural features that enhance human comfort. However, this dichotomy does not seem to exist in children. For instance, when six to nine-year-old students were asked to draw their preferred places at Ocean View Montessori School, the children created a relationship between school and home (figure 90).

To remediate to this problem, Buchanan (2012), Hertzberger (2008), Dudek (2005) and Day (2008) agree on the importance of integrating inclusive principles of design that bring a domestic layer to spatial qualities of regularly used buildings. Even more important, school with younger children should provide the comfort of a home (Hertzberger, 2008; Dudek, 2005; Day,2008). In respect of this view, Montessori schools are based on the concept of treating school as a home (Montessori, 1912; Hertzberger, 2008). In some cases, like Ocean View Montessori School, the students learn from buildings that were formerly housed. However, it would be naïve to infer that houses can be used as schools for even if, in principle, they have qualities that are needed for schools, they nevertheless lack specific spacial conditions needed for schools. No wonder Ocean View Montessori School attempted to readapt the house to meet the school spatial requirement. While this attempt resulted in classrooms with poor spatial articulation (figure 94), Delft Montessori school classrooms successfully treated classrooms as houses of learning with different rooms (figure 95). Moreover, Classrooms are connected through a large irregular corridor like houses along an interactive street, so the school becomes grounded as a house and flexible as a market. This parallelism extends the concept of school beyond physical boundaries into the community (Alexander, 1977; Hertzberger, 2008).



TYPICAL ORGANISATION OF A MARKET

Figure 110 Commonalities between Delft Montessori school and a Market. Adapted by author (2019)

6.4 THE SEPARATION OF SCHOOL AND CITY

Writers such as Dr Luckan (2016) and Herman Hertzberger (2008) argue that educational institutions do not exist for their own sake but should serve the immediate community. For this reason, it is preposterous that schools are often designed in isolation from the social context. Although some schools attempt to include social activities, the built environment of such places of learning often fails to connect to the context architecturally. This is a case found in Imara School, yet Mitra (2019), Gatto (2009) and Luckan (2016) see schools as laboratories for innovative ideas to serve the community. Consequently, Hertzberger (2008) is right in suggesting that schools should also function as a city. Moreover, this approach will prompt students to familiarise with the way a city operates.



Figure 111 Connection between school and city. By author (2019)

To establish this connection, Hertzberger (2008) proposes a design organisation that resembles the urban taxonomy developed by the urbanist Kevin Lynch (1960). The taxonomy is comprised of the interaction of paths (for movements) and nodes (for activities). In the context of a school, corridor acts as paths and spaces for collective activities act as nodes; the latter become centres of attention. Like in the case of the Montessori school in Delft, nodes can be agglomerated within a centralised space which serves as a marketplace to an exchange of idea (Alexander, 1977; Hertzberger, 2008). The central space in school functions like a central business district (CBD) where people interact, while home-based classrooms function as serene residential places. Such spaces would be useful for incident learning.



Figure 112 Commonalities between a city and a school. Adapt by author (2019)

6.5 CONCLUSION.

In conclusion, the influence of child self-directed learning on the built environment complexifies the spatial layout of school as individual, collective and contextual aspect of education needs to be considered. However, this approach is absent in formal schools and often incomplete in Child self-directed schools. To remediate this situation, Hertzberger (2008), Day (2008), Dudek (2005) and many more authors suggest that school should extend beyond the physical boundaries of a classroom through the outdoor space of the school extending to the city. In doing so, the built environment of schools become like that of a city.

CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

Introductory summary

The main problem identified in this work is that the built environment in formal schools of Lubumbashi does not stimulate creativity in children. For this reason, this work looked at alternative school environments that foster child self-directed learning (CSDL). This led to the following main question: How can child self-directed learning influence the design of the built environment within the context of Lubumbashi? Based on this question, the work aimed to explore the relationship between child self-directed learning and its built environment within the context of Lubumbashi. To achieve the research aim, the following four objectives were set:

- Explore a chronological and conceptual development of child self-directed learning in relation to the built environment to understand temporal far-reaching causes of restrictive school design.
- Develop a critical understanding of the context of Lubumbashi, with due consideration to social, cultural, economic, and environmental aspects in relation to the learning environment at a primary school level.
- Study examples of built environments regarding the influence of pedagogy on the built environment to subtract design principles.
- Determine a building typology, architectural design principles, and a spatial configuration that are conducive to child self-directed learning within the context of Lubumbashi.

The act of questioning the formal aspect of schools revealed that historical and sociocontextual factors were the major cause of this situation in Lubumbashi. While historical factors such ideologies of mass education played an important role in making the built environment of school formal, the social context of Lubumbashi maintained this limitation (Depeape & Hulstaert, 2014; Reybrouck, 2010).

However, many authors (Sugata Mitra, 2019; Hertzberger, 2008; Gray, 2008; Dudek, 2005; Khan, 2012) proposes that children learn more efficiently when they are in an environment that incites their interests. Subsequently, Christopher Day (2007) notes that such environments allow students, children, to self-direct their learning process engagingly and experientially.

Therefore, this validates the hypothesis that the integration of the multiple aspects of child experience in primary school, will render the built environment of such schools more inviting and explorative, hence this will stimulate creativity in students.

Major findings

This work reveals that the relationship between pedagogy (CSDL in this case) and the built environment as individual, collective and a contextual aspect that need to be accounted for. The latest research done by educationalist, such as Sugata Mitra (2019). In support of this observation, Partho (2007), Day (2007) and Juhani Pallasama (2005) argues that places of learning should be a domain with multiple layers that correspond to multiple senses of the human body. Nevertheless, the concept of senses can transcend the classic meaning that refers to five physical senses. Day (2007), Mitra (2019) and Wilber (2013) contend that senses encompass an exterior and interior experience through states of consciousness. On this note, Wilber developed integral to explore multiple dimensions of human experience using a diagram called All Quadrant All Level (AQAL). The theory categorises Human experience of the environment in two spheres. While the interior sphere includes individual and collective spaces from the same context, the exterior sphere is the domain of universal experience (Wilber, 2013; Buchanan, 2012).

Furthermore, Wilber (2013) and Long (2015) point out that these domains are interconnected. For instance, collective customs influence the way the environment is shaped, and the later will also influence individual usage of space (Hertzberger, 2008; Levebvre, 1974).

This dynamic relationship can be between students and the built environment schools or classrooms. Finally, research reveals that the smaller the environment is, the more private it becomes thus, in the following recommendation schools are articulated in a gradience of privacy from the master plan of the school to the smallest niche in a classroom. (Hertzberger, 2008; Day 2008; Dudek, 2005; Alexander, 1971).

7.2 RECOMMENDATION AND SUGGESTED DESIGN GUIDELINES

72.1 Design Principles



Figure 113 Diagram of process from design principle to design strategies. By author (2019)

Based on the findings mentioned above, the following design principles are recommended:

• Space in school should be articulated in a way that balances the individual and the collective aspect of human experience.





Figure 114 Gradience of privacy. By author (2019)

 Classrooms should be treated as houses of learning thus designed with principle based on the design of domestic environment yet adapted to the need of school. Such principle includes:

Creating physical and psychological safety, ensuring comfort, and providing a sense of belonging.



Figure 115 A welcoming classroom. By author and Bony (2019)

• School should be designed in a way that perspicaciously integrate the surrounding community so that learners would be contextually grounded in local culture while connected to the rest of the world. This involves an integration of social spaces such as community event halls, restaurants, and sports venues.





Figure 116 Spatial analysis of social space. By Author (2019)

To implement these principles, the following design strategies are suggested:

- Establish a gradience of privacy to articulate space into collective and individual spaces from a school scale down to a classroom scale.
- Centralize collective spaces to establish easy wayfinding and a clear focus.
- Connect classrooms to the central space through architectural principle such as orientation and proportion.



Figure 117 A Contextual connection. By author (2019)

• Finally, classrooms should be articulated into collective spaces for collaborative work and individual spaces for concentration work.





Figure 118 Proposed Classroom spatial Configuration. By author (2019)

Limitations and recommendation for further research

The scarcity of material by African authors on the architectural aspect of the topic of this work paused a strong challenge in terms of contextualising secondary data; more African researchers should explore this aspect. In doing so, researchers could explore integral and ontological ways of perceiving the built environment that can investigate the relationship between metaphysical elements such as music and the built environment in places of learning. The other challenge was that the limitation of time to understand the experiences of students in school from deep or recent ethnographic research method as the latter would have mainly increased the quality of primary data. However, such an endeavour was limited due to practical and logistics reasons. Finally, the continuous expansion of the internet shows the need for further research to explore the relationship between architectural space and virtual space, especially concerning child learning processes.
PART TWO

DESIGN REPORT

CHAPTER 1 INTRODUCTION

This report is a continuation of the exploration of the relationship between child self-directed learning (CSDL) and the built environment in Lubumbashi. Here the exploration is done from an architectural perspective as a testing of principles that have been established in part one. This project explores alternative ways of designing that incite children to unleash their abilities by providing spaces that are inclusive of both the individual and the collective aspect of leaning in the context of the city of Lubumbashi.

1.1 THE NOTIONAL CLIENTS

Since a number of Congolese middle-class young entrepreneurs are looking for ways to financially invest in their country with fresh ideas and in a more sustainable way, this work proposes that these entrepreneurs be the main shareholders in the construction of this model of primary school in consultation with the local branch of the Roman Catholic Church as the latter has more than a hundred years of experience in the educational field (Depeape & Hulstaert, 2014) These entrepreneurs would be represented by the 'Fédération des jeune entrepreneurs du Congo'(FNJEC) which means: association of young Congolese entrepreneurs. The project will be monitored by the Congolese department of education to ensure the proposed school meets the national standard, which also must be revised. To strengthen the accountability between shareholders, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) can also be included as an observer with no executive power.

Having said that, the word client is used by default to refer to shareholders with financial investment in the project; from an integral perspective the true clients are users of the building. Therefore, the client brief is not limited to financial shareholders but includes views of students, teachers, and many more potential users of the proposed building.

The association of young Congolese entrepreneurs 'FNJEC'



The FNJEC is a platform that aims to assist young Congolese entrepreneur who has new ideas that are a potential asset to the development of the Democratic Republic of Congo (DRC). As such, the following are its objectives:

- To train and introduce young Congolese to entrepreneurship.
- Exchange experience in the creation and management of businesses
- Assist its members with governmental formalities to implement innovative ideas.

The local Catholic Church



The local Catholic Church considers education has the key in preparing future generation and curbing joblessness.

The Congolese department of education



The Congolese department of education has set a 16% increase for the educational budget in 2019 (World Bank, 2019).

UNESCO



UNESCO aim to ensure that all school development is done with due regard to local heritage and environmental issues.

1.1.1 The Client's Requirements

Clients demanded a primary school that encourages children to explore their natural skills while being financially self-sustainable. Moreover, clients agreed that the design must be socially relevant to the city of Lubumbashi from a cultural perspective and an environmental perspective.

1.1.2 Detailed Client Brief

Didactic requirements

Because school is experienced as a mandatory work in most conventional schools, clients agreed to try a new model of school that would be child cantered. This school should have an exploratory eminent to incite children's imagination. Moreover, the school should have space that allows for interaction between students. Finally, the community should be part of this school in any ways possible so that the school become a platform where knowledge within the community is shared.

Economic requirements

This school should produce enough income to be self-sustainable and produce a return for the sustenance of shareholders over a minimum period of 50 years.

Environmental requirements

Since the DRC and Brazil together host the most biodiverse forest in the world, this school should be on the frontline of environmental awareness. The project should avoid cutting trees as much as possible. When it is imperative to do so, trees should not be indigenous, and no more than 5 % cents of trees should be cut down

CHAPTER 2 SITE SELECTION, SURVEY AND ANALYSIS

2.1 SITE SELECTION AND DISCUSSIONS (OPTIONS)

2.1.1 Option one



Figure 119 Site 1 location. From Google Maps (2019)

The site is in a residential area of Lubumbashi

Pros:

- One busy road exposes the site to the public while the two less busy roads seclude it with vegetation.
- Accessibility to public transport on the busiest road.

- Proximity to a national museum a public theater and the national radio.
- Proximity to sport facilities: a football field and a basketball court.



Figure 120 Site 1 inventory. By author (2019)

Cons:

- The side is predominantly made up of a built form with less natural environment.
- The space is too small for the design programme.

2.1.2 Option two (selected site)



Figure 121 Site 2 location. From Google Maps (2019)



Figure 122 Site inventory. By author (2019

Pros

- Proximity to the zoo and the alliance Française library
- A soft slope which can be used to implement the gradience of privacy principle.
- The site is not far from the CBD but is securely surrounded with trees which bring a serene quality.
- The site is large enough for the design programme.

Because the above is appropriate, practical, and didactic conditions to meet the requirement of the client, site two has been chosen.

2.2 SELECTED SITE (SITE 2)

2.2.1 urban analysis and site selection criteria



Figure 123 Urban analysis. By author (2019



Figure 124 arteries and zones. By author (2019)



Figure 125 Site analysis. By author (2019)

Legend



Site condition



Figure 126 location of subsequent images. By author (2019)



Figure 127 Areal view of site. By Kasongo (2019)



Figure 128 Sista toward the symbolic icon of Lubumbashi. By author (2019)



Figure 129 Existing pathway. By author (2019)



Figure 130 available limestone. By author (2019)



Figure 131 Most secluded and cleared space. By author (2019)

CHAPTER 3 DESIGN DEVELOPMENT AND RESOLUTION 3.1 CONCEPTUAL AND THEORETICAL ISSUES



The main challenge in exploring the relationship between child self-directed learning and the built environment is to treat school as a place that integrates different aspect of human experience. The quest to integrate such aspect caused conflictive conditions that had to be addressed. These conflicts were properly leveraged to lead to a dialectic relationship between different types of spaces.

In such cases, the two spaces become complementary. Thus, spatial relationships in terms of proximity, level of privacy, and the treatment of architectural element are critical.

3.1.1 Urban Design Concept Development

The concept behind urban development is to make the neighbourhood a learning environment (Lagae, 2014; Hertzberger, 2008; Day, 2007; Dudek, 2005). The challenge the city of Lubumbashi faces on an urban scale is that social spaces are being converted to private proprieties personal usage. Many more spaces need to be activated for both cultural and security reasons for this will serve as a preventive measure and render the city much more vibrant (Khomba, 2017; Depeape & Hulstaert, 2014; Hewlett, 2016).





Figure 132 proposed Master plan. By author (2019)

3.1.2 Architectural Design Concept Developments

Concept: School as a community of individuals

This concept was adopted in the aim of acknowledging both the individual and the collective aspect of learning within the context of Lubumbashi. As noted, translating such a concept in spatial terms raises a challenge of conflictive spaces that had to be addressed by analysing the relevance of the connection between such spaces. Thus, the most public zone shared by the community had to be a space that invites the public to slow down on their spatial journey and partake of the experience provided by the environment. However, since such zones become a melting pot of activities, a gradience of privacy needed to be observed to have space ranging from intimate to public areas. Space for concentration work had to be designed to avoid spatial intrusion as this might cause distraction. Thus, intermediary spaces were created between public(open) and intimate spaces. Finally, the concept of treating school as a community with different level of privacy was also implemented by taking advantage of the existing slopes such that the part of the site that slopes down zone become more intimate.



Figure 133 spatial organisation concept (section). By author (2019)



Figure 134. spatial organisation concept (3D) n. By author (2019)

Intermediary zone

Intimate zone

Classrooms/ "houses of learning"/ group room:

- collective spaces
- individual spaces
- ablutions

Shared outdoor learning space

Entrance lobby:

- reception
- welcome lounge

Inter-private

Admin block:

- principal' s office
- secretariat
- stuff lounge

Library

Laboratories:

- science: natural environment (outdoor and indoor)
- biology
- history+ museum

•

Clinic

Public zone

Community facilities: Multipurpose hall +café:

- basketball
- and tennis
- changing room
- ablutions

Entrance lobby:

- reception
- welcome lounge



Figure 135 Axonometric view of the proposed school. By author (2019))



Figure 136 Classroom analysis. By author (2019))

3.2 FINAL DESIGN PROPOSAL

3.2.1 Architectural Design Drawings



Figure 137 Floor plan section through the community hall, the library, and the learning hub of the proposed school. By author (2019))



Figure 138 Section through the school entrance, the welcome lounge, and the outdoor park. By author (2019))



Figure 139 Section though a 9-12 classroom, a classroom courtyard and a 6-9 classroom. By author (2019))



Figure 140 Illustration of the spatial condition in proposed classrooms. By author and Bony (2019))

3.3 TECHNICAL DETAILS



Figure 141 Technical strip section. By author (2019))



Figure 142 A detail section. By author (2019))

Keynote Legend		
Key Value	Keynote Text	
101.2	concrete piles to engineers detail	
102.1	Reinforced Concrete Slab to Engineer's Details and Specifications.	
102.2	Reinforced Concrete surface bed on to BRC Mesh, on to 250 Micron DPM laid on 50mm sanded bed onto well compacted hardcore Material Filled with soil poison in accordance with SABS 0124. All to Engineer's Details and Specifications.	
102.3	Reinforced Concrete Slab with minimum 85 mm weather step on the outside of the balcony finished with treated timber floor laid on Min. 40mm thick cement screed laid onto 3mm + 4mm Approved torch-on + 1 layer 'Interdek' protection / slip sheet (loose laid). All to Fall of 1 : 100 gradients towards a 50mm dia. PVC weep hole. to Engineer's Details and Specifications.	
102.4	Reinforced Concrete Slab with 4mm thick Derbigum heat apply waterproof Finished with silver paint to be taken up and over concrete upstand cover with steel cap all on 25mm max screed laid to fall at 1:80 toward drain with dome grating connected to 100mm dia. Pvc pipe. All to Engineer's Details and Specifications.	
102.5	Treated timber floor laid on Min. 40mm thick cement screed laid onto 3mm + 4mm Approved torch-on + 1 layer 'Interdek' protection / slip sheet (loose laid). All to Fall of 1 : 100 gradients towards a 50mm dia. PVC weep hole. To Engineer's Details and Specifications.	
102.6	Ruled v joint drip line by Specialist	
103.1.1	Reinforced Off shutter concrete column to engineers details	
104.1	220mm thick rock cladded adobe load bearing wall. to engineers detail	
107.1.1	Reinforced concrete upstand beam to engineers details	
107.1.2	Reinforced concrete downstand beam to engineers details	
107.2.2	Galvanized mild steel hollow structural I Beam section bolted to RC upstand using steel brackets holding roof structure using "C" Channel purlins. Sizes & Fixing to Engineer's Details and Specifications.	
110.1	Galvanized mild steel frame structure pined to galvanized steel tube fixed to 450 x 450mm RC column using steel brackets. Sizes & Fixing to Engineer's Details and Specifications.	
110.2	Galvanized mild steel tube fixed to 450 x 450mm RC column using steel brackets. Sizes & Fixing to Engineer's Details and Specifications details	
110.5	Galvanized mild steel "C" Channel to frame Edge of Roof with 100mm thick isoboard insulation to be installed. Sizes & Fixing to Engineer's Details and Specifications.	
110.7	Steel plate bolted to RC beam all to engineers details	
202.3	Aluminium Frame Window to specialist detail And To Comply With SANS 10400-N	
203.1	Interior Curtain Wall glazing by specialist to Comply With SANS 10400-N. Refer to Schedules	
203.2	Exterior Curtain Wall glazing by specialist to Comply With SANS 10400-N. Refer to Schedules	
501.2.3	Curved Copper Roof sheeting with 100mm thick Isoboard insulation to be installed by specialist, fixed to "C" Channel purlins on Galvanized mild steel hollow structural I Beam section bolted to RC upstand using steel brackets. Sizes & Fixing to Engineer's Details and Specifications.	
501.2.4	Curved Copper Roof sheeting with 100mm thick Isoboard insulation to be installed by specialist, fixed to "C" Channel purlins on Galvanized mild steel structural frame system on RC columns. Sizes & Fixing to Engineer's Details and Specifications.	
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