ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

THE INVESTIGATION OF CHILDREN-NATURE INTERACTION BASED ON BIOPHILIC DESIGN IN THE LEARNING ENVIRONMENT

M.A. THESIS

Meşküre Sena KAYACAN

Department of Interior Architecture

International Master of Interior Architectural Design Program

JANUARY 2024

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

THE INVESTIGATION OF CHILDREN-NATURE INTERACTION BASED ON BIOPHILIC DESIGN IN THE LEARNING ENVIRONMENT

M.A. THESIS

Meşküre Sena KAYACAN
(418201005)

Department of Interior Architecture

International Master of Interior Architectural Design Program

Thesis Advisor: Prof. Dr. Ervin GARİP

JANUARY 2024

ISTANBUL TEKNİK ÜNİVERSİTESİ ★ LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

ÖĞRENME ORTAMINDA ÇOCUK-DOĞA ETKİLEŞİMİNİN BİYOFİLİK TASARIM ÜZERİNDE İNCELENMESİ

YÜKSEK LİSANS TEZİ

Meşküre Sena KAYACAN

(418201005)

İç Mimarlık Anabilim Dalı

İç Mimari Tasarım Uluslararası Yüksek Lisans Programı

Tez Danışmanı: Prof. Dr. Ervin GARİP

OCAK 2024

Meşküre Sena Kayacan, a M.Sc. student of ITU Graduate School student ID, 418201005 successfully defended the thesis/dissertation entitled "THE INVESTIGATION OF CHILDREN-NATURE INTERACTION BASED ON BIOPHILIC DESIGN IN THE LEARNING ENVIRONMENT", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

Thesis Advisor :	**Prof. Dr. Ervin GARİP** İstanbul Technical University	.....
Jury Members :	**Prof. Dr. Ervin GARİP** Istanbul Technical University	.....
	Associate Prof Dr. Mehmet Emin ŞALGAMCIOĞLU Istanbul Technical University	.....
	Dr. Aliye Rahşan KARABETÇA Istanbul Kültür University	.....

Date of Submission : 26 December 2023
Date of Defense : 18 January 2024

To my family,

FOREWORD

To my thesis advisor Prof. Dr. Ervin GARİP, who provided me with guidance throughout the process and inspired me to complete my thesis with his extensive knowledge and enthusiasm;

To Aycan KIZILKAYA, who supported me in every way during my postgraduate studies;

and endless thanks to my dear father Hüseyin KAYACAN, and my dear mother Nilgün KAYACAN who supported me and always stood by me throughout this process.

January 2024

Meşküre Sena Kayacan
(Interior Architect and Industrial Designer)

TABLE OF CONTENTS

Page

FOREWORD ..... **ix**
TABLE OF CONTENTS ..... **xi**
ABBREVIATIONS ..... **xiii**
LIST OF TABLES ..... **xv**
LIST OF FIGURES ..... **xvii**
SUMMARY ..... **xix**
ÖZET ..... **xxi**
1. INTRODUCTION **1**
1.1 Purpose of Thesis 2
1.2 Methodology of the Study 3
1.3 Result of the Chapter 4
2. LEARNING ENVIRONMENT **7**
2.1 Learning Concept 7
2.1.1 Universial Design For Learning 14
2.2 Examining Classroom Environments Through Learning Approaches 17
2.2.1 Waldorf Learning Approach 18
2.2.2 Reggio Emilia Learning Approach 21
2.2.3 Montessori Learning Approach 24
2.2.4 Constructivist Learning Approach 27
2.2.5 Behavioral Learning Approach 29
2.3 Transformation of Learning Environment from Past to Present 31
2.3.1 The Situation in Turkey 33
2.3.1.2 Ottoman Duration 33
2.3.1.3 Modernization Process of Education in Turkey 39
2.3.1.3 Learning Environment Design in Turkey From The Recent History Of The Republic To The Present 43
2.3.1.2 Learning Environment Design Approaches on a Global Scale 54
2.4 Result of the Chapter 61
3. CHILDREN AND NATURE INTERACTION **63**
3.1 Importance of Child-Nature Interaction 63
3.2 Well-Being of Children in Learning Environment 68
3.3 The Impact of Nature on the Learning Process 70
3.4 Result of the Chapter 73
4. BIOPHILIC DESIGN CONCEPT **75**
4.1 Formation of the Concept of Biophilia 75
4.1.1 The Principles of Biophilic Design 78
4.1.2 Experiences and Attributes of Biophilic Design 81
4.2 Biophilic Design Patterns 93
4.3 Impacts of Biophilic Design on Human Behaviors 94
4.4 Children and Biophilic Design 96
4.5 Result of the Chapter 99
5. FIELD STUDY ANALYSIS AND FINDINGS **101**

5.1 Biophilic Design Patterns and Applicability to Learning Environment 101
5.1.1 Nature in the Space 101
5.1.2 Natural Analogs 104
5.1.3 Nature of the Space 105
5.2 Case Selection Parameters 106
5.3 Analysis of Classroom 106
5.4 Findings & Discussion 109
5.5 Design Guideline 115
5.6 Result of the Chapter 116
6. CONCLUSIONS 117
REFERENCES 121
APPENDICES 133
APPENDIX A 134
APPENDIX B 144
CURRICULUM VITAE 151

ABBREVIATIONS

ADHD : Attention Deficit Hyperactivity Disorder
BBOM : Bir Başka Okul Mümkün
CABE : Connecticut Association of Boards of Education
CHPS : Collaborative for High Performance School
IPKB : İstanbul Proje Koordinasyon Birimi
LEED : Leadership in Energy and Environmental Design
MEB : Milli Eğitim Bakanlığı
MIT : Massachusetts Institute of Technology
OECD : Organisation for Economic Co-Operation and Development
P : Pattern
TEAL : Technology Enabled Active Learning
UDL : Universal Design for Learning

LIST OF TABLES

Page

Table 2.1 : The Seven Intelligences **16**
Table 3.1 : Bloom et al.'s the six stages of cognitive maturation..... **66**
Table 4.1 : Elements and Attributes of Biophilic Design. **81**
Table 4.2 : Principles and Patterns of Biophilic Design **94**

LIST OF FIGURES

Page

Figure 1: The structure of the thesis..... **4**
Figure 2: Factors that influence learning **9**
Figure 3: Maslow's hierarchy of needs..... **14**
Figure 4: Universal Design for Learning Guidelines..... **15**
Figure 5: Green Meadow Waldorf School..... **19**
Figure 6: Green Meadow Waldorf School..... **20**
Figure 7: North Perth School of Learning / Tom Godden Architects & Matthew Crawford Architects..... **22**
Figure 8: Beelieve Preeschool of Life / 3Arquitectura. **23**
Figure 9: Montessori Kindergarten / ArkA – China **26**
Figure 10: Montessori Kindergarten / ArkA – China **27**
Figure 11: Constructive theory by Jean Piaget **28**
Figure 12: Historical Changes in Classroom Design..... **32**
Figure 13: TEAL classroom layout, top view..... **32**
Figure 14: A Turkish School, Amsterdam Museum..... **35**
Figure 15: Components of the madrasah structure (Üsküdar Mihrimah Sultan madrasah building survey..... **36**
Figure 16: The Double Minaret Madrasah..... **37**
Figure 17: Layout and Section of Caca Bey Madrasa (A. Kuran, Anatolian Madrasahs)..... **38**
Figure 18: A Turkish Republic School in 1937..... **42**
Figure 19: Ankara,Turkiye. Women Learning to Read and Write at the National School **42**
Figure 20: Ümraniye Yeni Çamlıca Leman main Primary School site plan and aerial photograph..... **44**
Figure 21: Ekinci, 2012 & meb.gov.tr..... **47**
Figure 22: DDPRL Architecture, Dağbelen Bodrum Project **49**
Figure 23: DDPRL Architecture, Dağbelen Bodrum Project **50**
Figure 24: Akşemsettin Primary School, Küçükçekmece **52**
Figure 25: Akşemsettin Primary School, Küçükçekmece **53**
Figure 26: Akşemsettin Primary School, Küçükçekmece **54**
Figure 27: Gilmore College, Middle School Learning Community..... **56**
Figure 28: Impacts of Forest School on Children's Development..... **59**
Figure 29: Uffculme Open-Air School **60**
Figure 30: Open-Air School in Netherlands, 1957 ..... **61**
Figure 31: Forest Schools **64**
Figure 32: The Ecology of Childhood **72**
Figure 33: Göbekli Tepe **76**
Figure 34: Hotel de Soubise..... **76**
Figure 35: The components of human settlement (building-human-nature) (Kayhan, 2017)..... **77**
Figure 36: Dask House, Naav Studio 2023..... **78**
Figure 37: TM Studio..... **79**
Figure 38: Bosco Verticale, Milan..... **80**
Figure 39: Terra Office Ahmedabad/India, 2023..... **82**
Figure 40: Audain Art Museum, Whistler, BC / Patkau Architects **83**
Figure 41: Experiences and Attributes of Biophilic Design **84**

Figure 42: Magdalene College Library, Cambridge, UK **85**
Figure 43: World Trade Center Transportation Hub..... **89**
Figure 44: Snowflake **90**
Figure 45: Habitat 2020, China..... **90**
Figure 46: Sea Otters in a Kelp Bed..... **93**
Figure 47: Biophilic Design Patterns (Browning et al, 2014) for Learning Environment..... **102**
Figure 48: Boboli Garden, Florance/Italy **103**
Figure 49: The Tote / Serie Architects..... **104**
Figure 50: Quetzalcoatl's Nest in Mexico city **105**
Figure 51: Layout of the Uçan Bisiklet School Classroom..... **107**
Figure 52: Layout of the Fide School Classroom **108**
Figure 53: Application (Classroom 1 & Classroom 2) **109**
Figure 54: Application (Classroom 1)..... **109**
Figure 55: Application (Classroom 1)..... **110**
Figure 56: Application (Classroom 2)..... **110**
Figure 57: Application (Classroom 1 & Classroom 2) **111**
Figure 58: Application (Classroom 1 & Classroom 2) **111**
Figure 59: Application (Classroom 1 & Classroom 2) **112**
Figure 60: Application (Classroom 1)..... **112**
Figure 61: Application (Classroom 2)..... **112**
Figure 62: Application (Classroom 1)..... **113**
Figure 63: Application (Classroom 1)..... **113**
Figure 64: Application (Classroom 2)..... **114**
Figure 65: Classroom Components..... **115**

THE INVESTIGATION OF CHILDREN-NATURE INTERACTION BASED ON BIOPHILIC DESIGN IN THE LEARNING ENVIRONMENT

SUMMARY

This thesis aims to define the impacts of the children-nature relationship in a learning environment and suggest a guided approach to establish this relationship by using Biophilic Design principles. To understand the effects of the learning environment on behavior, studies examined about learning environments conducted from 1970. Fromm suggested that connecting with nature could help humans achieve intellectual, emotional, and spiritual fulfillment, and Wilson later expanded on this to argue that evolution has forced humans' biological design to respond positively to this contact with nature (Wilson 1993).

These studies on the Human-Nature relationship under the concept of biophilia began in 1973, and as the effect of nature on human behavior and well-being was discovered, this issue began to be studied on spatial experience. Studies on this subject have been concentrated, especially in public spaces such as schools, hospitals, etc., where social behavior and psychology are at the forefront (Kellert, 2011). The subject of the Children-Nature Relationship has become an important issue in psychological and architectural studies with the effect of intense urbanization (Kellert, 2011).

Learning does not occur as a result of direct instruction, but rather as a result of how children interpret their interactions with people, environments, materials, and ideas (McNally et al., 2017). In this regard, learning environment design is a very important factor affecting the learning process. "Learning Environments integrated with Biophilic Design can establish child-nature interaction." is the hypothesis of the thesis. Therefore comprehensive literature research was conducted for understanding the fundamentals and main patterns of the Biophilic Design concept.

The research method can be described as the evaluation of two classrooms on this scale by preparing an evaluation table as a result of the literature examined. In line with the data collected, a design guide has been included within the thesis framework to show that it is possible to adopt a specific approach that will ensure the growth of the child-nature relationship when designing future learning environments.

Keywords: Biophilic Design, Learning Environment, Children-Nature Interaction, Built Environment

ÖĞRENME ORTAMINDA ÇOCUK-DOĞA ETKİLEŞİMİNİN BİYOFİLİK TASARIM ÜZERİNDE İNCELENMESİ

ÖZET

Bu tez çalışması ile çocuk-doğa ilişkisinin bir öğrenme ortamındaki etkilerini tanımlamayı ve Biyofilik Tasarım parametrelerini kullanarak bu ilişkiyi kurmaya yönelik bir yaklaşım önermeyi amaçlanmıştır. Öğrenme ortamının davranış üzerindeki etkilerini anlamak için 1970'den itibaren yürütülen çalışmalar incelenmiştir. Biyofili kavramı altında İnsan-Doğa ilişkisini konu alan çalışmalar 1973 yılında başlamış ve doğanın insan davranışı ve refahı üzerindeki etkisinin keşfedilmesiyle bu konu mekânsal deneyim üzerinden de araştırılmaya başlanmıştır. Fromm, doğayla bağlantı kurmanın insanların entelektüel, duygusal ve ruhsal doyuma ulaşmalarına yardımcı olabileceğini öne sürmüştür ve Wilson daha sonra bunu genişleterek evrimin insanların biyolojik tasarımını doğayla bu temasa olumlu yanıt vermeye zorladığını iddia etmiştir (Wilson 1993).

Şehirleşme ile daha fazla yapılı çevrede ve iç mekanlarda zaman geçirme durumunda kalan nüfusun artması ile insan davranışları ve psikolojisini etkileyen mimari tasarımın, bu etkiyi iyileştirme tekniklerine bakıldığında Biyofilik Tasarım konsepti ile karşılaşılmaktadır. Biyofilik tasarım konseptinin amacı, yapılı çevrede doğal aydınlatmayı, sıcaklık kontrolünü ve hava kalitesini teşvik ederek tüm ekosistemleri ve ekolojiyi geliştiren bir alan inşa etmektir (Madison, 2020; Guzzo, vd. 2022). Biyofilik Tasarım ile ilgili çalışmalar özellikle sosyal davranış ve psikolojinin ön planda olduğu okul, hastane vb. kamusal alanlarda yoğunlaşmıştır (Kellert, 2011).

Çocuk-Doğa İlişkisi konusu yoğun kentleşmenin etkisiyle psikolojik ve mimari çalışmalarda önemli bir konu haline gelmiştir (Kellert, 2011). Çocukların stres yaşadığı önemli bir alan olan okul binalarında doğa ile ilişkinin artırılması, çocukların üzerindeki stresin azalmasına ve refah düzeyine ulaşmalarına yardımcı olabileceği tez kapsamında çeşitli literatür çalışmalarına yer verilerek vurgulanmıştır.

Öğrenme, doğrudan öğretimin bir sonucu olarak gerçekleşmez; daha ziyade çocukların insanlarla, çevrelerle, materyallerle ve fikirlerle olan etkileşimlerini nasıl

yorumladıklarının bir sonucu olarak gerçekleşir (McNally vd., 2017). Bu bakımdan öğrenme ortamı tasarımı öğrenme sürecini etkileyen çok önemli bir faktördür. "Biyofilik Tasarım ile bütünleşen Öğrenme Ortamları çocuk-doğa etkileşiminin kurulmasını sağlayabilir." tezin hipotezidir. Tez çalışması, biyofilik tasarım içeren öğrenme ortamlarının çocuklar ve doğa arasında bir bağlantı kurabileceğini öne sürmektedir.

Bu bağlamda, tez çalışmasında öncelikle öğrenme kavramı ve süreci açıklanarak, bu sürecin farklı öğrenme yaklaşımlarıyla gerçekleştiği öğrenme ortamlarının tasarım farklılıkları ve özellikleri incelenmiştir. Türkiye'deki eğitim süreci ve öğrenme ortamlarının yapılarına, küresel ölçekte farklı eğitim sistemlerinin sınıf ortamlarına ve özelliklerine değinilmiştir.

İkinci adım olarak, doğayla etkileşimin öğrenmeyi nasıl etkilediğini anlamak için bu bağlamda yapılan çalışmalar üzerine literatür taraması yapılmıştır. Bir çocuğun öğrenme ortamında refahını sağlamanın uygulanabilirliği ve önemi konusunda araştırmalar yapılmıştır. Doğa ile etkileşimin refah düzeyini olumlu etkilediği ve refah düzeyinde ki artışın öğrenme sürecini geliştirdiği incelenen çalışmalar doğrultusunda saptanmıştır. Doğa ile etkileşimin sağlanması ile öğrenme aktivitesinde olumlu etkilere ulaşılabileceği bölüm sonucunda anlaşılmıştır.

Tezin bir sonraki bölümünde yapı-doğa ilişkisinin kurulmasına yönelik uygulanan tasarım yaklaşımı olan biyofilik tasarım kavramı detaylı bir biçimde açıklanmıştır. Bu kavramın ortaya çıkışı, çalışma alanları, mimari tasarım uygulamaları ve deneyimlerine yer verilmiştir. Çocuk ve biyofilik tasarım kavramları birlikte incelenerek biyofilik tasarımın çocuk-doğa etkileşimindeki rolüne değinilmiştir.

Araştırmanın yöntemi, incelenen literatür sonucunda bir biyofili tasarım kriterlerini içeren değerlendirme tablosu hazırlanarak, seçilen ortak özelliklere sahip okullara ait iki sınıfın bu ölçekte incelenmesi ve biyofilik tasarım uygulamalarının tespit edilmesidir. Toplanan literatür taraması ve alan çalışması veriler doğrultusunda, gelecekteki öğrenme ortamları tasarlanırken çocuk-doğa ilişkisinin gelişmesini sağlayacak bir yaklaşımın benimsenmesinin mümkün olduğunu göstermek ve bu bağlamda rehber niteliği taşıması amacıyla tez çerçevesine bir tasarım kılavuzu hazırlanarak dahil edilmiştir.

Tez kapsamında toplanan verilere göre refah düzeyindeki iyileşme, öğrenme sürecini ve akademik başarıyı doğru orantılı olarak etkilemektedir. Doğa-insan ilişkisinin sağlanması, refah düzeyini yükseltmek için etkili bir yöntem olarak uygulanabilir. Yapılı çevrede doğa ile ilişki ve etkileşimin sağlanması için biyofilik tasarım metodolojisinin okul ve öğrenme ortamlarının tasarımında uygulanması çocukların öğrenme sürecinin verimliliğini artırma potansiyeline sahiptir.

Anahtar Kelimeler: Biyofilik Tasarım, Öğrenme Ortamı, Çocuk-Doğa Etkileşimi, Yapılı Çevre

1. INTRODUCTION

Humanity began to construct its surroundings in order to defend and sustain its existence. During this process era by era, people started to live much closer to each other and they built communities, villages, cities and etc. In today's world, people continue to enlarge the cities they have built with the increasing population. As this growth continues, humanity is disconnecting itself each day from nature. The impact of the built environment on human life cannot be ignored. The built environment can have a variety of effects on the health and well-being of users who experience it; The negative human health effects of indoor living can be expressed in many ways, including an increase in disease symptoms that are often linked to psychophysiological causes (Burnard, Kutnar, 2020). Children are also adversely affected by this situation. They live in the city and grow up without experiencing nature adequately. They spend more time indoors with a modern urban lifestyle. We can clearly say that, lives trapped between concrete and steel structures in the built environment are being affected more and more negatively by this situation. Rudolph suggest that the risk of anxiety and depression and the risk of disruptive behavior are increased for children living in urban areas (Rudolph et al., 2014). Regarding society's growing urbanization and the amount of time individuals spend indoors, it is even more crucial that architecture enhances well-being (Watchman, 2021). Due to the digital activities that emerged with the development of technology, children spend more time indoors today. Spending time in a natural environment has been linked to improved psychological well-being. (R. Kaplan, 1973). Parents who neglect to give importance to any nature activity that will balance this situation may not be able to make up for this deficiency of their children unintentionally because of their busy city lifestyle. However, according to R. C. Moore's (1986) study, children like to spend time in a natural environment. He found that when urban children aged 9 to 12 were asked to sketch or build a map of all their favorite places, 96% of the drawings were of outside sites. In reality, just four sketches included interior rooms, and only one was entirely dedicated to constructing interiors. Lawns, playgrounds, and schoolyards, as well as their own house, local parks, and lone

trees, were the most commonly sketched preferred sites by the children (Moore, R. C. 2017). Children who interacted with nature on a high level were shown to be less likely to develop psychological distress (Wells and Evans, 2003). Considering the positive effect of nature on children, increasing their relationship with nature in the built environment they live in will be a great social development.

1.1 Purpose of the Thesis

Children spend more time at school than anywhere else, except at home, and the majority of their learning activities are existing in a built environment. Biophilic design can be used as a method to re-establish the broken child-nature relationship. A learning environment designed with biophilic patterns provides continuity to the need for contact with nature (Barbiero, 2021). For this reason, in several kinds of research, the biophilic designed educational space is suggested as an Innovative Learning Environment model that aims to support the connection between nature and children and to improve the learning process.

This thesis argues that people should respect and follow nature more while building their environment and developing architectural structures in harmony with nature. One of the aims of the thesis is to ensure the use of Biophilic Design, which is a design approach that helps to build structures intertwined with nature, especially in interior architecture. Based on the literature, it is envisaged to integrate school environments with nature so that children can get rid of the negative effects of being away from nature and in the built environment, increase their interaction with this hybrid structure, and enable them to adapt to school more. In particular, the classroom environment where the lesson activity takes place should be reconsidered with a biophilic design approach. Abdelaal suggests that the inclusion of biophilic elements such as plants, natural landscapes, light, and water in learning environments supports the learning function and thus can create a sustainable, inspiring, and innovative learning environment (Abdelaal, M.S., 2019)

The thesis includes fieldwork, which is a pilot study on re-establishing children's connection with nature, who are more exposed to indoor spaces with the effect of rapidly growing urbanization, with an architectural perspective and applying this connection in learning environments. In the study, the proposals and research findings that have the potential to establish the nature-children connection for future

architectural applications in children's learning environments are examined. Figure 1 shows how the thesis structured through the research questions.
The research questions of the thesis can be described as below:

- Why nature is important in education?

In literature, noteworthy studies have been conducted in several fields (psychology, education, architecture and design, human health, wellbeing, etc.) about nature and education issues. This thesis investigates the fundamental approaches and importance of the topic.

- How can we provide the interaction between the learning environment and nature?

- How is this interaction in the MEB classroom?
- How is this interaction on a Global Scale?

There are significant case studies in the literature to establish child-nature interaction in learning environments where students spend the majority of their time.

- Can we increase this relation by using Biophilic criterias?

It is almost impossible not to consider the concept of biophilic design when it comes to the integration of the built environment and nature. As you can see in the following sections of the thesis that the Biophilic Design lays the foundations for this integration.

- Hypothesis of the Thesis:

The hypothesis of the thesis is as follows; Learning Environments integrated with Biophilic Design can establish child-nature interaction.

1.2 Methodology of the Study

Within the scope of the thesis, a literature review containing the keywords Biophilic Design, Learning Environment, Children-Nature Interaction, Built Environment was carried out by considering three databases; Scopus, Web of Science and Google Scholar. The general overarching criteria for identifying relevant publications are:

- Explaining the concept of learning and the environment in which it takes place in Turkiye and globally,
- Examining the effects of nature on the child through empirical or experimental findings,

- Explaining the biophilic design concept and design strategies.

A field study was carried out as a result of the literature data obtained. For this field study, two schools with similar structural and systemic features were selected and their classroom environments were examined. Applications in classroom architecture were examined within the scope of biophilic design patterns presented by Browning et al. (2014). Based on the field study results and literature data, a biophilic learning environment design guide is presented within the scope of the thesis.

1.3 Result of the Chapter

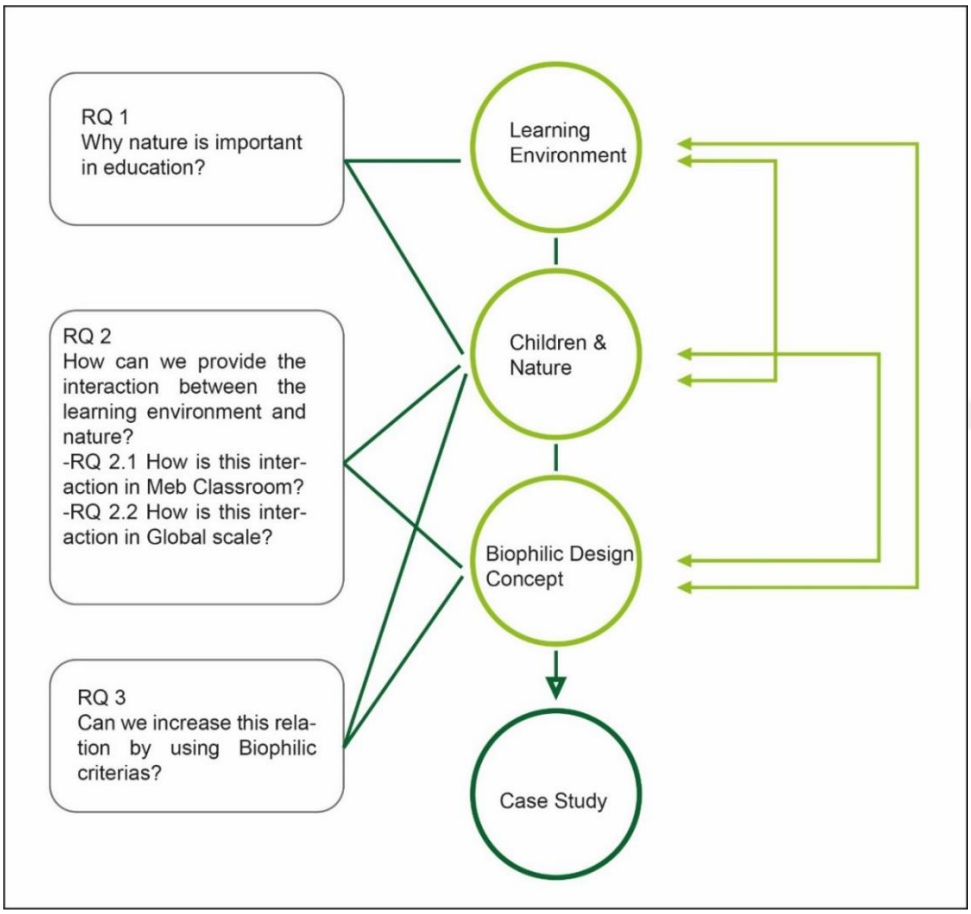


Figure 1: The structure of the thesis.

Learning Environment, Children and Nature Interaction, and Biophilic Design Concept were the three primary headings identified within the scope of the thesis stated with the purpose of raising the well-being level and quality of learning of children in the developing urbanization life. Answers to the following questions were searched for under these headings:

- Why nature is important in education?
- How can we provide the interaction between the learning environment and nature?
- Can we increase this relation by using Biophilic criterias?

The data provided were complementary to one another and served as the foundation for the field study and design guideline (Figure 1).

2. LEARNING ENVIRONMENT

Learning is an essential component of human existence. Learning influences a child's development. Learning, through interaction with society, helps to strengthen the child's intellectual abilities, acquire new habits, and strengthen both good and bad decisions, a sense of justice and aesthetics, etc. (Bashir, 2021). The effect of the built environment on the functioning of the learning process has emerged in many studies. In order to make this process more efficient, it is important for the architects who design the built environment to raise awareness on this issue in terms of the quality of child development and learning environments. In this chapter wthin the scope of the Learning Environment title, the definition and approaches of learning investigated and, it could be seen some theoratical and empirical studies from literature.

2.1 Learning Concept

The concept of learning has been defined in different ways by various researchers and although there are common approaches to these definitions, it is impossible to define it precisely with a single sentence. The lack of consensus on the definition of learning should be considered normal due to the abstractness of the concept. Learning has been the main focus of psychological research, and it is necessary to work on this topic in order to define it, even though it is notoriously difficult to define concepts that are as broad and abstract as the concept of learning (De Houwer et al, 2013).

Various definitions of learning have been included in the studies examined within the scope of this thesis:

- Learning is a relatively permanent change observed in behavior, knowledge, and thinking skills as a result of experience (Nagel & Scholes, 2016).
- Ülkü (1981) refered that learning is the result of an individual's being active, performing some actions or doing exercises, and it is a very permanent behavior change (Sünbül, 2014).

- Gates (1968) defined the change in behaviors as a result of knowledge acquired or transferred in living as learning.
- Learning is a multi-stage process that allows people to change their behavior, experience, knowledge, skills, and attitudes (Bashir et al, 2021).

Learning is much more complex than can be found in these definitions. In educational contexts, learning is often regarded as an outcome or goal that suggests some change in a learner (Nagel & Scholes, 2016). Therefore, it incorporates the definition types presented above. There are also researchers who divide the concept of learning into two as abstract and concrete definitions in the literature. Concrete definitions focus on the outcome of the learning process (Sünbül, 2014). Those who define learning concretely, to do what is learned; to be stored in memory, to become a habit; They attach importance to understanding what has been learned and they argue that when these products are not obtained as a result of learning, learning does not ocur (Başaran, 2005). Abstract definitions, on the other hand, deal with the process of learning rather than the result obtained, and definitions that deal with learning abstractly cause the reactions to the effects to settle on the nerves; They attach importance to the understanding of the situation with insight and the actions taken to satisfy the motives (Başaran, 2005). Whether these two approaches that define learning are made in terms of process or product, the result of all is behavioral change in people. Accordingly, learning; It can be defined as the change in behavior and perception as a result of a person's life, experiences and knowledge.

Learning occurs as a result of a person's behavior change. Behavior encompasses all of the observable and measurable conscious activities of human beings. What is meant to be explained by "change in behavior", which is encountered in all definitions of learning, is that all actions that people do consciously, such as their whole state, movement, thought, way of doing a job, display of emotion and attitude towards an event, explained as behavior (Sünbül, 2014).

Another common aspect encountered in the definitions is that learning occurs as a result of experience. According to definitions, learning depends on the realization of an experience. Experience is the meaning of human’s interaction with his/her environment for himself/herself (Sünbül, 2014).

Finally, another common aspect identified in the definitions is that learning is a process. It is not possible to learn a subject all of a sudden, it is a whole chain of interconnected changes, events, and activities (Sünbül, 2014). Looking at learning as a process rather than a product, on the contrary hand, requires a focus on what happens when learning occurs, and such explanations help to frame various theoretical orientations of learning (Merriam et al., 2007; Nagel & Scholes, 2016).

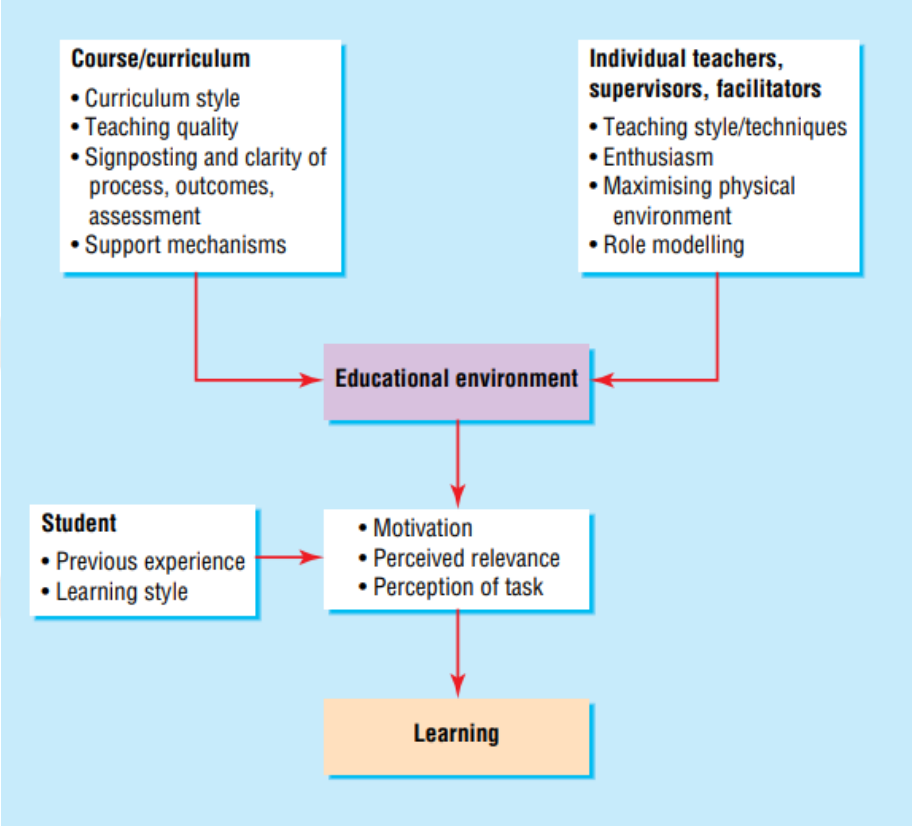


Figure 2: Factors that influence learning (Hutchinson, 2003).

Although learning depends on many factors, the engagement of the learner is very important, respectively, students' previous experiences and preferred learning styles, and the context and environment in which learning takes place are effective in students' participation (Hutchinson, 2003).

In Figure 2 factors that influence learning are represented. Five of the most commonly cited learning orientations that can be found in psychology and educational psychology include: behavioral orientations to learning, cognitive orientations to learning, humanistic orientations to learning, social cognitive orientations to learning, constructivist orientations to learning (Nagel & Scholes, 2016).

Behavioral Orientations to Learning:

An American psychologist, John Watson, stated that the key to understanding learning can be found through behavior analysis. Watson and a graduate student named Rosalie Rayner conducted an experiment to prove that they could teach a child to be afraid, in other words, to condition a fear response (Watson & Rayner, 1920). In the experiment, studies were carried out with a nine-month-old child as a subject. They exposed the gene child to a range of stimuli, exposed to. In the first stage of the experiment, the mouse was presented to the child, the child tried to touch the mouse and did not show any fear reaction.

In the second stage of the experiment, the mouse was presented to the child again, but this time accompanied by a loud sound stimulus hitting a metal pipe with a hammer from behind and out of sight of the child. As a result, this situation is repeated many times, it was recorded that the child started to cry every time he saw the mouse, even if there was no sound. End of the experiment, the boy learned to be afraid of mice.

Cognitive Orientations to Learning:

The dynamic nature of learning environment encompasses aspects of all disciplinary areas associated with 'cognition', but in terms of learning there are a number of important aspects surrounding cognitive orientation to this process (Nagel & Scholes, 2016). Cognition is an important field of study in many disciplines, but its meaning can vary between fields. The term cognition expresses the mental processes related to grasping and acquiring knowledge through experiences and senses (Santrock, 2011). While cognition in psychology and cognitive science is often depicted as a model of information processing within the mind, a branch of social psychology known as social cognition focuses on attitudes, attributions, and group dynamics (Blomberg, 2011; Sternberg, 2012).

Human development is recognized as one of the most important aspects of cognitive orientations towards learning, cognitive theorists argue that a gradual increase in the complexity of mental processes is closely linked to learning, the age factor will affect all aspects of learning, and cognitivists believe that internal processes such as insight, executive control, attention, memory and perception they focus on mental processes (Nagel & Scholes, 2016). Cognitive orientations focus on how students make sense of

knowledge and experience and the way they process information (Nagel & Scholes, 2016). Derived from this orientation is a fundamental framework in which learning is often defined as the acquisition of new knowledge.

Humanistic Orientations to Learning:

Humanist orientation to learning born from humanistic psychology in the 1950s, this psychology and learning orientation emerged as an alternative to the extreme "scientific" methods of behaviorism (Nagel, 2013a). Humanistic orientations tend to pay more attention to students' needs, feelings, values, and self-perceptions (Nagel & Scholes, 2016). Inspired by the work of Jean Jacques Rousseau, Friedrich Froebel, Maria Montessori, John Dewey, and Rudolf Steiner are a set of early twentieth-century figures who can be considered pioneers in humanist education. (Snowman et al., 2009).

Social Cognitive Orientations to Learning:

Social cognitive orientations to learning include elements of both behavioral (operational conditioning) and cognitive (information processing) theories, implying a link between relationships, cognition, and learning (Nagel & Scholes, 2016). This orientation is based on the social learning theory framework and emphasizes how behavioral and personal factors interact with the social and physical environment (Bandura, 1976). Social learning theory is a hybrid of behavioral and cognitive approaches to learning. Bandura's learning descriptions emphasized cognitive factors such as rehearsal, attention, memory, and motivation, and he updated his previous work on social learning theory to social cognitive theory (Nagel & Scholes, 2016). Fundamental principles underlying both social learning theory and social cognitive learning orientations suggest that people can learn by observing the behavior of others and the consequences of those behaviors (Nagel, 2013). Social cognitive learning orientations acknowledge the impact of physical and social environments on behavior and learning. According to social cognitive theorists, school resources, consequences of actions, the nature of a task, use of reinforcement or punishment or both, other people, group dynamics, and the actual physical size of a classroom can all have an impact on learning (Snowman et al., 2010; Woolfolk & Margetts, 2013; Nagel & Scholes, 2016).

Constructivist Orientations to Learning:

"Constructivism" -applied to learning theory and epistemology- addresses both how people learn and the nature of knowledge. The term refers to the idea that learners construct knowledge for themselves; Each student creates meaning as they learn individually (and socially) (Hein, 1991). Constructivist learning orientations (constructivism) are characterized by a number of related perspectives and theorists such as Dewey, Montessori, Steiner, Piaget, and Vygotsky were historical influences on aspects of this learning orientation (Nagel & Scholes, 2016).

One of the easily identified constructivist theories is that learning is a meaning-making process; how people make sense of their experiences (Merriam et al., 2007). The distinction between whether a person constructs their learning and understanding through a social process or as an individual is important. There are significant differences among constructivist theorists regarding the role of experience, the nature of reality, what information is of interest, and whether the meaning-making process is primarily individual or social (Steffe & Gale, 1995). This dichotomy has witnessed the emergence of the two most prominent versions of this orientation: cognitive constructivism and social constructivism (Nagel & Scholes, 2016).

Cognitive Constructivism:

According to Jean Piaget, a well-known French Swiss developmental psychologist who wrote numerous books and articles on learning, students learn as individuals who construct conceptual structures in memory to store information (Kalina & Powell, 2009). Making meaning within this branch of constructivism is dependent on an individual's cognitive capacities and abilities, with meaning constructed through the individual's previous and current knowledge structure; learning is the result of an internal cognitive activity; and active learning constructs comprehension and knowledge, according to this orientation, learning is regulated in the educational context by providing experiences that develop cognitive tension, which in turn motivates students to construct new knowledge schemas that are more appropriate for the given scenario (Nagel & Scholes, 2016). Piaget's work directly influenced cognitive constructivism; he formed his theories by observing his own children learning and playing together. Piaget's theory of cognitive development proposes that

humans cannot be given information that they instantly recognize and use; instead, humans must construct their own knowledge (Kalina & Powell, 2009).

Social Constructivism:

The term Social construction, which has its origins in John Dewey's Pedagogic Creed (1963), has been defined as the psychological and social aspects of education are organically related and education is the construction of a compromise between the two (Hirtle, 1996). Given the links between one's cultural tools and the need to talk socially about shared problems or tasks and participate in activities, social constructivists frequently refer to learning as a form of meaning negotiation (Snowman et al., 2014). Social constructionism emphasizes the use of cultural tools (eg, language, mathematics, diagrams, problem-solving approaches) as a primary influence on meaning-making, and also focuses on the construction of meaning (Merriam et al., 2007).

There are many learning theories available, and the theories and methods presented here represent an elite group in educational practice that stands out and continues to be prominent in the literature. Various aspects of the behavioral, cognitive, humanistic, social cognitive, and constructivist orientations to learning are presented in a broad overview to understand the concept of learning. For the act of learning to occur more effectively, basic human needs must be met. In the next section, Maslow's pyramid will be examined to understand what these needs are.

Maslow’s Hierarchy of Needs:

Abraham Maslow is a psychologist who investigated the 'hierarchy of needs,' a psychological health theory based on meeting basic human needs. Hierarchy of needs pyramid represented in Figure 3.

Maslow argued that basic needs must be met before higher levels can be reached (Rouse, 2004). If the physiological, safety and belonging needs are not met in line with these basic needs that affect the academic success of a student, an effective learning cannot be expected from the student (Nagel & Scholes, 2016). This situation clearly reveals the importance of environmental and social conditions in a child's learning experience. (Martinez, 2010).

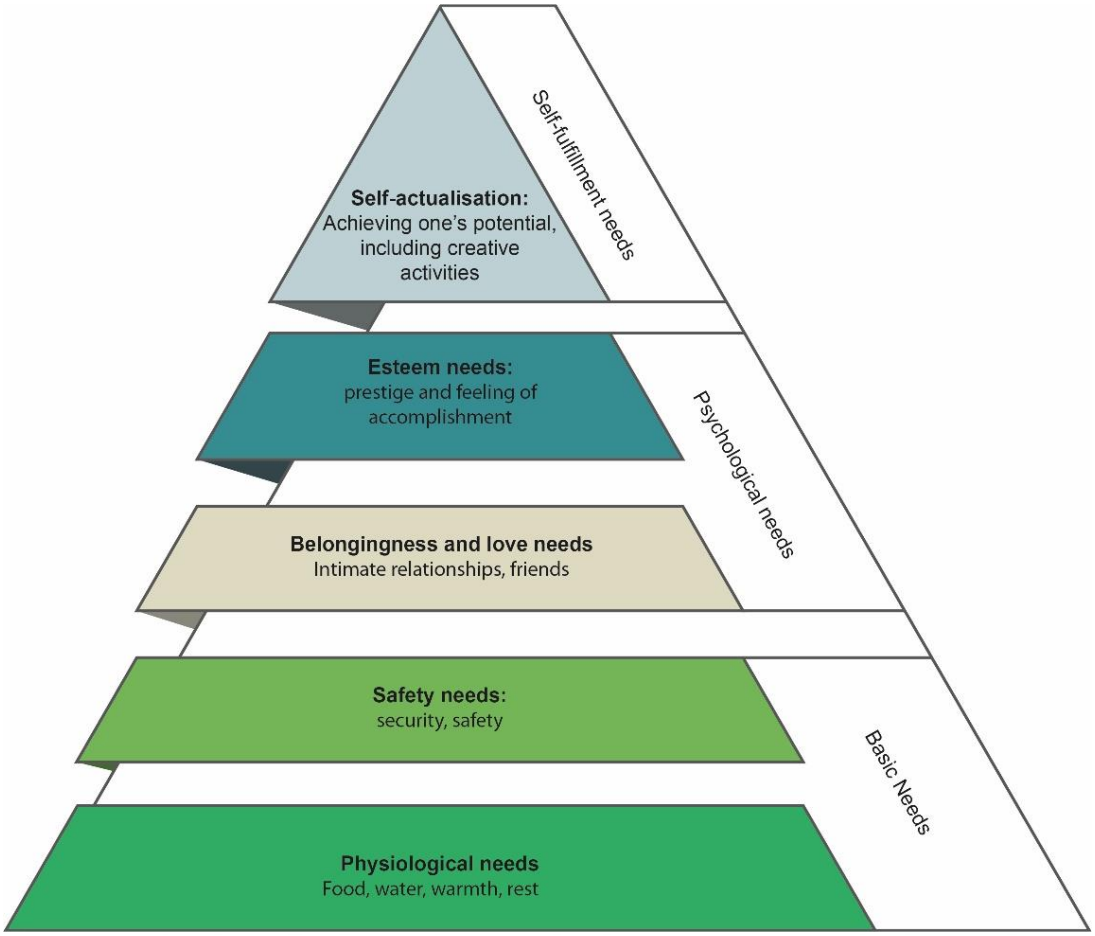


Figure 3, Maslow's hierarchy of needs (Malow, 1943; Rouse, 2004), (Reillustrated by author).

2.1.1 Universial design for learning

The concept of universal design, which basically emerged in the field of architecture by Ron Mace (Center for Universal Design, 1997), influences to build structures that can supply different needs of people to access buildings without the need to retrofit structural details (such as ramps, doorway widths, etc.) (King-Sears, 2009).

Presently, classrooms are characterized by an ever-increasing variety. A set of pedagogical principles for designing flexible teaching and learning methods that address the diversity of students (with and without special needs) in the classroom context is called Universal design for learning (UDL) (Sasson et al., 2022).

UDL philosophy is founded on three principles: (1) multiple means of engagement; (2) multiple means of knowledge representation; and (3) multiple means of understanding expression (Evmenova,2018).

Figure 4: Universal Design for Learning Guidelines (Meyer et al., 2014).

A detailed practical description of the application and research of pedagogical philosophy, the UDL implementation is supported by a set of nine guidelines and 30 checkpoints based on three UDL principles (see Figure 4) (Sasson et al., 2022). Universal instructional design (UDL), which includes curriculum development and teaching principles that give all students equal opportunities to learn, is a concept similar to UDL (Sasson et al., 2022).

To provide flexibility in learning methods and support an equal experience for all student types in the Universal Design of Learning methodology, mentioning Howard Gardner's Multiple Intelligence Theory would be the right approach to understanding the differences in this regard.

Gardner's Theory of Multiple Intelligences states that each individual processes information in seven comparatively independent ways; people differ from one another in the particular intelligence profile they display (Gardner, & Hatch, 1989). According to the multiple intelligences theory, a person's learning process should be customized to maximize their abilities in each multiple intelligence (See Table 2.1). Through identification and cultivation of these intelligences, people can enhance their capacity for knowledge acquisition and comprehension. For instance, reading and writing exercises are beneficial for someone with great linguistic intelligence, while tactile tasks and illustrations are beneficial for someone with strong visual-spatial intelligence. According to the multiple intelligence theory, it's critical to value and acknowledge the various forms of intelligence that exist, as well as to modify instruction to better suit the requirements of different types of students (Gardner, & Hatch, 1989).

Table 2.1: The Seven Intelligences (Gardner, & Hatch, 1989).

Intelligence	End-States	Core Components
Logical-mathematical	Scientist Mathematician	Sensitivity to, and capacity to discern, logical or numerical patterns; ability to handle long chains of reasoning.
Linguistic	Poet Journalist	Sensitivity to the sounds, rhythms, and meanings of words; sensitivity to the different functions of language.
Musical	Composer Violinist	Abilities to produce and appreciate rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness.
Spatial	Navigator Sculptor	Capacities to perceive the visual-spatial world accurately and to perform transformations on one's initial perceptions.
Bodily-kinesthetic	Dancer Athlete	Abilities to control one's body movements and to handle objects skillfully.
Interpersonal	Therapist Salesman	Capacities to discern and respond appropriately to the moods, temperaments, motivations, and desires of other people.
Intrapersonal	Person with detailed, accurate self-knowledge	Access to one's own feelings and the ability to discriminate among them and draw upon them to guide behavior; knowledge of one's own strengths, weaknesses, desires, and intelligences.

Sasson and colleagues (2022) conducted a study involving four rural primary schools in the process of implementing a pedagogical change from a more traditional to a constructivist approach. A total of 507 observations (45 minutes each) were carried out in four primary schools in the same geographic area, with 265 (52%) taking place in traditional classrooms and 242 (48%) in innovative learning areas. Similar initiatives, such as redesigning learning spaces, are gradually being developed in all schools. As a result of the study, the rate of student-centered learning in innovative areas was found to be significantly higher than in traditional classrooms (Sasson et al., 2022). Of the eight pedagogical practices examined, five were found to be significantly more prevalent in innovative learning domains: cooperative learning, guided instruction, integrative visual representation, integrative tasks that promote choice, and integrative tasks that address student differences. Teachers' explicit statements about organizing and managing written/oral learning processes were significantly more frequent in traditional classrooms (Sasson et al., 2022).

There was no significant difference in the expression of individual learning between learning domains. The teacher's expression of encouraging questioning and critical thinking was very low in both learning domains and there was no statistical difference. As a result of the research, it is recommended to design learning spaces that naturally invite various teaching and learning methods.

2.2 Examining Classroom Environments Through Learning Approaches

Civilization, which continues to develop and change day by day, and the emergence of new information with the development of technology, necessitates the updating of education systems and fields. Each educational theory has a certain image and a certain view of the learning process. (Schmitt-Stegmann, 1997). Today, education and learning are seen as a process of facilitating learning, helping the student to construct his/her own individual knowledge, meaning, or interpretation of the outside world in learning, and in the design and implementation of teaching practices, the emphasis is on where and which conditions students can learn better, rather than what and how teachers teach (Sünbül, 2014).

2.2.1 Waldorf learning approach

Rudolf Steiner (1861-1925), an Austrian scientist and philosopher, founded Waldorf education (Edwards, 2002). He applied his ideas directly to education with the establishment of the first Waldorf school in 1919 (Wright, 2009). Steiner Waldorf schools provide a genuine alternative to non-formal education around the world, and they see themselves as partners who provide a complementary service by contributing to and learning from other educational practices (Nicol, 2010).

Steiner's theory of knowledge expands in two directions: generalization and individualization. Individualization refers to the appropriate integration of general concepts with specific perceptions (because their generality is limited to an individualized form in their expression), whereas generalization refers to the active articulation and cognitive comprehension of conceptual contexts with their inherent legality. Because the penetration of one concept into a perception (individuation) presupposes the creative generation of the second in thinking, these two types of learning are mutually dependent (generalization). On the contrary, the enigmatic nature of perception drives the constant vigilant activity of thinking. This relationship will be discussed in greater depth below in relation to an interpretation of Steiner's theory of knowledge (Schieren, 2012).

Waldorf education theory of child development outlines three cycles of seven-year stages, each with its own set of unique needs for learning an ascending spiral of knowledge (Edwards, 2002). Until around the age of 7, the early childhood stage is the "imitation" and "will" stage, in which learning occurs primarily through physical activity. At this stage of development, teachers downplay the importance of academics; for example, reading is not taught in kindergarten but is gradually introduced in first grade (Schmitt-Stegmann 1997). Middle childhood, ages 7 to 14, is the "imagination" stage, when emotion and experience play the most important roles in learning. Finally, adolescence and young adulthood, beginning at the age of 14, are the "intelligence" stages, during which a sense of independence emerges and intellectual thinking occurs (Nicholson, 2000).

The Waldorf approach's principles are as follows:

- Each child has unique characteristics and superior abilities. When it comes to education, what children can learn is prioritized over what they need to learn.
- When children connect learning to their own experiences, they become more interested and lively, and they begin to learn with these experiences. However, after reaching a certain level of maturity in a field, it is necessary to advance in education.
- Art; It helps academic integrity, self-realization, resolution of conflicts, and development of self-esteem by nurturing the source of necessary forces for moral, social, mental, emotional and voluntary development.
- The school should be completely free from any economic and political control. In order for the subjects to be learned to be associated with the child's life, each school should organize its curriculum according to the society in which it is located.
- The purpose of the evaluation is to make the child aware of his/her development, so that he/she feels the enthusiasm of learning and producing more. Equal importance is given to areas such as the acquisition of knowledge, the application of skill (See Figure 5), the empowerment of creativity, the stimulation of imagination, the nurturing of understanding and empathy, the importance of social responsibility, and moral principles. (Ekici, 2015)

Figure 5: Green Meadow Waldorf School, New York, USA (URL-1).

Children can sing, do watercolor, paint with wax crayons, cook, listen to a story, go hiking, work in the garden, play with wooden blocks, and so on as part of their educational experience. As a result, they immerse themselves in such activities, developing concentration and motivational abilities (Edwards, 2002).

In the Waldorf Education approach, the child is accepted as a part of nature and argues that if his integration with nature is provided, it can only be achieved in his personal integrity. It is thought that the rhythms and cycles found in nature (such as the seasons) affect humans' own vital rhythm and that humans exist within this rhythm. Since nature is thought to have an important effect on children, natural elements are included in classroom environments (See Figure 6). In kindergarten and primary school, the nature table is positioned in the classroom, and thanks to this table, the child is provided to experience the beauty and rhythm of nature. Seasonal objects are placed on the nature table.

Figure 6: Green Meadow Waldorf School, New York, USA (URL-1).

Children can contribute to this table and decorate the classroom with artwork that reflects their culture and traditions. The use of music to transition from one activity to another is an example of the aesthetic aspect of the Waldorf school. (Hutchingson, 1993; Ekici, 2015) There are equipment arrangements in Waldorf learning environments where activities can be done individually or in teams. Functions are not isolated from one another. Although natural lighting is given importance in the environment, artificial lighting is used because of the need (Ekici, 2015).

2.2.2 Reggio Emilia learning approach

Reggio Emilia is a prosperous region of Northern Italy and is home to one of the world's most innovative, high-quality city-managed children's and pre-school systems (Hewett, 2001). In order to include children in a school system that will foster their intelligence and equip them for life, the Reggio Emilia approach was developed (Anıktar, 2017). The social and cultural influences of the region inevitably shaped the development of Reggio philosophy. Emilia Romagna has a long history of democracy, collegiality, participation, and responsible citizenship. Reggio Emilia citizens value encounters, debate, discussion, and negotiation. Individual and community-based human relations are important, and different points of view, perspectives, and cultures are welcomed. (Thornton & Brunton, 2015)

The Reggio Emilia approach is founded on a set of core principles and an educational philosophy that emphasizes the child as an active, engaged learner. The following are key principles of the approach (McNally et al., 2017, Edwards, & Gandini, 2018):

-Respect for the Child: The Reggio Emilia approach values the child as a unique individual with specific needs and interests. Children are viewed as capable, competent learners capable of directing their own learning experiences.

-Collaboration: The approach prioritizes collaboration among children, parents, and educators, with a focus on developing strong relationships and community partnerships.

-Documentation: A key component of the Reggio Emilia approach is the documentation of children's learning. Teachers and students collaborate to create visual and audio documentation of the learning process that can be used to reflect on and expand on learning experiences.

-Environment: The classroom environment is intended to encourage exploration, creativity, and hands-on learning. Materials and resources are carefully chosen to pique the interests of children and promote learning through play.

-Emergent Curriculum: The curriculum is not pre-determined, but rather emerges from the children's interests and needs. Teachers serve as facilitators, assisting in the direction and extension of children's learning experiences based on their interests.

Reggio educators recognize and advocate for the fact that learning does not occur as a direct result of teaching, but rather as a result of how children interpret their interactions with people, environments, materials, and ideas. The emphasis is on how relationships interact with learning to help the child recognize his or her own worth and develop the confidence to participate in school activities (McNally et al., 2017).

In the classroom, the Reggio Emilia approach focuses on creating a child-centered learning environment that encourages exploration. The classroom is intended to be a welcoming, warm environment that encourages children to interact with their surroundings and explore new ideas. (Schroeder-Yu, 2008).

Figure 7 North Perth School of Learning / Tom Godden Architects & Matthew Crawford Architects (URL-2).

Teachers in Reggio Emilia classrooms serve as coordinators, observing and identifying children's learning experiences while also assisting in their expansion and support. Collaboration is a key component of the approach, in which teachers and students work together to create meaningful and relevant learning experiences based on the child's interests. (Thornton & Brunton, 2015).

The method focuses the visual and performing arts, as well as the use of materials and tools to explore and express creativity (McNally et al., 2017). Children are encouraged to collaborate on collaborative projects such as murals or group performances, which promote social skills and a sense of community (Thornton & Brunton, 2015).

Every Reggio Emilia school has a "Atelier" workshop. A graphic arts expert known as a "Atelierista" collaborates with the teacher and students in the studio and laboratory mix workshop, which is filled with natural and art materials. This person assists in the planning of weekly activities related to the current project. These activities allow students to express themselves through the use of new tools such as clay, painting, collage, and sculpture (Aslan, 2005).

Figure 8: Beelieve Preeschool of Life / 3Arquitectura (URL-2).

The educational setting is used to strengthen the bonds between children, teachers, and families. The classroom has light furniture; instead, various visual materials such as children's works, pictures, photographs of completed projects, products, and photographs of children with their families are displayed throughout the school (See Figure 8). Local culture is expected to differ from school to school in Reggio Emilia schools (Anıktar, 2017). While empirical evidence for the effectiveness of the Reggio Emilia approach is limited, there is a growing body of research that suggests the approach may have positive effects on children's learning and development. According to Hohmann and Weikart (1995), children who attend a Reggio Emilia kindergarten have higher levels of school readiness and social competence than children who attend a traditional preschool program.

Other research has found that the approach can improve social-emotional development as well as creativity and problem-solving skills (Dahlberg, Moss, & Pence, 1999). More research, however, is required to fully assess the approach's effectiveness and impact on children's long-term outcomes.

2.2.3 Montessori learning approach

Dr. Maria Montessori, an Italian physician and educator, developed the Montessori method in the early 1900s. Dr. Maria Montessori developed the Montessori method based on her extensive observations of children's learning processes. Her views are based on the characteristics of the naturalist movement, an orientation toward nature (Lillard, A. S. 2005). The method has evolved and adapted over the years by educators all over the world, but its basic principles have not changed (Lillard, A. S. 2005). It is based on the idea that children are naturally curious and capable learners who, when provided with the right environment and materials, can be empowered to reach their full potential (Montessori, 1948). The Montessori method has gained popularity around the world due to its emphasis on individualized learning, hands-on experiences, and the development of social and emotional skills (Özerem & Kavas, 2013).

The Montessori method is based on the idea that children are capable and intelligent beings who should be allowed to explore and learn at their own pace (Montessori,1912). This philosophy emphasizes the importance of providing a nurturing and stimulating environment that encourages the child's natural curiosity and development and the Montessori method emphasizes the value of individualized learning as well as the development of social and emotional skills (Kayili & Ari, 2011). Montessori believed that children should understand and appreciate nature's order, harmony, and beauty. The rules of natural form are the foundation of science and art. As a result, understanding natural laws is the foundation of science (Özerem & Kavas, 2013). The Montessori approach emphasizes the importance of order in the environment. In such an environment, the child's relationship is with the material rather than with the teacher. The teacher only guides the students in how to use the material correctly (Dreyer and Rigler,1969; Özerem & Kavas, 2013).

Montessori Education is based on eight fundamental principles (Wilbrandt 2011; Özerem & Kavas, 2013):

1. Movement and cognition are inextricably linked. Movement improves both thinking and learning.
2. When people have a sense of control over their lives, their learning and well-being improve.
3. People learn more effectively when they are interested in what they are studying.
4. Tying extrinsic rewards to an activity, such as money for studying or high test grades, has a negative impact on motivation to participate in that activity when the reward is removed.
5. Collaborative learning arrangements can be extremely beneficial.
6. Meaningful context learning is often deeper and richer than abstract context learning.
7. Certain types of adult interaction are linked to better child outcomes.
8. Children benefit from order in their surroundings.

Environment design is crucial and pertinent in the Montessori educational philosophy for encouraging independent learning and self-discovery. The environment is carefully planned and structured to encourage exploration, curiosity, and creativity while also supporting the child's natural development (Rathunde, 2001). The Montessori classroom is child-centered, with an emphasis on providing a comfortable and safe environment that allows for freedom of movement and choice. The furniture and materials are set up in such a way that children can move freely and choose their own activities, encouraging them to explore and learn at their own pace (Lillard, A. S. 2005). The order of the environment is very important in the Montessori approach because the child learns by himself without any assistance from anyone (Rathunde, 2001). As a result, the environment is designed with the child in mind. The most important elements of the environment are materials (Kayili & Ari, 2011). Because the child learns not from the teacher, but from the materials presented in his environment through his own experiences (Anıktar, 2017).

Figure 9: Montessori Kindergarten / ArkA – China (URL-3).

The learning materials used in Montessori classrooms are carefully chosen to accommodate each child's interests and developmental needs. The materials are self-correcting so that children can learn from their mistakes and gain a sense of mastery and independence. The materials also encourage sensory exploration, assisting children in developing their senses and refining their perceptions of their surroundings (See Figure 9), (Kayili & Ari, 2011). Additionally, the Montessori environment aims to promote social and emotional development. Children learn to respect and care for each other, to cooperate and to take responsibility for their environment. A supportive and inclusive classroom community fosters a sense of belonging and connection (Lillard, A. S. 2005). Children studying in Montessori schools can move as they wish, both in the classroom and in open spaces. Areas to grow plants in the open area have been arranged. Different functions are combined in the learning environment. Walls limit no space and due to the importance of nature, wood is preferred as a material in the interior (Anıktar, 2017).

The classroom environment should be adequately illuminated by daylight and dominant colors should be avoided (See Figure 10). In general, the Montessori approach emphasizes the importance of environmental design in promoting the child's natural development and love of learning. The environment in which students communicate with nature is an important component of the Montessori approach because it helps to train independent, self-motivated students who are well prepared to succeed in the future (Montessori, 1948).

Figure 10: Montessori Kindergarten / ArkA – China (URL-3).

2.2.4 Constructivist learning approach

There has been a surge of interest in constructivist learning approaches in recent years, which emphasize the importance of active participation, metacognition, and social interaction in the learning process (Land & Jonassen, 2012). The constructivist approach states, learning is internally controlled by the learner, learners actively construct their own understanding of the world based on their own experiences, and learning is most effective when contextualized and embedded in authentic problem-solving activities (Jonassen, 1991). The constructivist learning approach has significant implications for teaching and learning because it emphasizes the importance of educators creating environments that encourage active engagement, metacognition, and social interaction among learners (Land & Jonassen, 2012).

According to this approach, learning is believed to be an active, social process involving the construction of knowledge rather than passive transfer of knowledge from teacher to student (Driver & Oldham, 1986). The constructivist learning approach is based on several key principles that guide how educators design and facilitate learning experiences for their students. These principles are supported by a wide variety of literature and include:

-Learning is an active process: Students actively participate and take responsibility for their own learning. This principle is supported by inquiry-based learning research that emphasizes the significance of active participation in the learning process (Barrows, 1996).

-Knowledge is structured rather than transferred (See Fig. 11): Knowledge is not simply transferred from the teacher to the student in the constructivist learning approach. Students, on the other hand, actively construct their understanding of the world through their experiences and interactions with their surroundings. Jean Piaget, a psychologist, first proposed this concept and argued that learning is an extension of reality rather than a copy of it (Piaget, 1977, p. 7).

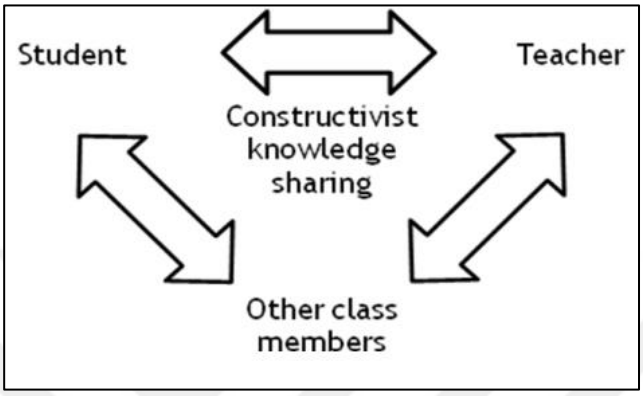


Figure 11: Constructive theory by Jean Piaget (Piaget, 1977; Elouarat et al., 2011).

-Learning is contextual: The constructivist learning approach emphasizes the importance of designing learning experiences that take into account the student's prior knowledge, experiences, and cultural background. This principle is supported by established cognition research, which indicates that learning is not independent of the context in which it occurs (Driver & Oldham, 1986).

-Learning is social: A key component of the constructivist learning approach is social interaction. This principle is supported by cooperative learning research, which indicates that social interaction can improve learning outcomes (Land & Jonassen, 2012).

-Learning is metacognitive: A key component of the constructivist learning approach is metacognition, or the ability to reflect on one's own thinking and learning processes (Land & Jonassen, 2012). These principles can be a guide to designing learning environments that support active participation, critical thinking, and a deep understanding of complex concepts and ideas. To maximize the approach's effectiveness, educators should create environments that encourage students' active participation, metacognition, and social interaction.

2.2.5 Behavioral approach

The Behavioral Learning Approach is a psychological perspective that emphasizes the role of learning in human behavior and argues that experience and environment shape behavior (Skinner, 1965). The Behavioral Learning Approach was developed by Ivan Pavlov, who discovered classical conditioning in dogs in the late 19th century, and B.F., who developed the operant conditioning theory in the mid-20th century. It was developed from the work of Skinner.

Some theories have been devised to date in order to comprehend and shape human behavior. Three main approaches can be identified in the theoretical development of behavior (Davis & Luthans, 1980). Firstly, according to some theorists (Maslow, 1954; Vroom, 1964; Adams, 1965; Locke, 1969) behavior is explained as a function of the person. Internal psychological structures such as motivation, perception, attitudes, expectations, and personality traits are used to explain why people behave the way they do (Davis & Luthans, 1980).

Secondly, according to some researchers, behavior is explained as a function of the environment. Skinner's (1953) operant conditioning (one of the key principles of the behavioral learning approach), this position is externally oriented and, in particular, is concerned with the role that reinforcing contingencies play in maintaining and changing behavior (Davis & Luthans, 1980). The third theoretical approach framed in Kurt Lewin's work is the conciliatory position, which states that behavior is a function of the person and the environment. It is argued that both the person (internal structures) and the environment (external contingencies) must be taken into account to explain behavior (Davis & Luthans, 1980).

The Behavioral Learning Approach has principles applied in a variety of settings, including education, therapy, and work. In education, these principles were used to develop effective classroom management strategies (Brophy, 2006). The key principles of the Behavioral Learning Approach:

1. Classical conditioning: Pavlov's experiment with dogs is the most famous example of classical conditioning; a bell is associated with the presence of food, causing dogs to salivate just at the sound of the bell. The idea behind this principle is that a neutral stimulus can be associated with a natural stimulus, resulting in a similar response. Pavlov's experiment with dogs is the most famous example of classical conditioning; a bell is associated with the presence of food, causing dogs to salivate just at the sound of the bell. (Clark, 2004)

2. Operant conditioning: A behavior is more likely to be repeated in the future if it is followed by a desirable outcome, such as a reward. A behavior is less likely to be repeated if it is followed by an unfavorable outcome, such as punishment. This principle assumes that behaviors can be strengthened or weakened based on their consequences. (Skinner, 1965)

3. Observational learning: It entails watching others and imitating their behavior. This principle was demonstrated by Bandura (1977) in the famous Bobo doll experiment, in which children observed an adult behaving aggressively toward a Bobo doll and then imitated this behavior when given the opportunity to interact with the doll. (Bandura, & Walters, 1977).

This approach can be applied to classroom design by providing a physical environment for students that supports and encourages positive behavior. The behavioral learning approach emphasizes the importance of a positive learning environment that reinforces desired behaviors using feedback, positive reinforcement, and opportunities to apply new knowledge and skills (Skinner, 1954).

Positive reinforcement for desired behaviors, such as praise and rewards, can encourage students to continue engaging in those behaviors. To provide application and practice in the context of classroom design, this can be incorporated into the classroom setting in areas for cooperative learning and hands-on activities. It is important to provide timely and specific feedback on their work to help students understand what they are doing well and what they need to improve (Nelson & Schunn, 2009). Creating areas where students can present their work and including group discussions can be provided by including them in the classroom design.

2.3 Transformation of Classrooms from Past to Present

Education is one of the basic tasks of a democratic society in order to raise conscious generations. The built environment in which this important task is provided not only shapes the way of teaching-learning but also represents the values we have in common as a society. In line with the socio-cultural structure, technology, and increasing population needs that have developed from the past to the present, the school design and classroom environment are built environments that are in constant change and development. Although the design of educational areas differs on a global scale within the scope of different educational approaches and cultural contexts that differ between societies, it is seen that the basic functions provided by schools and especially classroom environments are almost the same. In this part, the current classroom situation in Turkey and on a global scale has been examined. But first, addressing the history of classroom environments and their evolution and causes will provide a more comprehensive understanding of the design of learning environments.

The earliest classrooms recorded in research to date are found in ancient Greece and Rome. A teaching system has been identified in which the teachers are in the center and the students sit on stools in a semi-circle around the teacher (Altbach, et.al, 2011). In the Middle Ages, it is seen that education took place mainly in religious institutions. Classroom environments were created to include lectures and discussions rather than hands-on learning. Bustling classrooms with a raised platform for teachers, a central corridor for students, and desks were widely existing (Cobban, 1961).

In the Renaissance period, education has undergone a significant change. The reason for this is that in this period, more importance to humanism and individualism is given more importance and the development of society in this regard. Aesthetics and the comfort of the students were given more importance in classrooms. (Grendler, 2003)

As Sanoff & Walden points out, business and industry grew rapidly in the 19th century and this expansion was also reflected in the school setting, students' learning was perceived in terms of productivity, and in schools viewed as a workplace (factory). At the beginning of the 20th century, students were referred to as raw materials to be converted into products that would meet needs (Sanoff, 2012).

As illustrated in Figure 12, learning environments grew in size during the industrial period as education moved from elitism to classification (Park & Choi, 2014).

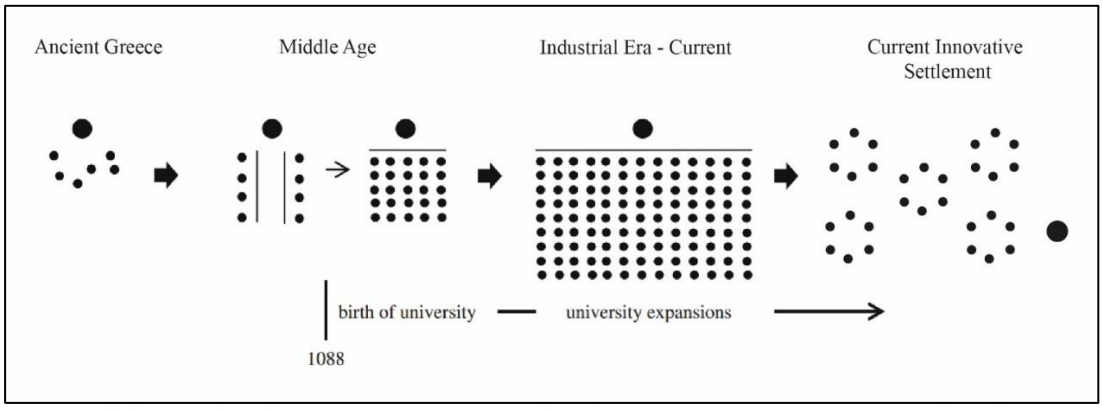


Figure 12: Historical changes in classroom design (Park & Choi, 2014).

(Reillustrated by the author).

Schools were built in larger, longer structures to accommodate the growing number of students. This order is still prevalent in the majority of today's higher education classes. Although the teacher-centered classroom layout has been common from past to present, some student-centered classroom layout approaches have also emerged (like MIT's TEAL classrooms, (See Figure 13) or North Carolina State's SCALE-UP classrooms). Aim of the this approach is to create a learning environment where students are more engaged with the material and with each other (Lasry et al., 2014).

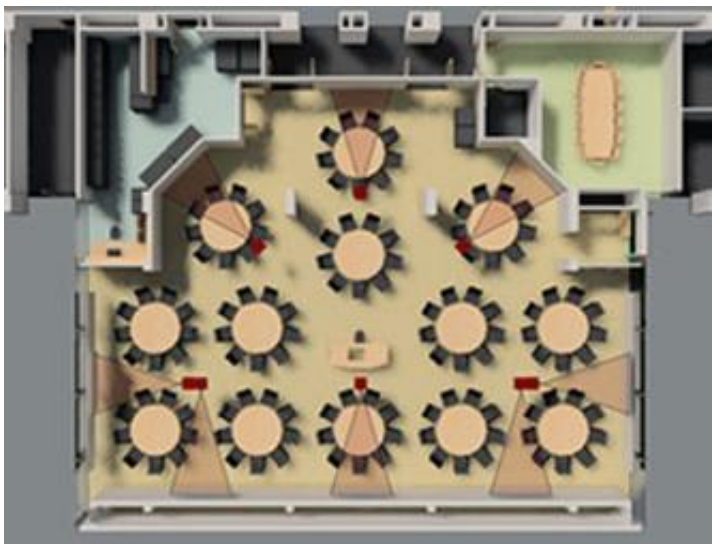


Figure 13: TEAL classroom layout, top view (URL - 4).

Student-centered classrooms are known as socio-technological classrooms. In many ways, socio-technological classes differ from teacher-centered classrooms. The transmission model of instruction is used in teacher-centered classrooms; instructors are experts who pass on information to less knowledgeable (and possibly understanding) students. As a result, traditional classrooms are designed to be teacher-centered, with an instructor at the front of the room and all students facing the instructor. In contrast, socio-technological classrooms are intentionally designed to be student-centered (Lasry et al., 2014).

According to Lasry's (2014) qualitative work; One major warning is that teachers' epistemic beliefs about teaching and learning should be carefully considered before assigning them to such classrooms. Further research on altering teachers' epistemic frameworks is necessary in order to increase the adoption of new pedagogical approaches and enhance the utilization of new learning environments.

2.3.1 The situation in Turkey

In Turkey, which is a country with a young population, meeting the needs is the main purpose in the design of the buildings, with the addition of the increasing population and migration, and it is observed that the structures shaped in line with educational approaches and ideologies are mostly limited to private education institutions. In the national context, the changes in educational institutions and classroom environment in Turkey which has a deep-rooted history have been examined within the scope of the thesis from the Ottoman Empire to the present.

2.3.1.1 Ottoman duration

The Ottoman Empire was a powerful empire spanning three continents, spanning more than six centuries from the late 13th to the early 20th century (Faroqhi, 2004). Education and training in the Ottoman Empire generally took place in mosques and madrasas because the education system was based on a religious model and was heavily influenced by Islamic teachings (Demir, 2017). The formal educational institutions of the Ottoman Empire are the primary schools (Figure 14), Enderun School, and military schools at different levels. In addition, there are non-formal education institutions that appeal to all segments of society; Mosques, masjids,

libraries, second-hand booksellers, bookstores, and statesmen's houses are the main non-formal education or public education venues (Gündüz et al., 2019).

Primary schools called "Sıbyan Mektebi" have a civil character and their architecture was built on the basis of the houses where the people lived. The purpose of designing educational structures in this way, which is an important detail in terms of child psychology and pedagogy, is to ensure that children do not feel alienated in the educational space (Gündüz et al., 2019).

Places representing the level of advanced education after primary education were called Madrasahs. The Ottoman Empire's giving great importance to education and educators, the fact that educational institutions were free, and the accommodation needs of the students enabled the society to advance in education in a short time (Demir, 2017).

One of the most important formal education institutions is undoubtedly the Enderun School, which is a Palace School. This institution was established during the II. Murat era, and remained operational until the state's dissolution. The brightest, most intelligent, and most honorable of the children were taken to the palace and instructed in various sciences. They trained in the palace for helping the government. Numerous grand viziers, master architects, and other titles have increased in the Enderun Schools. (Gündüz et al., 2019)

The classroom environment was characterized by various factors such as religion, culture, and politics (Özveren, 2008). Culturally speaking, the Ottoman Empire was a multi-ethnic and multi-religious society encompassing various cultures. Therefore, a diverse education system accommodated different cultures and religions. For example, while the Turkish community had schools providing education in Arabic/Turkish, the Greeks had schools providing education in Greek (Faroqhi, 2004).

Figure 14: A Turkish School, Amsterdam Museum, Netherlands, 1846 (URL-5).

Islamic values and methods were influential in the Ottoman education system (Demir, 2017). It was essential to complete a book instead of passing a class. Since the education system emphasized memorization and rote learning, which is necessary for Islamic education, when a book was memorized, the next book was passed (Faroqhi, 2004). Teaching methods were also based on verbal communication, and students were encouraged to ask questions and participate in discussions (Gündüz et al., 2019). In the functioning of the education system, the Sultan was the central authority, and decisions were made regarding teacher appointments and education in a hierarchical order (Faroqhi, 2004).

Madrasahs were the Ottoman Empire's second level of education, following primary schools. The educational system can be thought of as a continuation of the Seljuk madrasahs. Built during the reign of Orhan Gazi, the Iznik madrasah was the first madrasah in the Ottoman Empire. Later, as the empire expanded through conquest, numerous madrasahs and schools were established in the newly conquered lands (Furat, 2003). Due to its Islamic identity, the madrasa was an educational establishment during this time that equated to secondary, high school, college, and university education following primary school and was exclusively attended by Muslims (Tekin, 2018).

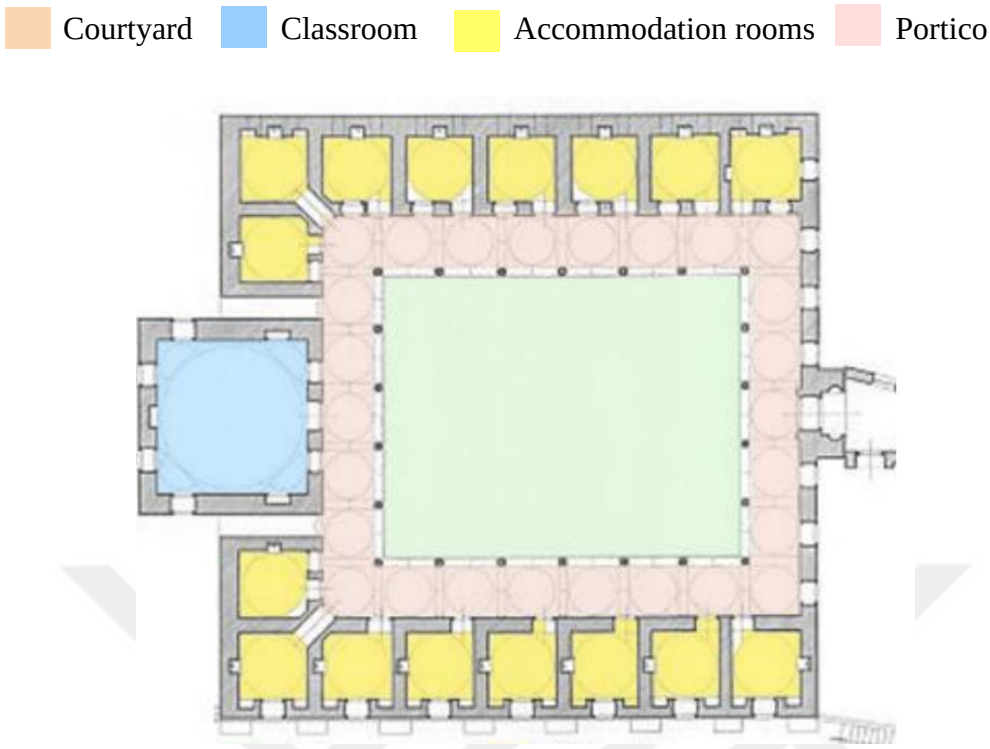


Figure 15, Components of the madrasah structure (Üsküdar Mihrimah Sultan madrasah building survey, (Ülgen, 1944).

These buildings were built as single-storey or double-storey structures consisting of classrooms and student rooms placed around a courtyard, especially for the students to receive education and shelter in the building at night (Tekin, 2018). Three elements constitute the basic plan scheme in madrasahs (Figure 15). These are the classroom (headroom, masjid), cells (accommodation rooms), and the courtyard. The planning scheme is shaped according to the location of the classroom. In addition, other architectural spaces and elements that can be found in madrasas are portico, iwan, toilet, pool, fountain, library, and masjid (Aslanapa, 1989).

A few fundamental factors contributed to the evolution of madrasahs over time. These variables can be categorized as the madrasah's endowment, the topography and climate of the area in which it was founded, and the necessity of the madrasah's educational program (Furat, 2003). It is evident that traditional madrasah designs with enclosed courtyards are favored in areas with severe climates, while open courtyard designs are preferred in hot, dry regions. Nonetheless, it is also noted that the same regions employ both kinds of building forms (see Figure 16), (Furat, 2003).

Figure 16:, The Double Minaret Madrasah, Erzurum (URL- 6).

There were three classes of officials in madrasahs: administration, education, and service. The administrative staff consisted of the trustee (minister) and his subordinate clerks, cabi (collecting taxes on the foundation properties of the madrasa), and civil servants. The teaching staff consists of a müderris (teacher) and a muidden (assistant teacher), and the service staff is generally hafız-ı kütüb (librarian), bevvab (gatekeeper), ferraş (cleaner), kennas-ı hela (toilet cleaner), siraci (oil lamp officer) (Furat, 2003).

In the Caca Bey (Figure 17) and Vacidiye Madrasahs, which were also used during the Ottoman period and are thought to have made astronomical observations, the top of the dome covering the courtyard was cut off and a well was built underneath, which is thought to have been used as an observation well. All these findings lead us to the conclusion that some architectural changes can be made according to need in the madrasahs where the courses that need practice are taught. In addition, it is thought that in these madrasahs, the classroom space is generally decorated with blue and green tiles that continue the Seljuk tradition, thus creating a more spiritual atmosphere (Furat, 2003).

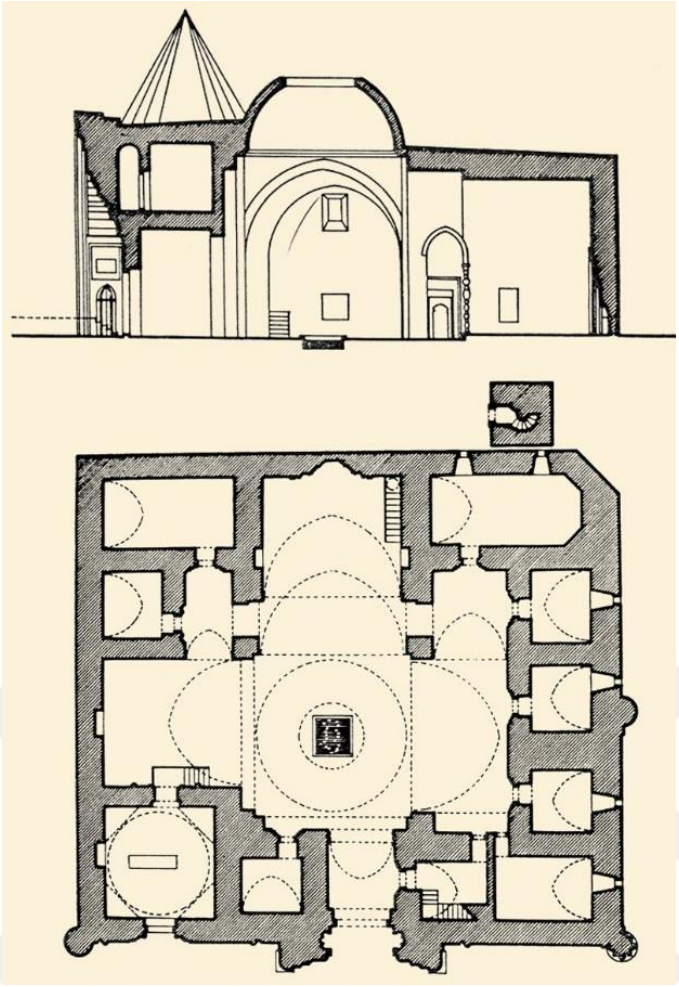


Figure 17: Layout and Section of Caca Bey Madrasa (A. Kuran, Anatolian Madrasahs).

In summary, it is understood that the education system in the Ottoman Empire, which was seen as one of the main pillars of the state, was greatly influenced by the Islamic teachings. When the construction around the central garden in madrasah buildings is examined, it is seen that the interior space has a strong relationship with the exterior and nature. There was a central and authoritative classroom order as well as the comfort of home in classroom environments. There was a teaching approach based on memorize and repetition system. It is also clearly understood that all decisions regarding the education system are under the control of the Empire. In the period from the proclamation of the Tanzimat Edict until the establishment of the Republic, efforts were made to renew education and keep up with Europe, as well as the changes in policy. Unfortunately, these reform efforts have been incomplete and modernization in education has not been fully realized.

2.3.1.2 Modernization process of education in Turkey

The field of education is an area that has been directly affected by the processes of Turkish modernization. Ottoman modernization started with the need felt as a result of the failures in the military field, and the process that worked on military schools led to the formation of civilian (secular) educational institutions (Yelkenci, 2023). In 1734, a school named Hendesehane was opened, which was seen as the predecessor of military and civilian engineering schools and the first vocational school teaching positive sciences (Unat, 1964). Another important example is during the reign of III. Mustafa, in 1773 in Kasımpaşa, Istanbul, the Mühendislikhane-i Bahr-i Hümayun was opened to train officers and engineers (Yelkenci, 2023). This school was later organized by III. Selim in 1796 as two separate schools, namely Mühendislikhane-i Berrî-i Hümayun and Mühendislikhane-i Bahr-i Hümayun, with some courses being shared. These two pioneer schools formed the basis of today's Army and Naval Academy and Military Academies. It is also possible to count Tıbhâne-i Âmire, which started teaching in Istanbul in 1826, as the beginning of the process leading to modern medical faculties (Unat, 1964)

Besides relying on religious sources in the field of education, it was seen that different legitimacy tools gained validity. These radical modernization efforts and the secular nature of the new field of education began to become more evident, and the resulting dualism pushed those on each side of this duality into a permanent opposition (Yelkenci, 2023). Thus, a dual structure was formed in education that would continue until the Republic, and this structure caused many problems that would later be experienced in the field of education. On the other hand, while the state was carrying out the secularization process in educational institutions in the Ottoman Empire, non-Muslims also attempted to secularize educational institutions despite the church. (Ortaylı, 2005). European languages (French, English) have been included in the teaching programs. The issue of compulsory primary education was brought to the agenda for the first time in this period, As a new situation, the process of learning Western science and thought began, relations with the West began to intensify, and in the 1830s for university education, students began to be sent to Europe (Yelkenci, 2023).

The opening of public schools during the Tanzimat period was an important development in terms of institutional modernization. The idea that public education should include girls also developed during this period (Demirel, 2012). The Ottoman education system was experiencing a huge structural problem caused by the lack of necessary levels between primary education and higher education (Yelkenci, 2023). In 1869, education was started to be organized in a holistic manner. This was tried to be done by regulating education legislation; in short, the content of the regulation was to bring and implement the educational approaches carried out in Europe to the Empire (Yelkenci, 2023).

Kanun-i Esasi was established following Abdulhamid II's ascension to the throne (1876–1909), and it is crucial to the comprehension of the history of Turkish democracy. Within the context of the history of education, three articles from the Kanun-i Esasi hold great significance. The state's right to control schools, the freedom of private education, and the determination to unify and regulate the education provided to Ottoman subjects—articles 15 and 16—are the first two of these articles. Article 114, the third, states that primary education is required (Yelkenci, 2023).

During the Second Constitutional Monarchy (1908-1923), many professional organizations emerged and held educational congresses in various cities, education policy had a very important place in the programs of every association and party that emerged in the political field (Yelkenci, 2023). Solutions to Turkey's educational problems began to be searched in the light of contemporary views, and the Second Constitutional Monarchy brought about the changes that formed the basis of the post-Republican education system (Demirel, 2012).

The proclamation of the Turkish Republic in 1923 was a turning point in the history of Turkey, especially in the field of education. Education was the most fundamental issue for the development and modernization of the newly established republic. The innovation activities in education, which started in the era of Atatürk, continued in the era of Ismet Inönü. In the innovation movements in education, a "National/Secular" education policy was followed during the Atatürk period, and then a "Humanist/Secular" education policy was followed during the İsmet İnönü period (Kuşci, 2021). The Ottoman education system could not comprehend all parts of the

empire in general, so a central education system was not mentioned. With the establishment of the Republic, determining a central education system, which is an important factor in ensuring and maintaining national unity, was carried out under the leadership of Mustafa Kemal Atatürk (Incebacak, 2019).

The Law of Tevhid-i Tedrisat, which came into force in the process towards secularism in education, was an important step (Gündüz et al., 2019). With this law, the understanding of dogmatic education, which continued under the influence of the Ottoman Empire, came to an end. The school/madrasah dichotomy was eliminated and schools were placed under the supervision of the Ministry of National Education (Kuşci, 2021). The number of teachers was insufficient due to the effects of the wars in this period and the death of many teachers in the war. The number of people who could read and write was also very low compared to the population. In order to overcome this problem, emphasis was placed on education for teacher training as well as students (Incebacak, 2019).

With the aim of centralizing education, a uniform curriculum, standardized textbooks, and teacher training programs were established (Gündüz et al., 2019). Educational policies followed within the framework of Atatürk's understanding of education aimed to provide universal education to all citizens, regardless of gender, ethnicity, or social class. It was decided to use the Latin alphabet instead of the Arabic alphabet, and an increase in literacy rate was achieved by introducing compulsory education for all children (Kuşci, 2021).

According to the adoption of the new Turkish letters on November 1, 1928, National Schools (Figure 18) were opened all over the country (Gündüz et al., 2019). National Schools provided the introduction of Latin letters to the citizens, increase the literacy rate and the gaining of an institutional identity for non-formal education in the country (Kuşci, 2021). National schools were assigned the task of not only teaching reading and writing, but also public and civic education (Gülbahar, 2006). By the Public Reading Rooms, educational activities were carried to the farthest village of the country and thus equality of opportunity in education was tried to be ensured. Through this corporate school movement, the number of those who attended these schools exceeded 2.5 million until May 1932 (Gündüz et al., 2019).

Figure 18: A Turkish Republic School in 1937 (URL-7).

Another important reform in the field of education in the Atatürk Era was the university reform in 1933 (Kuşci, 2021). The studies of Darülfünun (higher education institution from the Ottoman Empire) were not found sufficient by the Republic. In 1932, Swiss Prof. Albert Malche was invited to Turkey and asked to prepare a report containing suggestions for the improvement of Darülfünun. With the reform carried out in line with this report, Darülfünun was closed in 1933 and Istanbul University was established in its place (Gündüz et al., 2019).

Figure 19: Ankara,Turkiye. Women Learning to Read and Write at the National School (URL -8).

Republic aimed to provide modern and functional learning environments in new schools (See Figure 19). While implementing these radical changes in education, various laws covering primary education to higher education have been enacted, but these laws do not include standards and features related to the physical structure of school buildings. Active learning, critical thinking, and problem-solving skills were emphasized in the new learning environments and curriculum, encouraging students to be independent and creative (Kuşci, 2021). The first modern school examples in the Turkish Republic were reminiscent of madrasas in terms of design, these structures were high-rise buildings with open rectangular or square courtyards (Anıktar, 2017).

As a result, the educational reform started with the opening of Hendesehane, the first example of a school in the Western sense, in 1734 and continued with the Tanzimat and accelerated during the reign of Abdulhamid II. Turkish Education Reform, which was discussed with all its issues during the Constitutional Monarchy period, took its final form and was completed with Ataturk. The experiments and studies carried out in the field of education after Ataturk are related to expanding the content of the reform. The changes are related to implementation rather than structural (Yelkenci, 2023).

2.3.1.3 Learning environment design in Turkey from the recent history of the republic to the present

Since the foundation of the Republic, there have been important developments in the field of education both in terms of quality and quantity. The concept of primary education was used for the first time in the Primary Education and Education Law, which came into force in 1961; "Primary education is the basic education that every citizen should see." defined in the format. The concept of basic education used in the National Education Basic Law No. 1739 was changed to primary education with Article 7 of the Law No. 2842 dated 16.6.1983 and it was stated that it covers the education and training of children aged 6-14 and is compulsory for all citizens (Taşçı, 2014). In line with societal objectives, primary education aims to develop students' minds, morals, and bodies. With the country's resource situation and the expansion of the information that should be covered in basic education, the length of this education and the type of school it will be held in have changed as well (Gündüz et al., 2019).

A type project application has been made in schools, similar to other public structures, in order to address the school structure deficit, which has grown to be a major issue in Turkey due to the country's rapid population growth and migration to urban areas. Due to financial constraints, the type project era began after the 1950s, and schools were first constructed by ministry staff based on state-sponsored projects (Anıktar, 2017). Type projects are applications for projects based on specific data and the repetition of organizations of a similar nature to be used in the construction of educational structures (Terzioglu, 2005). Type project applications are still being made in our nation to reduce errors in school planning and provide economy from construction.

At first glance, it seems to be advantageous in terms of cost to make a type project in primary school buildings. However, important deficiencies in implementation cause extra costs when the primary school building is constructed without suitable architectural features and when the project type is adjusted according to the local environmental conditions.

Type projects are usually multi-storey, bulky structures that have no garden-classroom relationship. Ignoring the factors affecting the design of primary education buildings and having many psychological and pedagogical deficiencies are the most important flaws in the existing primary school applications (Terzioglu, 2005). The common negative aspects of the type projects are land use and site plan settlements (Figure 20).

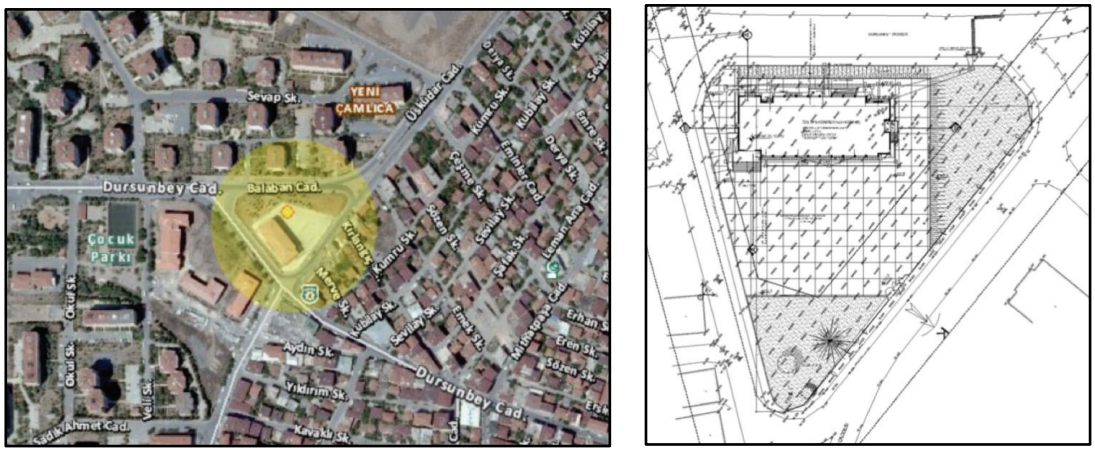


Figure 20: Ümraniye Yeni Çamlıca Leman main Primary School site plan and aerial photograph (Köse & Barkul, 2012).

In today's world where nature is consumed rapidly, the construction of school spaces with ecological details should be gradually expanded in order to instill environmental awareness in children. Unfortunately, we see buildings that do not carry this concern and are incompatible with the environment in primary school buildings that cover 8 years of basic education in Turkey. The 98 projects examined in Köse and Barkul's (2012) study revealed that no environmental information was taken into account when primary school buildings were constructed, most did not meet the spatial standards demanded by modern education, had only classrooms, and were generally unhealthy structures.

When we examine the classroom environment where the learning activity is most intense in school buildings, we encounter a standardized interior design in line with a guideline determined by the Ministry of National Education. The most recent "Educational Buildings Minimum Design Standards Guide" was published by the Ministry of National Education in 2015. According to the items in the minimum design guide for educational buildings of the Ministry of National Education in Turkey, the current classroom environment should be as follows;

- **Purpose of use:** Students, under the supervision of teachers, lecture, research, etc. It is the place where they teach by making use of various educational tools and materials.
- **Location:** It should be away from noisy environments and should be located in easily perceptible places within the building. *Classrooms of branches that are close to each other in terms of areas should be close to each other.
- **Field:** M.E.B. needs programs will also be designed at the specified size. *The area per capita, excluding the warehouse area, is min. 1.60 m², min. in secondary and high schools. 1.86 m²
- **Doors:** All doors opening directly to the corridors must have a hinge system that provides at least a 90-degree opening in the niche. Doors that are not placed in a niche must have a hinge system that provides 180 degrees opening. The wing width of the classroom doors is at least 1.00 m. There should be a glass space on the door at the level that will provide the viewpoint of the adults. Unbreakable tempered or wired glass should be used on classroom doors. Toe

guards and stoppers should be used against non-sill details and impacts on the doors. Details should be produced on the doors to help natural ventilation.

- **Windows:** The ratio of classroom windows to the floor area should be at least 25%. This rate can be increased up to 50% depending on the characteristics of the climate zone. Min. 90cm. should start from the top. Large-span windows should have both small and large-piece openings. Wingspan 85 cm on all opened wings. should not exceed and it should be possible to use biaxially.
- **Flooring:** It should be hygienic, resistant to friction and impact, require low maintenance and be non-slippery. The fire resistance of the selected materials should be class A. 3-5mm thick shock-absorbing mattresses should be used between the final coating material screed and the reinforced concrete floor.
- **Ceilings:** It should be covered and painted with building materials that can be easily cleaned and do not require much maintenance and repair. If suspended ceilings are used, plasterboard suspended ceilings should be preferred. The formation of unhygienic environments under the suspended ceiling should be prevented. In classrooms, sound insulation should be made under plaster or on suspended ceilings at the lower level of the ceiling.
- **Walls:** Sound insulation should be considered on all interior walls and TMMOB's STC (Sound Transmission Class) values should be followed. Easily cleanable, water-based paints should be preferred. (For the fire resistance period, see Regulation on Fire Protection of Buildings and all its annexes) Impact and friction-resistant epoxy paints should be preferred on the lower elevations of the walls. In cases where epoxy paint is not used, oil paint should be used in these areas.
- **Daylight/ventilation:** The classroom should be designed so that daylight comes from the left side for the student, furnishings and door openings should be arranged accordingly. Natural ventilation in classrooms should preferably be a chimney system. These chimney systems should be considered independently for each classroom. Window openings should allow ventilation from the top. Ventilation windows opening to the corridor should also be considered.

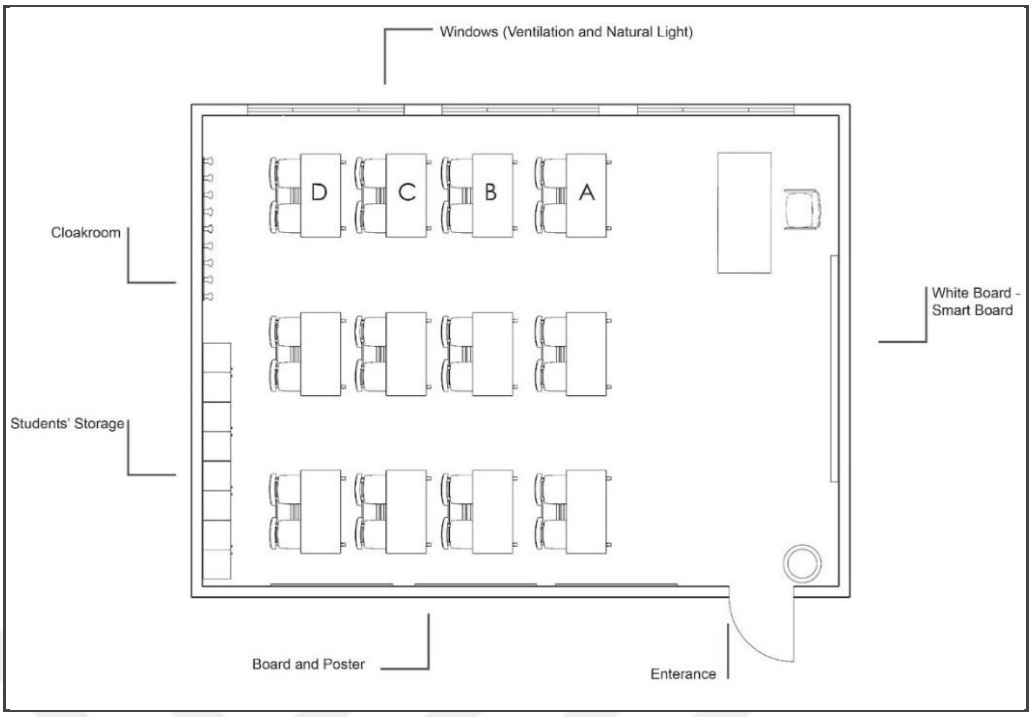


Figure 21: Ekinci, 2012 & meb.gov.tr (Re-illustrated by author).

According to this guide, classrooms (Figure 21) should be designed as rectangular and long-sided exteriors and should allow for different seating plans. The classroom should be designed in such a way that daylight comes from the left side for students, and furniture and door openings should be arranged accordingly. Classes will be arranged in pairs with interactive boards/blackboards, use of slides and videos, internet access, projection device, hangers, cupboards, teacher's desk, chairs and cupboards, and presentation boards. Classroom materials or bookshelves and lockers where their clothes can be placed will be considered for each student. Student lockers can be planned inside or outside the classroom. Indoor air quality standards must be followed. The brightness level should be at least 300 lux. Sockets, panels and devices that are directly connected to electricity should be solved in places where students cannot easily reach them, and necessary safety precautions should be taken. Energy and data lines, data and energy inputs for smart boards and projectors in classrooms should be planned close to the teacher's desk. The classrooms of the branches that are close to each other in terms of area should be close to each other. (Ministry of National Education, 2015)

The current class example has a hierarchical and industrial order. Classroom communication is also a type of organizational communication. The communication between the teacher and the students and the communication between the student and the student affect the education process and the commitment to the class. It has been observed that the communication between the student and the teacher differs between the A row and the D row (Figure 21) due to the current layout. While the student sitting in row A attends the lessons more, the student sitting in row D attends the lesson less. It has been determined that students who prefer to sit in front of the room show high positive value to learning, while students behind the classroom or by the window have negative attitudes towards learning and their own success capacity (Weinstein, 1981).

The Existing Type School Project has been effective in Turkish School Architecture for many years, but in recent years, various educators and architects have begun to carry out innovation studies and projects in learning environments by going beyond the existing school design. Başka Bir Okul Mümkün (BBOM), Association was founded in 2010 by volunteers from many different disciplines such as educators, academics, social scientists, lawyers, architects, engineers, etc., with the aim of eliminating the problems in the existing primary education structure, developing solutions, and renewing. The vision of the association is “To establish schools that implement the rights set out in the Convention on the Rights of the Child, enable children to realize themselves, are managed with participatory democracy, respect ecological balance, and are established and run without profit by initiatives consisting of families and volunteers; "to spread this educational approach and serve as a model for the implementation of other similar schools." (BBOM, 2010).

In the Istanbul and Bodrum (see Figure 22 & 23) schools, which started preparations for the 2013-2014 academic year, each school created an independent cooperative structure in addition to the association structure. The spaces of the BBOM education model were researched through research on alternative educational spaces and the contextual situations of the targeted school structures.

These two research and design-based study axes focus on two basic questions:

1.What should BBOM educational spaces be like?

2. What should be the method of designing and realizing these spaces? (Dündaralp, 2014).

A participatory design model approach has been developed in designing BBOM spaces. The Principles of BBOM schools are based on variables at the regional, climate, topography, settlement, and parcel scale, aiming to keep a common understanding and value world while allowing different architectural structural formations according to different social environments, financing, opportunities, and uses.

These principles are respectively (Dündaralp, 2014);

1. BBOM school does not have a type project. It does not adopt the concept of a typical school, but rather the concept of unique schools that derive their commonality from the understanding of space.

2. BBOM school spaces do not consist of box spaces stuck within walls defined for education. In the school, all indoor and outdoor areas, are used as learning spaces as a whole with its environment.

3. BBOM school spaces enable educators to adapt their curriculum that can respond to children's individual interests and needs, not the areas they apply; Offering opportunities to learn together and individually; It is child-centered and consists of spaces that are not only teacher-focused, but also offer interaction and communication opportunities where everyone who is part of the school can learn from each other.

Figure 22: DDPRL Architecture, Dağbelen Bodrum Project, 2013 (URL-24).

4. BBOM school is not just a building in which education takes place, but also the agent and source of learning.

5. BBOM school architecture combines cognitive learning with sensory elements, includes a real-life model, and is based on interaction and communication; A structure and structure that can establish dynamic and productive relationships not only within the boundaries of the school area but also with the life around it. It offers an understanding of space. Venues It is participatory, not restrictive.

6. BBOM school spaces are democratic and participatory, not hierarchical and descriptive. It does not impose or direct, it creates opportunities. It is not rigid and static, but flexible and open to transformation.

Figure 23: DDPRL Architecture, Dağbelen Bodrum Project 2013, (URL-24).

7. BBOM school architecture does not define flexibility as flexibility of use only depending on furniture movements. It starts from the construction phase and continues throughout the life of the entire structure. It expands parallel to the participants. That's why BBOM schools offer a phaseable architecture with their own unique financing structure; which allows for additions and variations of the structure over time; It has the flexibility of structural evolution to increase its usage possibilities.

8. BBOM school has access to all the places that real life includes; It includes public space, private space, artificial space, natural space, meeting, discussion, learning, teaching, production, consumption, thinking, research, conflict, reconciliation, harmony and escape spaces, without ignoring its own communication dynamics.

9. BBOM school architecture does not think of the structure in terms of 'storey' structure, it is related to interior-exterior spaces that interact with its environment; It adopts a structure concept consisting of volumes that think with space possibilities and its ergonomics.

10. BBOM school spaces combine with real life; it does not produce a simulation of it. Instead of trying to produce them, opportunities that will allow them to be produced are present.

11. BBOM school does not include labeled ecological concepts, but rather recognizes the resources it has, does not use them selfishly, and uses the balance of consumption by supporting production; While doing this, it adopts the concept of 'deep ecology', which does not reduce nature to an object of exploitation in the name of sustainability, participates in its cycles and lives it instead of exposing it.

12. BBOM school focuses on how much it adds to the nature it is in and how much it transforms it; From material selection to the construction process; It contains content that questions many details, from energy use during the usage process to factors such as health and hygiene, to building physics and building chemistry, with this deep ecology concept.

13. BBOM school architecture does not view land as a structure to be built on; He perceives his environment, social life, and nature as a whole. He explores all its possibilities, possibilities, and potential within his own 'value' system.

14. BBOM school architecture is not a building that is not used outside school hours, it is not just an educational building. It is a living space that lives together with the social and natural fabric it is in, has continuous life in different temporal cycles, and is where people of all ages learn together (Dündaralp, 2014).

Istanbul Governorship Istanbul Project Coordination Unit (IPKB), which manages the preparation of public buildings in Istanbul against possible earthquakes, has carried out a project with the aim of ensuring that students receive education in more modern and earthquake-safe conditions through its work in educational institutions. IPKB, which was established within the Istanbul Governorship in 2006 with the slogan "We strengthen our future", has rebuilt and strengthened public buildings, especially schools and hospitals, against earthquakes. The 44 schools designed by Uygur Architecture stand out with their structures that prioritize energy efficiency and savings in operating costs, and their quality living spaces that form the basis of social sustainability. A different design approach was applied than typical school projects (See Figure 24). All spaces are discussed separately with their surrounding users and their foreseen future over time (Uygur & Uygur, 2015).

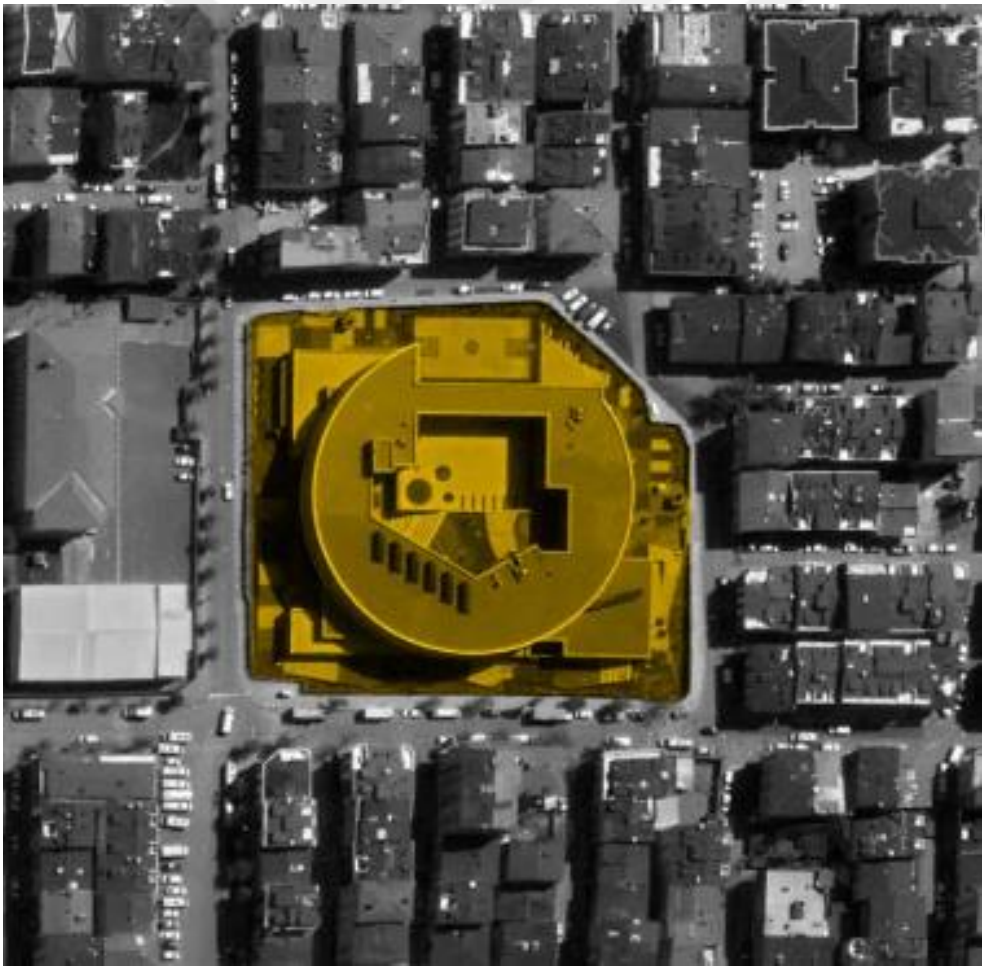


Figure 24: Akşemsettin Primary School, Küçükçekmece, Istanbul (Uygur Architects, 2021).

Thus, importance was given to the integration of educational buildings in the existing space and to add a new value to it. For the comfortable use of students, workshops and common areas are included, and they are designed as spaces that are always enriched with natural light (See Figure 25), (Uygur & Uygur, 2015).

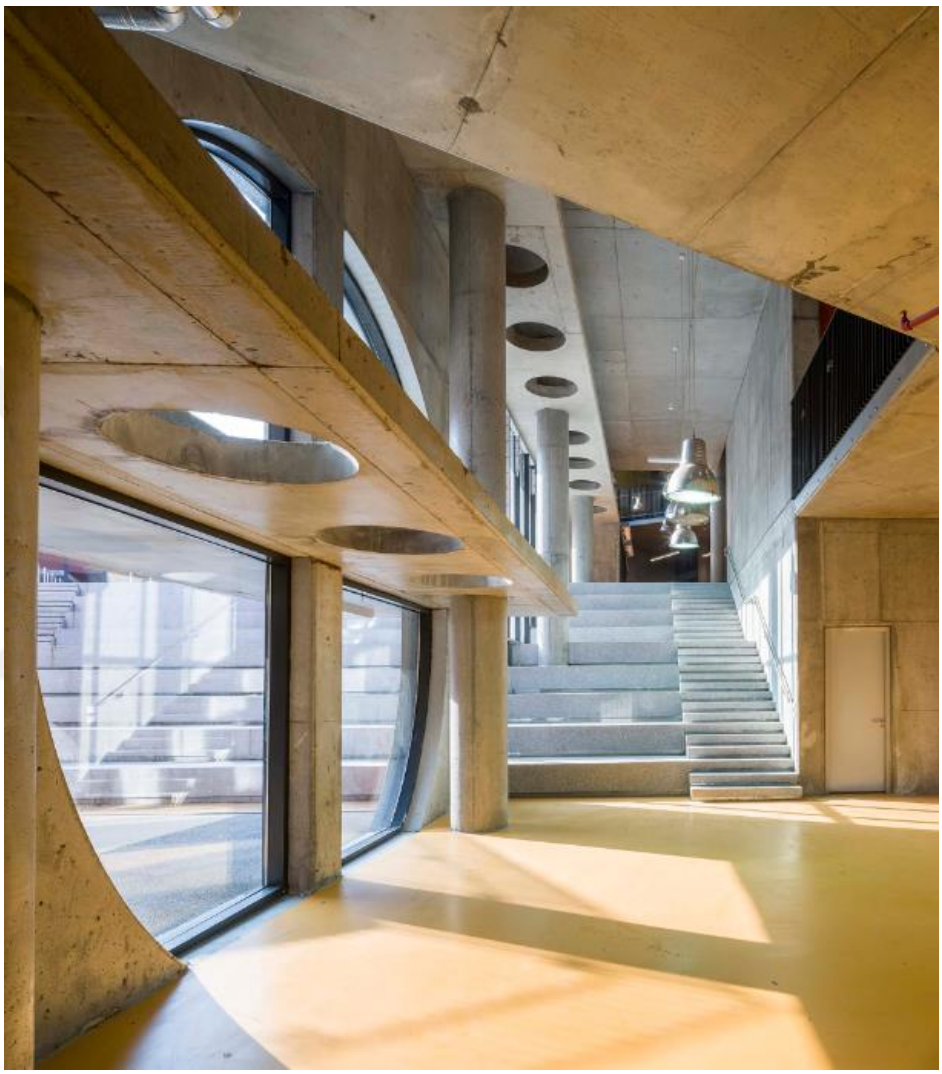


Figure 25: Akşemsettin Primary School, Küçükçekmece, Istanbul (Uygur Architects, 2021).

Children, young people, educators, and their voices, who are the main colorants of educational buildings, were evaluated as those who gave the most obvious details to the freedom of the place. For this reason, modesty and simplicity were the main priorities in school structures. Projects have been carried out with the aim of moving public schools beyond being typical projects (See Figure 26).

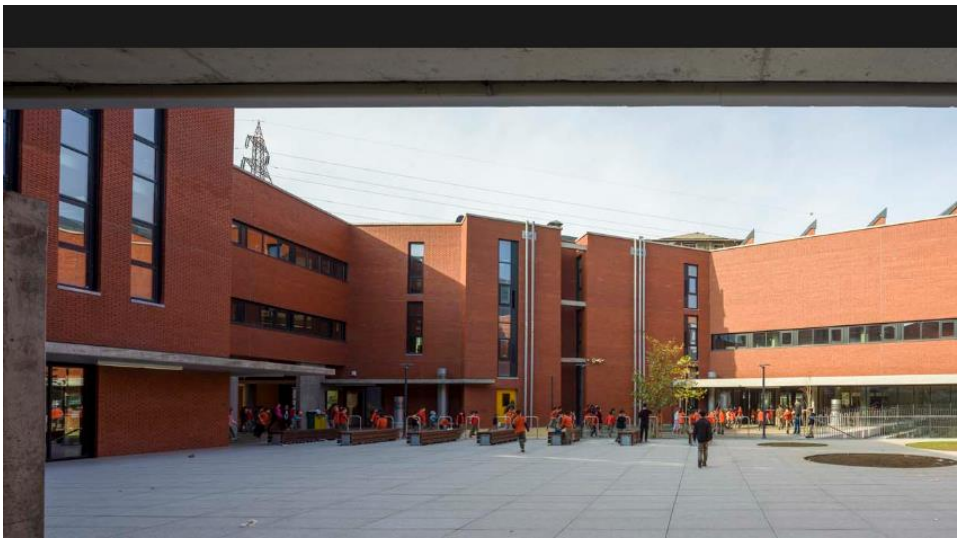


Figure 26: Akşemsettin Primary School, Küçükçekmece, Istanbul (Uygur Architects, 2021)

The construction of 44 school buildings at once is considered a Breaking Point for improving the standards of existing educational spaces, increasing spatial awareness in educational buildings, and changing the shell (Uygur & Uygur, 2015).

2.3.2 Learning environment design approaches on a global scale

The characteristics of the school design and learning environment vary according to the region in which the building is built; Differences in cultural, religious or social needs create globally different school design approaches and practices. Nonetheless, there are certain similarities across the designs of schools across nations. The prevalent design is still the typical classroom set-up with rows upon rows and a teacher's desk in the front. Yet, due to the improvements that time and technology have brought about, there has been a shift toward more flexible designs that support various learning styles and enable collaborative learning.

OECD

"Do Physical Conditions Have an Impact on the Learning Climate?" an OECD paper from 2010, stresses the significance of maintaining a balance between the social environment and physical circumstances as the fundamental design model. According to the OECD's report on 21st century schools, schools should be planned to be comfortable for students and staff. This report is also the only one to emphasize the value of participatory design. The main goal of all comparable studies is to create the most appropriate, excellent, and environmentally friendly environments for instructors

and students who participate in establishments where education and training are combined with opportunities to learn about innovation, teamwork, creativity, communication, and entrepreneurship. (Anıktar, 2017)

According to this report, the school design brief incorporates both functional specifications and aspirational objectives. The aspirational and inspirational aspects of the brief call for a commitment from all stakeholders, including the school, the parents, other users, and the consultant team, to explore and expand the boundaries (Robinson & Robinson, 2009). Moreover, each component of the project—including the facilities, the planning, the building form and structure, the finishes, embedded technology, adaptability and flexibility, location, and sustainability—must enhance or somehow improve the overall school environment. (Robinson & Robinson, 2009).

Design principles can be listed as follows;

- **Adaptability and flexibility:** Architectural standards are always changing, therefore if a structure is to fulfill the goals established, it must be flexible and adaptable enough to take into account changes in technology as well as in the needs and desires of its user groups and the community at large.
- **Maintainability;** School buildings need to resist a lot of "wear and tear." Hence, it's important to choose materials and finishes properly to provide a sustainable physical environment that requires minimum maintenance.
- **Siting;** Since major site characteristics have an impact on the facility's design, it is crucial to have a thorough understanding of the context in which the new facility will reside amid nearby existing buildings. With respect to the buildings that are right next to it, the design should be responsive to the context; it shouldn't simply duplicate the architecture that already exists, but rather follow design trends as necessary.
- **A culture of the community;** In essence, students interact as a community. The size of this community is important, and experience shows that forming smaller groups of students in a building (and often a school) is more conducive to fostering this sense of community. Learning takes place socially within a physical space, and the design of this space is crucial in fostering a culture of participation in the learning process. See Figure 27.

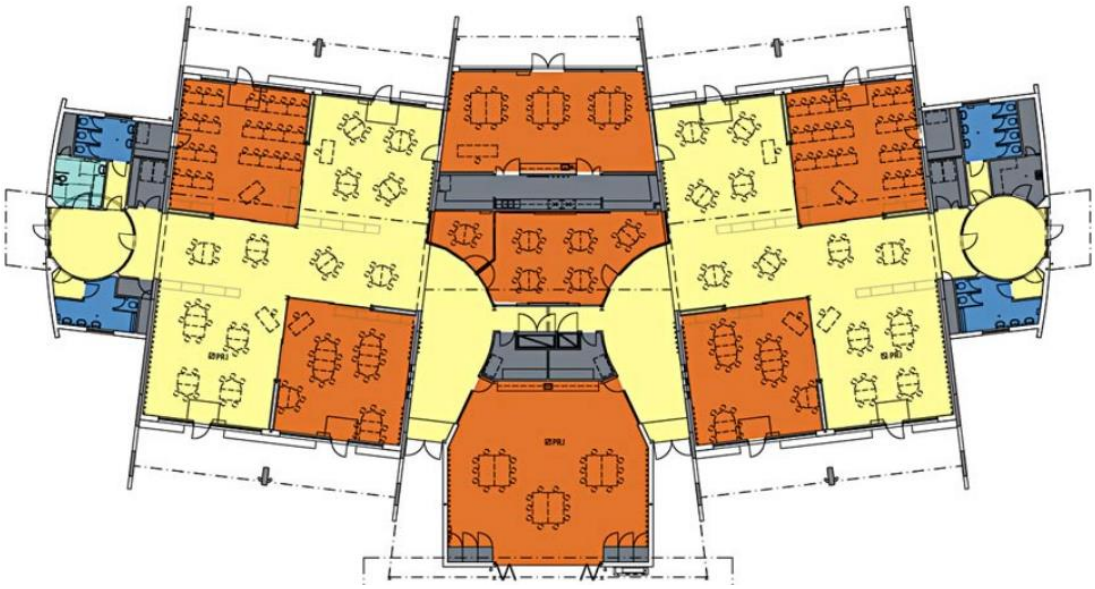


Figure 27: Gilmore College, middle school learning community, (Robinson & Robinson, 2009).

Sustainability; The structure should show a dedication to innovation and utilize both passive and active technologies, materials, finishes, and design aspects with the ultimate aim of leaving no environmental footprints. It would be wise to renovate old structures that can no longer accommodate a contemporary curriculum. (Robinson & Robinson, 2009).

CABE

England has a national organization called CABE (Connecticut Association of Boards of Education). They have established a significant, reliable network of regional design consultants, whose members are reputed to be top scholars, architects, planners, engineers, landscape architects, and urban designers. The institution seeks to meet the public's need for the idea of good design and to give students and teachers a sense of place in the living and learning environments. By making "site"-specific recommendations throughout the design phase, they highlight the value of regional priority.

The titles determined by CABE can be listed as follows (Anıktar, 2017):

- Learning-oriented space organization,
- Land selection and use,
- Outdoor and landscape use,
- Security,
- Material efficiency and resource use,

- Building form and quality,
- Using environmental conditions for natural light and ventilation,
- Visual, thermal, acoustic comfort,
- Innovation in design.

CHPS

In California, the CHPS (Collaborative for High Performance School) system was developed in 2001 to ensure that many new or refurbished school buildings perform better than their predecessors. In summary, CHPS is a green building evaluation system that has built its foundations on the LEED green building rating system, aiming to evaluate the performance of school buildings in California only in terms of sustainability in the first place (Arslan, 2016). A school building that saves energy, resources, and money while creating a healthy environment that can support learning is defined as a "green building".

The CHPS design guide consists of three volumes: planning, design and criteria (Kayıhan, 2006).

Planning principles;

- Land selection and use,
- Outdoor and landscape use,
- Security,
- Physical factors.

Design principles;

- Building form and quality,
- Identity.

Under the “Criteria” heading, there is a checklist, which was explained in the previous volume, in which the design principles of high-performance school buildings are brought together and scored. The priority issues that make up the principles in the checklist are as follows;

- Natural lighting,
- Energy efficiency,
- Indoor air quality,
- Care,
- Task distribution and personnel training,

- Spatial comfort conditions,
- Sustainable use of materials,
- Reducing waste. (Kayıhan, 2006)

LEED

Leadership in Energy and Environmental Design (LEED) is a collaborative system of members working voluntarily on the design of high-performance and sustainable buildings, produced by the members of the American Green Building Council working in various fields of the construction industry. System developers work continuously to upgrade the system (Kayıhan, 2006).

LEED Standards are currently available for the following sub-topics;

- New commercial structures and major repair projects (LEED-NC),
- Operation of existing buildings (LEED-EB),
- Commercial interior projects (LEED-CI),
- Core and shell projects (LEED-CS),
- Residences (LEED-H),
- Environmental improvement (LEED-ND).

Forest Schools

The idea of "forest school" originated in Denmark in the 1950s, and after some time, it was incorporated into the curriculum of Swedish pre-schools for children younger than seven (Miralinikkhou, 2021).

Forest schools are a type of educational setting that emphasizes independent study in natural settings. This approach enables children, teenagers, and adults to gain knowledge and skills by regularly going on group outings to the woods while also allowing them to experience nature and learn through hands-on activities in natural settings (O'Brien, 2009). In contrast to a typical kindergarten, this program encourages students to play, discover, and learn year-round by engaging with all types of weather (Schäffer & Kistemann, 2012). Children can learn how to play from one another and make new things that boost their creativity and self-confidence while also enhancing their social abilities (Harris, 2018). Benefits of forest schools include learning outside, interacting with nature, and social and emotional growth. Figure 28 depicts these benefits.

Figure 28: Impacts of forest school on children's development (Harris, 2018).

Children's health is improved along with their physical, mental, and cognitive development when they spend time outside and engage in unstructured play. Programs at forest schools are overseen by qualified supervisors with training in child development and outdoor play pedagogies. Children (3–12 years old) congregate in a particular natural setting and play freely there during programs that are primarily based on weekly sessions in the woods. They can choose to play alone or in groups (Harris, 2018).

Eco-Schools

The United Nations Conference on Environment and Development in 1992 provided evidence for the eco-school curriculum. Following the conference, the European Commission supported the initiative for the first time, and it was eventually implemented in Denmark, Germany, and the UK in 1994. The Eco-school curriculum was proposed as a model for Education for Sustainable Development by the United Nations Environment curriculum (UNEP) in 2003 (Miralinikkhou, 2021). The basic idea behind the eco-school curriculum is that eco-consciousness should become a way of life. The project is founded on interdisciplinarity principles, a comprehensive and systematic approach, activities, connecting real local environmental problems to global environmental issues, and playing an active role in democratic decision-making on environmental issues by combining cognitive, emotional, and aesthetic aspects (Pauw et al., 2013).

Open Air Schools

Open Air School concept began implemented in Birmingham, 1925 (See Figure 29). Initially, the schools were meant for children with serious diseases like tuberculosis (TB) or who were otherwise deemed sensitive. Fresh air and outdoor exercise were regarded to be the greatest thing for these youngsters, thus classrooms and sick rooms were built with big verandahs or were entirely open to the weather, and nap and leisure hours were held outside. As they developed methods to treat and avoid these dangerous diseases, the number of infected children decreased until outdoor service began to be phased out across the country following World War II.

Figure 29: Uffculme Open-Air School, Birmingham, Great Britain, classroom (URL-9).

Open-air schooling became very prevalent in Northern Europe in the early twentieth century. The photograph (Figure 30) was taken in 1957 in the Netherlands where open-air schools were quite popular at the time. Open-air classroom instruction, which became known by the forest schools, spread to other European nations. By 1937, 96 open-air day schools were operating across Britain. The open-air school movement was also established for healthy kids, encouraging all pupils to spend as much time outside as possible.

The Waldeschule (forest school), which was established in Charlottenburg, Germany in 1904 and intended to give its students the maximum amount of exposure to sunlight, served as the impetus for everything that followed. Classes were held in the nearby forest because it was thought that doing so would help urban kids develop their independence and dignity. (URL-10, Classrooms without Walls: A Forgotten Age of Open-air Schools).

Figure 30: Open-Air School in Netherlands, 1957 (URL-10).

2.4 Result of the Chapter

Although there is no specific and precise definition of the concept of learning, various definitions have been made by many educators. The learning process appears as a complex concept that may vary from person to person and includes more than one method.

In this chapter, the basics of the learning activity have been tried to be understood. The effect of the built environment on the learning process was examined and the characteristics of learning environments applied by different learning approaches on a global scale were mentioned.

How the learning environment and school structure have evolved from past to present and different approaches and practices in Turkey and globally are examined. In this part of the thesis, the education systems and school structures from the Ottoman period to the early Republic and today are also researched. Finally, different design practices of learning environments on a global scale are included. In this section, it was determined that the learning environment has positive or negative effects on the learning process in children and the study continued with the aim of improving this process.

In the next chapter, a more comprehensive understanding of the effects of nature on children is provided by looking at the studies carried out on child-nature interaction with the aim of developing and improving the learning activity.

3. CHILDREN AND NATURE INTERACTION

Migration to cities continues to increase day by day with developing technology and new business areas. Due to the growing urbanization, the relationship of society with nature is broken. Higher psychological well-being has been linked to time spent in contact with the natural world (R. Kaplan, 1973). As a result of the emergence of video games, computers, and the internet, children today spend more time indoors, and they have a life model where nature activities are a low priority. According to a number of researchers, the middle years of childhood (6-12 years old) are critical for the development of the child's relationship with the natural world (White, R; Stoecklin, 2008). What are the consequences of the disconnection of the built environment from nature, where children spend time in their growing years? What is the importance of the child-nature relationship and what are the benefits? In this section, these questions were tried to be answered by examining the empirical, psychological and social studies in the literature.

3.1 Importance of Child-Nature Interaction

The significance of nature in a child's healthy development is a matter that needs to be addressed immediately. It has been observed that environmentally sensitive and socially influential individuals have a childhood connected with nature (Burns & Manouchehri, 2021). Integrating with nature in environmental problems and climate change issues, which are of critical importance all over the world, is vital not only for human health, but also for our planet. For this reason, it is our important responsibility to increase the empathy and sensitivity of children, who will form the society of our future, by providing them with a relationship with nature. In addition to the benefit of society and the earth, children's relationship with nature is important for their individual and mental development (Kaplan, 1973). The rapid decline in children's access to nature and its negative effects is a common concern among researchers studying children and nature (e.g., Kaplan 1989, Kahn, 2002; Kellert, 2002). Contact

with nature (See Figure 31) is as important to children as good nutrition and adequate sleep, so current trends in children's access to nature need to be addressed and more research is needed (Taylor & Kuo, 2006). The effects of nature on child development have been determined in a variety of studies. These include Physical Development, Cognitive Development, Social and Emotional Development, and Psychological Development (Bakır, 2016).

Figure 31: Forest Schools (URL-11).

Physical Development:

According to studies, children's physical activity and time spent in green spaces are positively correlated. (Ward, et al., 2016) The findings of the 2016 study by Ward et al. on 118 primary school-aged kids lend more credence to the idea that green spaces promote physical activity and highlight the importance of including green space exposure in child health promotion initiatives. According to this study, there is a significant correlation between the amount of time spent outdoors and indoors. There was a 0.95% increase in physical activity for every 1% increase in time spent in the green. This study lends credence to the idea that more physical activity is strongly encouraged by green spaces (Ward, et al., 2016). Some researchers argue that the green environment has a positive effect on reducing the rate of obesity in children, and they

carry out studies that prove this. Bell, Wilson, and Liu (2008) showed that children and youth living in neighborhoods with green environments have lower Body Mass Index (BMI) scores because they spend more time outside doing physical activities. This finding determined that children who have a strong relationship with nature in a green environment reduce the obesity rate due to the high rate of physical activity.

Cognitive Development:

Dadvand et al. (2015) evaluated seven to ten-year-old children's cognitive growth over the course of a year in Barcelona and contrasted their advancement with vegetation levels near their homes, on the way to school, and inside and outside school boundaries. Children demonstrated noticeably greater improvements in working memory and less inattention when there was more vegetation in and around their school and when there were higher overall scores for greenery (Chawla, 2015).

According to Kahn and Kellert (2002), it is possible to investigate the potential impact of various forms of nature on children's mental development by using the taxonomy of cognition created by Benjamin Bloom and colleagues (Bloom et al., 1956; Maker, 1982). This taxonomy (Table 3.1) identifies six stages of cognitive maturation, from simple to complex, that are broadly hierarchical and possibly sequential.

The child encounters in nature an especially visible, diverse, and energizing stream of objects and subjects useful in developing and practicing the labeling, differentiating, and classifying abilities that are so fundamental to the knowledge stage of cognitive maturation. Natural objects with distinct identities, such as trees, large rocks, ponds, and streams, appear to evoke a strong image in the mind of the user, according to children's cognitive maps (Moore, 1977) .

Children, for example, encounter many and varied opportunities for naming and rudimentary categorizing trees, birds, bushes, flowers, mammals, geological forms, and many other features of nature in almost any environmental context, including the modern suburb and city. Observational learning or symbolic experience of nature is an important aspect of this and other stages of cognitive development, but it is often underappreciated (Kahn & Kellert, 2002).

Table 3.1: Bloom et al.'s the six stages of cognitive maturation (Huitt, 2011; Kahn & Kellert, 2002)

Knowledge	Understanding facts and terminology and using them to present ideas clearly and concisely, create extensive classificationschemes,and identify causal links.
Comprehension	Applying interpretations and paraphrasesof concepts and information to new situations and contexts.
Application	Using knowledge of broad concepts, notions, and principlesin a variety of contexts.
Analysis	Examining and categorizing knowledge,as well as determiningunderlying structural and organizational relationships.
Synthesis	Integrating and assemblingparts or elementsto form patterned, organized, and structural wholes,as well as identifying and developingunderstandings of relationships and interdependencies.
Evaluation	Based on a careful examination of evidence and impacts,rendering about the functional significance and efficacy of various elements and functions.

In a study conducted by Taylor et al. in 2001 on children with Attention Deficit Hyperactivity Disorder (ADHD) in the 7-12 stone range, it was determined that children playing indoors without windows had significantly more severe symptoms than children playing in open areas with trees or trees without grass. In other words, it was stated that the attention functioning of the children in the natural environment rather than the built environment is better (Taylor et al., 2001). Attention is divided into voluntary and involuntary, and in willful attention we deliberately direct our attention, focusing on tasks (for example, problem solving) or situations (for example, driving in heavy traffic) that require sustained attention and are not easy to deal with by nature (James, 1892/1962; Taylor et al, 2001). Some elements in the environment can draw our attention involuntarily, in this type of attention we focus effortlessly, for example, animals, bright things, etc. factors may involuntarily attract our attention. It can be useful for resting involuntary attention and restoring tired directed attention. He argues that natural environments help relieve directed attention fatigue, in part, because they attract involuntary attention rather than directed attention (Kaplan, 1995).

Social and Emotional Development:

Numerous studies in the literature have demonstrated the benefits of green on children's socioemotional development. Young children's healthy social and emotional development is dependent on their access to the kinds of social interactions, experiences, and environments that will support them (Thompson, 2007). Ward et al. (2016) discovered that a child's exposure to green space has a significantly stronger relationship with emotional well-being than with physical activity level in their study. In the study, both physical activity and exposure to green space were associated with improved emotional well-being. This study, however, discovered that children's emotional well-being was more strongly associated with green space exposure than with physical activity. These findings emphasize the significance of spending time in green spaces as part of raising an emotionally healthy child. (Ward et al.,2016) Experiences gained in nature in the company of family, friends, and teachers leave a mark on the permanent memory of children and the learning gained here becomes permanent (Thompson, 2007).

Robinson & Zajicek, 2005 held a study to reveal the effects of a one-year school garden program on primary school children. In line with the findings obtained in this study, it was determined that working in the garden had a positive effect on students. Students' teamwork, taking responsibility, strengthening their social relations, gaining self-confidence emerge as a result of taking part in the gardens (Robinson & Zajicek, 2005). It has been observed that children who have a sense of responsibility and self-esteem are more involved in school and social activities, and their school completion rate is higher (Beane and Lipka, 1987).

Using a purposive sampling technique, Bakir-Demir et al. gathered data from 299 mother-child pairs between the ages of 8 and 11 from four primary schools in the Turkish capital city. The researchers discovered that connection to nature mediated the association between regulation skills and greenery (cognitive and emotional) (Bakir-Demir et al., 2019). This discovery highlights the importance of interactions between kids and nature. According to empirical studies, researchers concur that taking lessons outside in nature has a significant positive impact on children's interaction with nature, student learning, and mental and physical well-being (Harvey et al., 2020).

Psychological Development:

The interaction between children's experiences and their sociocultural environment and how changes in childhood are influenced is a major topic in the literature on developmental psychology. Outdoor play frequently has a slower, less structured rhythm and is associated with exploration; the psychological benefits of aimless exploration, particularly in natural settings, may be more significant than many realize. These benefits include creativity, stress relief, and self-esteem.

On the other hand, children's games are becoming more and more virtual, and the prediction and concern that video games can contribute to psychological distancing and social aggression is discussed by psychologists. What would be the consequences of including the natural world in this virtual gaming experience? On top of that, Levi and Kocher (1999) conducted a study and found that the simulated experience with nature had positive psychological benefits on individuals watching the scenes (Levi & Kocher, 1999; Kahn & Kellert, 2002).

High accessibility to nature in school and home areas has a positive impact on children's well-being (Corraliza et. al., 2011). It has been determined as a result of studies that children who perceive nature at a lower level in their environment exhibit higher levels of stress compared to children who perceive nature at a higher level in their environment. (Corraliza et. al., 2011)

3.2 Well-Being of Children in School

A critical component of a child's overall development is their well-being at school. According to Article of the Declaration of Alma-Ata, held at the International Conference on Primary Health Care in 1978 definition of health, ‘‘Health, which is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity, is a fundamental human right’’ (World Health Organization, 1978). The concept of "well-being" describes the emotional and physical states of being at ease and in good health. It includes several aspects, such as good physical health, strong social ties, emotional stability, and academic achievement. Aristotle (2014) summarized well-being as a happiness and stated that happiness is the ultimate goal of human life and that it is achieved when people realize their abilities in a full

and balanced way. Well-Beign is stated as a human right in the Alma Atma Declaration, therefore it is mentioned that the government and institutions are obliged to ensure that citizens realize all their abilities.

By fostering a supportive environment that encourages positive emotions and offers opportunities for students to develop skills related to emotional regulation and mindfulness, schools can play a significant role in the ability to bring' well-being. A critical component of a child's overall development is their well-being at school. According to studies, kids who report feeling more content tend to perform better in school, have higher self-esteem, and have better mental health. (Diener et al., 2018)

Physical Well-Being:

One essential component of total well-being is physical well-being. Children that have a healthy physique feel better, work more, and have superior cognitive abilities. It has been discovered that children's physical health benefits from exposure to nature (Ward, et al., 2016). Increased physical activity, a stronger immune system, and a lower risk of obesity and chronic diseases have all been linked to exposure to nature (Kuo & Taylor, 2004). According to studies, students who attend schools with access to nature and green spaces engage in more physical activity (Dadvand et al., 2015). According to research by Soderstrom et al. (2013), Swedish preschoolers with high-quality schoolyards integrating trees, shrubs, rough terrain, open spaces and play structures, with health measures such as blood pressure and cortisol levels, performed better than those with low-quality playgrounds.

Social and Emotional Well-Being:

Schools play a crucial role in students' health and social-emotional development, in addition to their fundamental role in encouraging academic progress (WHO, 2004). Social well-being refers to the quality of an individual's social relationships, including the ability to create and sustain positive relationships with peers, teachers, and other adults, as well as the extent to which an individual is integrated into a social network, fulfilled and productive in social roles, and experiencing a sense of belonging and social support (WHO, 2004). A sense of belonging and social connectedness is also essential for supplying social and emotional well-being. Good social relationships foster feelings of belonging and support, both of which are necessary for mental health

and academic achievement (McNeely et. al., 2010). Schools can improve social well-being by supporting peer support programs and providing chances for social contact.

Effect on Academic Success:

Several data indicate a positive association between well-being and academic success (Gräbel, 2017; Seymour, 1999; Suldo et al., 2011). Academic success may also be positively impacted by school environments. In 2016, Phan et al. When the positive benefits of well-being on academic performance are reported, the learning process can be faster and of better quality when students feel comfortable and happy in school. A comprehensive experimental study conducted in three countries found that students are taught concerning their well-being positively affected their well-being, and those students markedly improved their academic achievement at the conclusion of the 15-month intervention (Adler, 2016).

Integrating well-being interventions into the curriculum is one way that educational institutions can encourage wellbeing. For instance, Schonert-Reichl et al (2015) study found that a mindfulness-based intervention improved the academic performance and overall wellbeing of elementary school students. According to this study only 4 months of adding a social and emotional learning (SEL) curriculum with mindfulness instruction to the regular curriculum can produce promising and noteworthy results regarding children's positive behavioral and cognitive change. A positive psychology intervention helped students' academic performance and well-being (Schonert-Reichl, 2015).

3.3 The Impact of Nature on the Learning Process

In the previous chapter, we saw that learning activity occurs according to experiences and behavioral activities, it can be defined also permanent change observed in the behavior (Nagel & Scholes, 2016; Sünbül, 2014; Bashir et al, 2021). Many factors affect the learning process, and the most important factor is the environment in which the process takes place. The bond and experience that a child establishes with his/her environment affect his/her physical, social-emotional, and cognitive well-being and this effect is reflected in his/her social relationships and academic performance (Hutchinson, 2003; Corraliza et. al., 2011; Diener et al., 2018).

Children's capacity to adopt different learning styles can be influenced by their learning environment (Harris, 2018). Theorists and practitioners in education have long recognized the value of physical space in a child's early learning environment. They contend that a child's environment is crucial to their physical and cognitive development and that learning environments should be stimulating and offer opportunities for experimentation (Moore, 1987).

New learning environments offer various settings and places for children to learn because they are related to practices, behavioral norms, aims, and learning goals (Kritchevsky & Prescott, 1969). Children's health is improved as well as their physical development, mental wellness, and cognitive growth when they spend time in nature (Sabirah & Shazly, 2017). In this situation, giving kids opportunities to interact with nature in the classroom can help to increase their learning process.

Childhood is a continuous process of growth, learning and change that occurs as children interact with the environment and adapt as a result of this interaction (Moore, 1977). As illustrated in Billings' (1970) Childhood Ecology diagram in Figure 32, the individual child is interrelated with two factors, social and natural. In a social relationship; interactions with other children, adults, and social institutions cause cultural continuity or change (Moore, 1977). In its relationship with nature, it interacts with biotic and abiotic objects, materials, and phenomena in places of play and learning (Moore, 1977). Such linkages may easily be altered by architecture; for instance, large buildings frequently prevent children from experiencing greenery because they block sunlight from reaching plants. Intentional physical change, planning, design, and education may have a direct impact on how children engage with their environment (Moore, 1977).

All factors and effects in children's relations with the environment, directly and indirectly, affect their learning processes. Childhood is a continuous process of growth, learning and change that occurs as children interact with the environment and adapt as a result of this interaction (Moore, 1977).

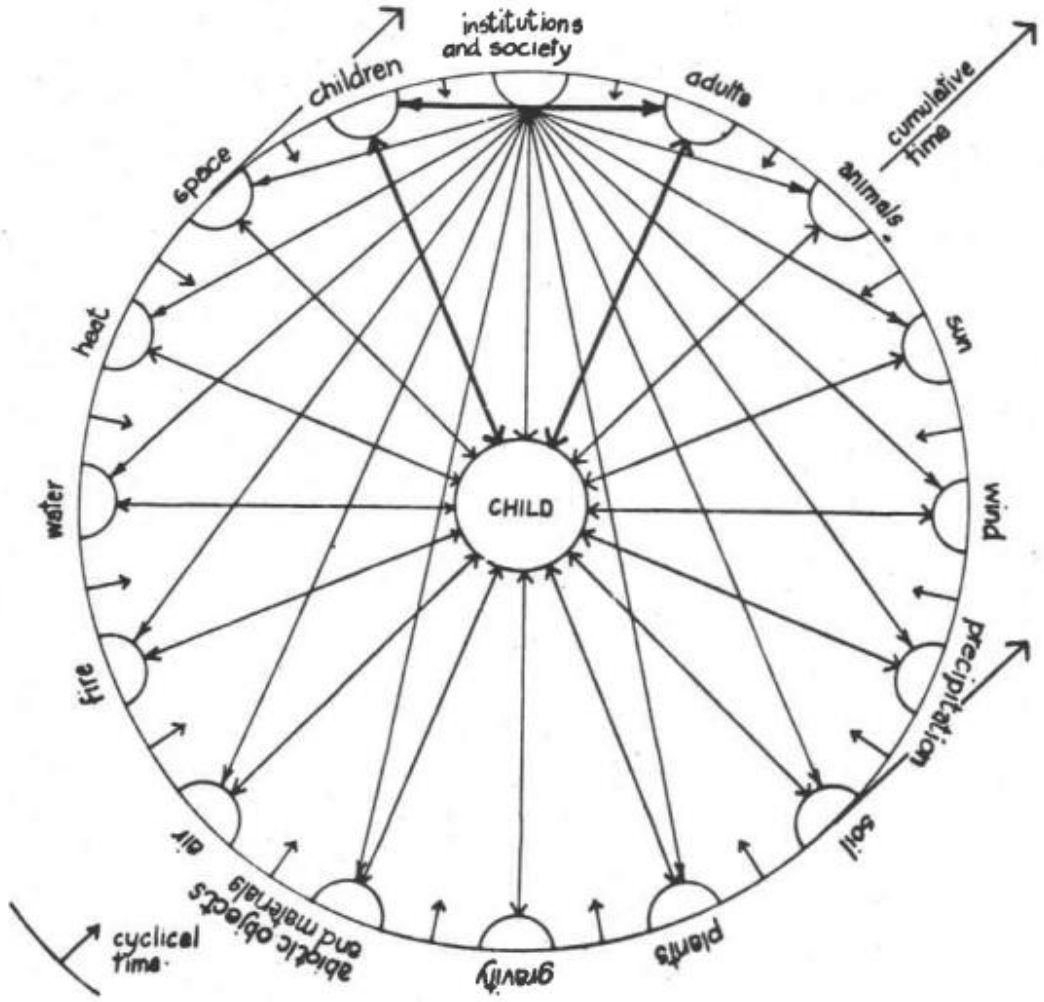


Figure 32: The ecology of childhood (Moore, 1977; Billlngs 1970).

In 2016, Ward and colleagues conducted an empirical study using objective techniques to explore the relationship between children's time spent in green space (open space covered with grass or other vegetation) and various physical and psychological variables. In three intermediate schools in Auckland, New Zealand, 108 students between the ages of 11 and 14 were evaluated. Results showed that exposure to greenspaces is positively correlated with children's physical activity level (Ward et al., 2016). Moreover, exposure to greenspace and medium physical activity both showed a positive link with overall well-being, with the former showing a stronger relationship than the latter. The hypothesis that green spaces have a significant environmental impact on children's physical activity and wellbeing is supported by research.

It is possible to reach the conclusion that green areas indirectly contribute positively to the learning process, as the high level of physical activity and well-being increase the quality of the learning processes of the students.

3.4 Result of the Chapter

Numerous studies have demonstrated the healing properties of nature for human health. The well-being of future generations must concentrate on the children who suffer from this circumstance in a society that is becoming more and more cut off from the natural world. This section examines several experimental studies and applications to gain an understanding of the relationship between children and nature. The physical, cognitive, social, and physiological effects of nature on the child have been examined in detail. In the previous section, we looked at the direct link between learning—a crucial activity for a child's development—and the built environment. In this section, we explore this relationship by putting the welfare of children first. This chapter contains literature reviews that demonstrate how nature affects learning.

In the next chapter, the concept of biophilic design, which is an approach that ensures human-nature relationships in the built environment, is mentioned. At the same time, the history of Biophilic design, its fields of study, application strategies, and its relationship with architecture are the topics included in the content of the next chapter.

4. BIOPHILIC DESIGN CONCEPT

The term biophilia is described as a love of life and living things; it is derived from the prefix "bio," which means "life and living things," and the words "philia," which means "to enjoy and love" (Kellert, 2005). It is necessary for human health and well-being to come into contact with nature. This theory has been developed as a framework with the aim of establishing the relationship between humans and nature in the built environment (Kayhan, 2017). Biophilic Design is not about simply greening our buildings or adding trees and bushes to make them more visually appealing. It is a design approach where reciprocity, respect, and enriching relationships may and should exist at all levels and emerge as the norm rather than the exception (Kellert et al., 2011). The biophilia hypothesis, help to understand; why the garden landscape can foster creativity, why shadows and heights arouse fascination and fear; why raining sound and crashing waves are tempting, and why animal companionship and park rides have restorative, healing effects. In this chapter, the formation of the concept of biophilia and the principles, patterns, etc. of biophilic design information is provided.

4.1 Formation of the Concept of Biophilia

Although the term "biophilia"—which means a love of life—is commonly credited to Nobel Prize-winning scientist E. O. Wilson, it was actually coined by psychotherapist Erich Fromm in the course of his investigation into what constitutes humanity as a whole (Söderlund, 2019). Connecting with nature can help people's intellectual, emotional, and spiritual fulfillment, according to Fromm; Wilson later expanded on this, claiming that evolution compelled humans' biological design to respond positively to this contact with nature (Wilson 1993). The reason why Wilson came to this claim is based on the history of humanity, and the fact that the origin of humanity did not start simultaneously with the first village-type construction and the experience of nature gained in hunter-gatherer life clarifies this statement. Early researchers of biophilic design made extensive use of historical examples to illustrate various

propositions of how built works and nature itself can create a sense of positive connection with 'nature' and natural processes (Wilson 1984; Downton et al, 2017). When we look at these examples, we see that they can be found even in the oldest human structures: animal patterns unique to Neolithic Göbekli Tepe (Figure 33); acanthus leaves adorning Greek temples and their Vitruvian origin stories; The delicate, leafy filigrees of Rococo design (Figure 34), etc. (Browning et al, 2014). The literature shows that by providing connections between people and their environment, biophilia can function as an educational tool that can guide in constructing an ecologically appropriate built environment (Downton et al, 2017). Even though the field of study of biophilia is well-established and expanding quickly, it is still relatively new, especially in the field of architecture.

Figure 33: Göbekli Tepe (URL 12) **Figure 34:** Hotel de Soubise (URL 13)

Biophilia—the innate human propensity to interact with nature—even in contemporary lifestyles, remains essential to people's physical and emotional health and well-being (Kellert & Calabrese, 2015). The landmark study revealing the healing power of interaction with nature emerged when Roger Ulrich compared the recovery rates of patients with and without nature view (Ulrich, 1984). Biophilia, or a love of life with an awareness of place, is a strong stepping stone to altruism and neighborly affection (Söderlund, 2019).

Fromm lists the personal conditions he believes are required for the development of biophilia, which include:

- During infancy, warm, affectionate contact with others,
- Liberty and the absence of dangers
- Modeling (rather than preaching) the principles of inner harmony and strength.
- Advice on the "art of living,"
- A stimulating influence on and response to others; and
- A generally interesting way of life.

Security, freedom, and justice are identified as necessary societal conditions by Fromm (Fromm 1964, pp. 47-48). As a result of increasing employment possibilities and demand for people after industrialization, migration from villages and rural regions to cities has increased day by day. Therefore the gap between nature and humans is developing in cities that are expanding at an unmanageable rate. However, people's connection with the natural environment and living spaces is necessary for physical and psychological well-being.

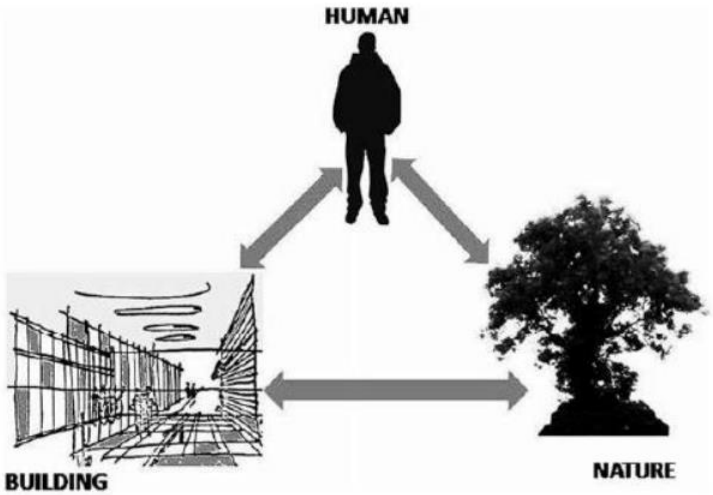


Figure 35: The components of human settlement (building-human-nature) (Kayhan, 2017)

The hypothesis sets out this need and proposes to recognize the evolutionary legacy of all species in the biosphere (Kayıhan, 2017). Fromm's realization that mechanical and artificial cities contribute to a detachment from nature leads to an appreciation for the possibility of cities becoming places of nature that promote biophilic consciousness (Söderlund, 2019). Architecture should be the main element in establishing this relationship (Fig: 35) (Kayhan, 2017).

4.1.1 The principles of biophilic design

In the contemporary built environment, the biophilic design aims to provide a pleasant habitat for humans as biological creatures that improve their health, fitness, and welfare. While the green/ecological design approach in architecture is developed with a physical and material focus, biophilic design focuses on the emotional and psychological aspects of the need to interact with natural elements (Kayhan, 2017). The effective implementation of biophilic design involves the persistent application of some fundamental principles. These ideas are key prerequisites for the efficient use of biophilic design (Kellert & Calabrese, 2015). Kayhan (2017) summarized the importance of biophilic design in his study as follows;

Many scientific studies have proven that biophilic principles provide real, measurable benefits in human performance such as emotional well-being, stress reduction, productivity, learning and recovery. Biophilic features can lead to the formation and protection of the natural environment and reduce pollution, as it focuses on nature. Finally, it has been revealed by various scientific studies that it has many positive effects on the psychology of the user, such as increasing concentration, stimulating and soothing effects, when establishing a connection with the natural environment.
Kellert and his colleagues explained these principles in 5 substances:

1. Biophilic design necessitates continuous and long-term interaction with nature (See Figure 36).

Figure 36: Dask House – Naav Studio 2023

2. The biophilic design emphasizes human adaptations to the natural environment that have improved people's health, fitness, and well-being over the course of evolution (See Figure 37).

Figure 37: TM Studio (URL-14)

3. An emotional connection to certain environments and locations is encouraged through biophilic design.
4. Biophilic design encourages beneficial interactions between people and the natural world that foster a deeper sense of connection to and responsibility for the communities of people and animals.
5. The biophilic design promotes connected, integrated, and mutually reinforcing architectural solutions (See 38).

Figure 38: Bosco Verticale – Milan

The implementation of biophilic design should support an ecologically sound and sustainable natural community in the long term.

The positive experience of natural systems and processes in our buildings and the built environment is important to human performance and well-being, a fundamental premise of biophilic design (Kellert et al, 2008; Kayıhan, 2017). According to Kellert et. al (2015) a wide range of behavioral, mental, and physical advantages should follow from the effective application of biophilic design;

-Physical benefits include more comfort and enjoyment, fewer indications of disease, higher physical fitness, lower blood pressure, and better health.

-The advantages of mental health include better motivation and fulfillment, reduced stress and anxiety, and enhanced problem-solving and creativity.

-Better coping and mastery abilities, higher focus and attention, improved social interaction, and less animosity and aggression are all examples of positive behavior change.

4.1.2. Elements and attributes of biophilic design

Six elements of biophilic design can be related to the two basic dimensions of biophilic design:Environmental features, Natural shapes and forms, Natural patterns and processes, Light and space, Place-based relationships, Evolved human-nature relationships. These six elements are then revealed in more than 70 biophilic design attributes. (Kellert, et al. 2011). All the design elements and attributes are listed in Table 4.1, and a small number of illustrations are provided.

Table 4.1: Elements and Attributes of Biophilic Design (Kellert, et al. 2011)

Environmental features	Natural shapes and forms	Natural patterns and processes
Color	Botanical motifs	Sensory variability
Water	Tree and columnar supports	Information richness
Air	Animal (mainly vertebrate) motifs	Age, change, and the patina of time
Sunlight	Shells and spirals	Growth and efflorescence
Plants	Egg, oval, and tubular forms	Central focal point
Animals	Arches, vaults, domes	Patterned wholes
Natural materials	Shapes resisting straight lines and right angles	Bounded spaces
Views and vistas		Transitional spaces
Façade greening	Simulation of natural features	Linked series and chains
Geology and landscape	Biomorphy	Integration of parts to wholes
Habitats and ecosystems	Geomorphology	Complementary contrasts
Fire	Biomimicry	Dynamic balance and tension
		Fractals
		Hierarchically organized ratios and scales
Light and space	**Place-based relationships**	**Evolved human-nature relationships**
Natural light	Geographic connection to place	Prospect and refuge
Filtered and diffused light	Historic connection to place	Order and complexity
Light and shadow	Ecological connection to place	Curiosity and enticement
Reflected light	Cultural connection to place	Change and metamorphosis
Light pools	Indigenous materials	Security and protection
Warm light	Landscape orientation	Mastery and control
Light as shape and form	Landscape features that define building form	Affection and attachment
Spaciousness		Attraction and beauty
Spatial variability	Landscape ecology	Exploration and discovery
Space as shape and form	Integration of culture and ecology	Information and cognition
Spatial harmony	Spirit of place	Fear and awe
Inside-outside spaces	Avoiding placelessness	Reverence and spirituality

In practice, biophilic design is experiences and attributes that involve the application of changing design strategies. The choice of design practices to be used varies depending on the conditions of a project, including the specific building and landscape uses, project size, changing economic, logistical and regulatory factors, as well as cultural and ecological conditions (Kellert et al., 2015).

Kellert et al, (2015) define the biophilic design framework in three kinds of experiences of nature; the direct experience of nature, the indirect experience of nature, and the experience of space and place.

The direct experience of nature provided in the built environment atmosphere is real contact with all environmental features including natural light, plants, water factor, animals, air and landscapes. As an example of interior design that provides direct experience with nature, we can examine Terra Office designed by Mandviwala Qutub and Associates architecture (Figure 39).

Figure 39: Terra Office Ahmedabad/India, 2023 (URL- 15)

The design includes central courtyards with skylights that bring the outside in a meaningful way to establish a strong connection with nature. Each office is located around an inner courtyard that provides communication between the rooms and connects them with the sky and the surrounding vegetation. The overall work environment is improved with this design strategy that maximizes the filtered light inside the office. The interplay of horizontal and vertical features adds to the light and airy atmosphere of the office.

Indirect nature experience includes elements that represent and reflect nature in the indoor atmosphere. These include works of art, paintings, wooden furniture, natural materials, and biomorphic forms inspired by natüre (Example; Figure 40).

Figure 40: Audain Art Museum, Whistler, BC / Patkau Architects (URL-16)

Third and last, the experience of space and place includes the characteristic spatial features of the environment that promote human health and well-being. The 24 characteristics of biophilic design are described in Figure 41 under these three categories of experience. It is important to explain more deeply the 24 characteristics under these 3 categories defined by Kellert to understand the scope of biophilic design.

-Direct Experience of Nature

Direct experience refers to the relatively unstructured contact between humans and nature in the built environment with its self-sustaining features such as sunlight, plants, animals, natural habitats, and ecosystems (Kellert et. al, 2011). Attributes that are under the Direct Experience of Nature are also explained by Kellert et al. in 2011, under the title of Environmental Features, which is the first and most obvious element of biophilic design.

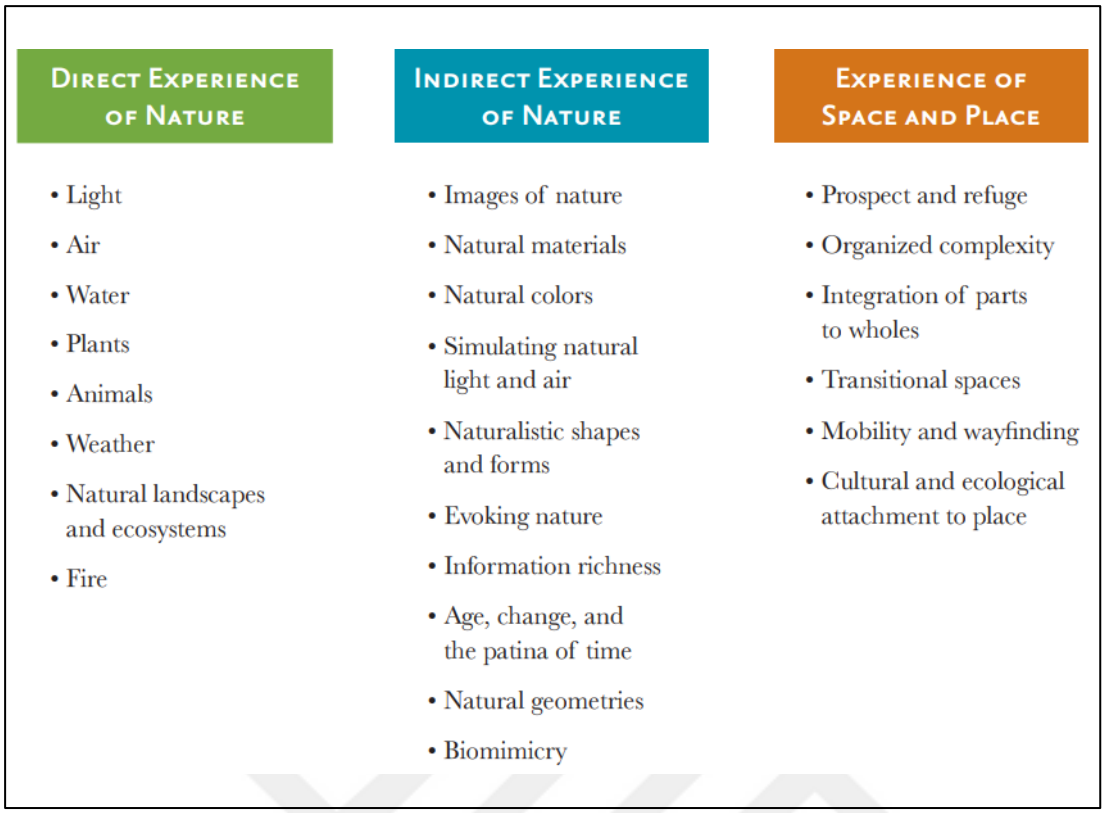


Figure 41: Experiences and Attributes of Biophilic Design (Kellert et al. 2015)

Light: Recognized as a consistently important and preferred feature by most people, daylight is a factor influencing human behavior and experience in the built environment. The experience of natural light that adapts to the day, night and seasons according to the position and cycles of the sun is essential for human health and well-being (Kellert et al, 2015). For the fulfillment of numerous physical, emotional, and intellectual needs, people depend on their visual acuity.

The right use of natural light in architecture can facilitate movement and orientation and contribute to comfort and satisfaction. The use of natural light in preference to artificial light can improve morale, comfort, health and productivity (Kellert et. al, 2011). Natural light can take aesthetically interesting forms through the diffuse and variable inspired interaction of natural light and the integration of light with spatial features. Natural light can be brought into the interior through design strategies such as glass walls, mezzanines, reflective materials and the use of color (Kellert et al, 2015). Magdalene College Library can be a good example of bringing daylight into the building (Figure 42).

Figure 42: Magdalene College Library, Cambridge, UK (URL-17).

Niall McLaughlin Architects designed thin layer of light structures located on the roof that gives equal brightness to the main reading rooms and reduces glare by balancing the side light and overhead light. Little direct light is allowed to reach the floor and shelf levels, but there is a lively play of light on the ceiling and window sills. In this way, it created the character of a natural animation building that gives people calmness.

Air: A building must offer the conditions required for people to be thermally comfortable. Natural ventilation is preferred by people indoors. Allan (2005) listed these conditions as follows: Control of the mean radiant temperature, control of the air temperature, control of humidity and the flow of water vapor, and control of air circulation. It is important to use natural ventilation rather than treated and stagnant air. Natural ventilation increases efficiency and comfort (Kellert et al, 2015). Natural ventilation experience in the built environment can be achieved by simple means such as windows or by accessing the outside using technology/engineering.

Water: Water has positive effects in the built environment such as reducing stress, increasing satisfaction and increasing the level of well-being (Kellert et al, 2015). Human contact with water in the built environment, including views of prominent bodies of water, fountains, aquariums, wetlands, and others, can be achieved through a variety of design strategies (Hildebrand 2000).

Plants: Plants form the basis of human existence as sources of food, fiber, feed and other livelihood and security aspects (Kellert et. al, 2011). The presence of plants can reduce stress, improve physical health and comfort, and increase performance and productivity (Kellert et al, 2015). Application of single or isolated plants is not a very effective method. Instead, it is a better design strategy to bring the direct experience of nature to the built environment by focusing on local species (Kellert et al, 2015).

Animals: Animals are quite important to humans and provide them with a variety of benefits, including food, resources, protection, and companionship. In the built environment, it can be tough and challenging to allow for animal-human contact. Animals are shown in the interiors of buildings as ornaments, decorations, and works of art that are stylized, very abstract, and representational (Kellert et al, 2015). Humans are satisfied, happy, and emotionally interested by the existence of animal forms. Using various design approaches, it might be possible to provide a direct connection to the built environment. It is possible to guarantee the presence of wild animals through the use of aquariums, aviaries, and green roofs (Kellert et al, 2015).

Weather: Human survival and well-being depend on individuals being aware of and reacting to the weather in their experiences of nature. It can be enjoyable and energizing to give the built environment an indirect connection to the outside world. As an illustration, it could contain exterior views, movable windows, porches, balconies, terraces, pavilions, gardens, etc. (Kellert et al, 2015)

Natural Landscapes And Ecosystems: Conventional natural landscapes with wide-spreading trees, the presence of water, and wooded areas are preferred by people over manufactured and human-dominated landscapes. Ecosystems that can support themselves can offer rewarding and captivating experiences. In the constructed

environment, self-sustaining ecosystems can be created through design techniques including hydrological management, wetlands, and forest clearings. Functional ecosystems are rich in biodiversity. Direct connection with natural systems, active participation, or observation platforms can all enable it. (Kellert et al, 2015)

Fire: Controlling fire has been one of humanity's greatest accomplishments since it enables the use of energy outside of animal life and makes it easier to change materials from one state to another (Kellert et al, 2015). Fire is a valued element frequently linked to the advantages of heating and cooking, despite being a complex and challenging design challenge in the built environment. Both comfort and worry can be felt being around fire. Construction of fireplaces and hearths can successfully imitate the presence of fire in the built environment, as can the imaginative use of light, color, movement, and materials with different thermal conductivities (Kellert et al, 2011).

-Indırect Experıence of Nature

Images of Nature: When used in the built environment through the use of photographs, paintings, sculptures, motion pictures, simulations, and other formats, representative expressions of nature (plants, animals, landscapes, etc.) can be emotionally and intellectually fulfilling. This depiction works best when it is frequently used, is themed, and is repeated.

Natural Materials: The use of materials is one of the most essential factors affecting the human experience in the built environment and is very crucial. Despite the fact that with the advancement of technology, artificial materials are becoming increasingly similar to natural materials, people nevertheless prefer to use natural materials. Transforming natural materials commonly generates positive visual and tactile responses that few manufactured materials can match (Kellert et al, 2015). Material selection is critical for the building's and the environment's sustainability. Materials should be chosen based on local conditions and available resources.

Natural Colors: An awareness of the perception and use of color and its effects on human behavior is essential for designers. Studies have shown that color can create feelings of relaxation, calmness, excitement or joy in the built environment and increase productivity (Kilmer and Kilmer, 1992). Color is a subjective term that

changes from culture to culture and from person to person, therefore color selections should be made with care based on the region in which they will be used. People are attracted to the colors of colorful flowers, rainbows, stunning sunsets, sparkling water, blue skies, and other natural phenomena. Preference for soil, rock, and plant-specific tones would be the best method for an effective application within the scope of biophilic design (Kellert et al, 2015). Bright colors, inspired by nature (flower, sunset, sunrise, rainbow, some animals, etc.), should be utilized with caution. Colors that are overly unnatural and contrasted should be avoided.

Naturalistic Shapes and Forms: Naturalistic Shapes and Forms also claimed as second element of biophilic design by Stephen Kellert and his colleagues (2011). This element contains natural world representations and simulations, which frequently appear on building facades and interior spaces.

Eleven attributes are associated with this design element; 1. Botanical motifs, 2. Trees and columnar supports, 3. Animal (mainly vertebrate) motifs, 4. Shells and spirals, 5. Egg, oval, and tubular forms, 6. Arches, vaults, domes,7. Shapes resisting straight lines and right angles, 8. Simulation of natural features, 9. Biomorphy, 10. Geomorphology, 11. Biomimicry (Kellert et al, 2011). Natural shapes and forms can transform a static setting into one with the dynamic and environmental features of a living system (Kellert et al, 2015).

Evoking Nature: When you look at some designs, you may have noticed that they evoke nature. Satisfying, impressive and creative experience of nature can emerge with different descriptions and interpretations. These representations may be abstractions of what is found in nature and may not have an exact equivalent in natüre (Kellert et al, 2015). Despite this, there are design details that are sharply evocative of nature. For example; When we look at the World Trade Center Transportation Hub structure (Figure 43), it reminds us of a bird that has spread its wings. Seeing such a structure in the middle of a dense urbanization like New York City can be an impressive experience.

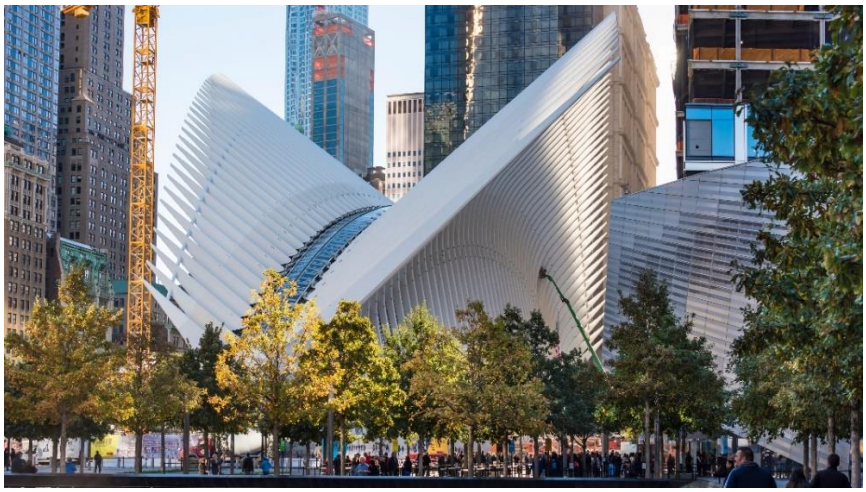


Figure 43: World Trade Center Transportation Hub (URL-18)

Information Richness: Exploring and encountering new information and experiences excite and satisfy people. Nature is defined as the richest environment in terms of information that people will encounter, with its diversity full of surprises at every moment. Information-rich and diverse spaces that offer a wealth of choices and opportunities have a positive impact on people as long as complexity is experienced in the built environment in a coherent and legible way.

Age, Change, and the Patina of Time: Another distinctive feature of nature is its change over time. Nature, in constant flux and change, reflects the dynamic forces of growth and aging. People respond positively and adapt to this dynamic relationship of nature with time (Kellert et al, 2015). These dynamic trends are satisfying when balanced with stable and integral complementary qualities. Change and a patina of time can be achieved by using time-varying materials, and design strategies that adapt to weather conditions and reflect the sense of the passage of time.

Natural Geometries: Prominent natural geometries include hierarchically ordered scales such as the "Golden Ratio" and the "Fibonacci Sequence". Mathematical properties commonly encountered in nature are expressed as natural geometries. For example, fractals (Figure 44) are a geometric form often encountered in the natural world, where a basic shape appears in repeated but varied and predictable ways that add both variety and similarity to a setting (Kellert et al, 2015). These kinds of geometries can be encountered indoors (fabric, surface, etc.) or in exterior facade designs.

Figure 44: Snowflake (URL-19)

Biomimicry: Animals, plants, and microbes are excellent engineers. The basic idea in the concept of biomimicry is that when we look at nature, people have already found the solution to the problems they are trying to solve (Rao, 2014).

Figure 45, Habitat 2020, China (URL-20)

Biomimicry refers to being inspired and developing solutions by looking at the solutions of nature. Examples include features such as the structural strength of spider webs, the bioclimatic controls of termite mounds, and the heat retention ability of some animal hairs (Kellert et al, 2015). One of the effective ways to reduce the ecological footprint of buildings is to follow nature's solutions through biomimicry (Rao, 2014). The China envisioned Habitat 2020 building (Figure 45) in 2008 is an example of biomimetic architecture, which mixes cutting-edge ideas with basic cellular functions

to produce 'alive' structures that function like natural organisms (Rao, 201). This nature-inspired approach to city life considers the urban landscape to be a dynamic and ever-changing ecosystem. Buildings in this metropolis open and close, breathe, and adapt to their surroundings. The Habitat 2020 structure alters the perception of a structure's surface dramatically. Instead of a system of inert materials used exclusively for building and defense, the outside is conceived as a living skin. Fresh air and natural air conditioning will be provided by directing air and wind into the structure and filtering it. The active skin will be able to collect rainwater, which will then be treated, filtered, utilized, and recycled. Even moisture from the air can be absorbed by the skin. The trash generated will be transformed into biogas energy, which will be used in a variety of habitat applications. Capturing these features of non-human nature with technology may result in practical and direct benefits, as well as arousing human admiration for the creativity of the natural world (Kellert et al, 2011).

- Experıence Of Place And Space

Prospect and Refuge: The potential of a construction or natural environment to provide a secure and sheltered setting is reflected in the term refuge. This is frequently achieved in the physical environment through the creation of comfortable and nurturing building interiors and hidden landscape locations (Kellert et al, 2011). Prospect refers to extended views of surrounding environments that allow people to notice both opportunities and hazards, whereas refuge provides safe and secure locations (Kellert et al, 2015). In the constructed environment, these complimentary qualities can be both functional and pleasurable. This biophilic outcome can be accomplished by design methods such as exterior vistas, visual links between interior spaces, and the presence of secure and sheltered surroundings.

Organized Complexity: People prefer the built environment, which includes the physiologically and psychologically organized complexity of the area in which they are located, to the plain and overly ordered or irregularly complex structures (Salingaros, 2006). People appreciate complexity in both natural and human scenarios, indicating regions brimming with possibilities and chances (Kellert et al, 2015). The connections we make with the environments we live in play an important role in our lives, as they affect our health and mental well-being (Kellert et al, 2011). Still, excessive complexity is often confusing and chaotic. The most satisfying

environments are experienced in a way that tends to have qualities of complexity but is also orderly and organized. When the geometric properties of the type of visual complexity responsible for the positive effects were examined, its commonality with biological structures was determined (Kellert et al, 2011). To apply such concepts to architecture, we must first bring as much of our everyday environment as we can to experience nature firsthand, and second, shape our built environment to include the same geometric qualities found in nature (Kellert et al, 2011).

Integration of Parts to Wholes: This attribute has been placed under Natural patterns and processes, the third element of biophilic design, by Kellert and colleagues (2011). People are satisfied with the whole feeling that emerges in built environments where different parts form an integrated whole and they prefer to be in such environments (Kellert et al 2011). This integrative experience develops a sense of structural integrity even in large complex structures (Kellert et al 2015). The sense of whole can be achieved by the sequential and cascading of spaces as well as by clear and discernible boundaries. A prominent focal point that arises functionally or thematically might increase this satisfying integration of space (Kellert et al, 2011).

Transitional Space: We can also see this feature under natural patterns and processes, the third element of biophilic design. Important passageways in the built environment include sills, portals, gates, bridges, and fenestration. Transitional spaces between and within built and natural environments often increase comfort by providing access from one space to another. Navigating an area successfully requires obvious links between spaces, which are typically aided by clear and detectable transitions (Kellert et al, 2011).

Cultural And Ecological Attachment to Place: This attribute actually contains two attributes under the fifth element of Biophilic Design, Place-based relationships which are the ecological connection to place and cultural connection to place. Humans became territorial as they evolved because they favored resource control, improved safety, and security, and enabled travel and mobility (Kellert et al., 2015). People are frequently motivated to maintain and safeguard both natural and man-made surroundings by their cultural and ecological affiliations. By integrating a region's history, geography, and ecology, a cultural connection to place becomes an essential

part of both individual and social identity (Kellert et al., 2011). Nature is unavoidably changed by the built environment's design. Like any ecologically adaptive organism (such as otters on a kelp bed; see Figure 46), humans have the ability to both add to and take from their natural systems. Therefore, achieving net ecological productivity can be a goal of built environment design.

Figure 46: Sea otters in a kelp bed (URL-21).

4.2 Biophilic Design Patterns

Translation of biophilia into built environment design as a hypothesis, 4.1.2. As explained under the title Elements and Attributes of Biophilic Design in the thesis, it has entered the literature with Stephen Kellert's 2004 conference on biophilic design, in which he described more than 70 different mechanisms, and his subsequent book (Kellert, Heerwagen & Mador, 2008).

Creating and contributing to a biophilic experience, authors William Browning and Jenifer Seal-Cramer have outlined three classifications of user experience: Nature in the Space, Natural Analogs, and Nature of the Space (Browning et al, 2014). Browning et al. (2014) proposed 14 biophilic design patterns (Table 4.2) under these three classifications. This table provides a framework for understanding biophilic design opportunities, providing ideas for design practices as a way to effectively increase health and well-being for individuals and society, and establishing the human-nature relationship with built environment design.

Table 4.2: Principles and Patterns of Biophilic Design (Browning, 2014)

Biophilic Design Principles	**Patterns of Biophilic Design**		
	Nature in the Space	Natural Analogues	Nature of the Space
Design Narratives	Visual Connection with Nature Non-Visual Connection with Nature Non-Rhythmic Sensory Stimuli Thermal & Airflow Variability Presence of Water Dynamic & Diffuse Light Connection with Natural Systems	Biomorphic Forms & Patterns Material Connection with Nature Complexity & Order	Prospect Refuge Mystery Risk & Peril

The patterns are backed up by actual data, the works of Christopher Alexander, Judith Heerwagen, Rachel and Stephen Kaplan, Stephen Kellert, Roger Ulrich, and others, as well as considerable multidisciplinary study. These 14 types were intended to be versatile and adjustable, enabling application to suit the Project (Browning et al, 2014). They have a wide range of uses for both indoor and outdoor locations. Biophilic design patterns presented as a result of this key study that brings together Biophilia and Architecture are explained under the title of Field Study Analysis and Findings within the scope of the thesis.

4.3 Impacts of Biophilic Design on Human Behaviors

Biophilic design is a design approach that encourages people to engage and reconnect with nature (Tarakçı Eren et al., 2018). Ulrich (1993) expressed people's tendency to prefer natural qualities, systems, and processes which is coined as biophilia, "the belief that contact with nature is somehow good or beneficial for them" (p. 73), (Kellert, 2008). The presence of water, plants, and other natural elements can reduce anxiety and make stress management easier (Ulrich, 1979, Kellert, 2005; Nevzati et al., 2021). The biophilic design concept promotes air quality, temperature control, and natural lighting in the built environment and expresses the effort to create a space that improves all ecosystems and ecology (Madison, 2020; Guzzo, et al. 2022). It is well known that implementing biophilic design principles in offices, hospitals, schools, and other public spaces will improve both the well-being of every individual on the planet

and the state of the world economy (Kellert, 2005; Browning et al., 2014). Studies have demonstrated the positive effects on physical and mental health of environments with biophilic design elements, such as strategically placed windows to frame views of the outside, appropriate variation in lighting levels, bringing nature indoors, and the use of natural materials (Browning, et al., 2014; Peters, et al., 2020). Earlier research on the advantages of a biophilic approach to interior design have shown improvements in a variety of areas, including physical health, blood pressure, mood, work satisfaction, creativity, motivation, and concentration, as well as a reduced risk of diseases (Kellert and Calabrese, 2015; Annerstedt and Währborg, 2011; Ulrich, 2008, 1993; Wells and Rollings, 2012; Nevzati et al., 2021).

The attention restorative theory is a major tenet of the biophilic design literature (Kaplan, 1995). Understanding how attention to natural elements affects well-being, stress reduction, and mood restoration has been the theoretical focus (Morton et al., 2017; Guzzo et al., 2022). A previous study used the psychoevolutionary theory of emotions (Ulrich, 1983) to explain how nature attributes affect emotional responses and outcomes like motivation, satisfaction, job performance, and self-regulatory behaviors. The theory explains how people respond to biophilia based on memory and cognition (Guzzo et al., 2022). Architecture can help people experience nature. One of the most difficult user experiences in a public building is environmental stress, which has detrimental psychological and physiological effects, and it is crucial, especially in educational buildings where stress can negatively impact students' learning and health (Nevzati et al., 2021).

School environments that incorporate biophilic design elements could maximize the restorative qualities of the environment, allowing students to feel less stressed and concentrate better on their studies (Peters, et al., 2020). Ambient stressors, among other environmental stressors in public interiors, cause students' ongoing battles with mental fatigue, stress, loss of attention, and their depleted mental state (Nevzati et al., 2021). Incorporating biophilic design into learning environments can benefit students by promoting stress-reducing environments that also encourage creativity and cognitive development (Peters, et al., 2020).

The main topics of Ulrich's psychoevolutionary theory from 1983 are stress relief and the therapeutic effects that nature may have on people. Ulrich contends that people have a biological propensity for "quick-onset" reactions to their natural surroundings. The approach or avoidance behaviors that this response process encourages can foster well-being and even survival and have evolutionary roots. Kaplan and Kaplan (1989) were the first to suggest that exposure to nature has cognitive benefits (Guzzo et al., 2022). In particular, it has been demonstrated that the psychoevolutionary theory offers solid theoretical support and is perhaps the most useful for examining how natural (biophilic) elements affect people and their well-being. According to studies, being in nature can both calm and stimulate the mind, enhancing well-being and productivity. For instance, in one study, participants who spent four days immersed in nature and cut off from technology and multi-media performed 50% better on tests of creativity and problem-solving than a control group (Atchley et al., 2012; Peters, et al., 2020).

4.4 Children and Biophilic Design

Children today have far fewer opportunities than previous generations did to enjoy outdoor play and the natural world due to growing urbanization. Today, many barriers limit children's access to nature, which can prevent them from growing up with love, respect for the planet, and a passion for protecting it (Kellert, et. al., 2011). The barriers include the lack of direct exposure to natural processes and materials in early childhood when sensory input is the primary method of learning, unfavorable messages from adults who have long since lost their biophilic feelings toward nature, and the absence of living environments in schools where children receive primary education at a stage of development when minds and bodies are open to everything the world has to offer and the seeds of understanding are most easily planted (Kellert, et. al., 2011).

The built environment can affect a child's lifestyle and negatively affect their mental and physical health (Russo, et al., 2023). The results of a study involving more than 10,000 11- to 12-year-old British children, funded by the Economic and Social Research Council (ESRC), were reported by psychologist Michael Shayer in an interview with the Guardian newspaper (Crace 2006). The primary outcome was that children in the UK are now two to three years behind where they were fifteen years

ago in terms of cognitive and mental growth. When asked to explain these findings, Shayer responded that the most likely reasons are the rise of video games, TV culture, and the lack of experiential play. Both prevent children from engaging in hands-on play that enables them to understand how the world actually functions and form accurate opinions about imprecise ideas (Kellert, et al, 2011). It has been stated that biophobia may also occur in children who are away from nature. If children's natural attraction to nature is not allowed to develop in their early years, biophobia or hatred of nature may develop (Russo, et al., 2023). Biophobia encompasses a wide range of emotions, from discomfort with natural environments to disdain for anything man-made, unmanaged, or unconditioned (Russo, et al., 2023).

It is well known that nature has a positive impact on children in a variety of ways, making it one of the most crucial factors for supporting children's overall growth and development (Lee et al., 2018). According to literature, children who have regular access to nature experience improvements in their behaviors and ADHD symptoms as well as improved attention, memory, competence, socialization support, self-discipline, and stress management (Russo, et al., 2023). Children directly interact with environmental systems, and these systems are most influenced by the microsystem in which children are actively involved (Lee et al., 2018). The microsystem is made up of a variety of settings, including homes, daycare centers, schools, and children's libraries, which demonstrate how the physical, emotional, and social stages of children's development are directly impacted by their immediate surroundings (Lee et al., 2018).

Children's attention functions have been shown to benefit significantly from even small amounts of nature (Kellert et al. 2011). A growing body of research indicates that spending time in nature and being outdoors may be considered a "preventive treatment" for normal attention function. According to empirical research (Faber Taylor et al. 1998), exposure to nature—even as little as the view of trees from an apartment window—improves attentional function (Kellert et al. 2011). The intention of the nature-friendly environment, which is created in the children's primary learning and play areas by the application of various natural elements like light, plants, water, soil, and stones, is to encourage people to develop in a peaceful and cooperative way (Lee et al., 2018). It also positively affects the creative and active development of

children. These natural elements, in particular, make it possible to design an inviting, livable learning environment that promotes kids' physical, mental, social, and cognitive growth (Lee et al., 2018). A new biophilic culture can take root thanks to precedents (time-tested case study designs) that support biophilic design for kids. These precedents can also serve as an impetus for local action. These case studies are intended to encourage the development of regulations that will promote more inclusive, healthy lifestyles. (Kellert et al. 2011). Lee and his colleagues (2018) investigated a comprehensive case study in children's libraries and according to their summary the top five important averages of biophilic design patterns were as follows: 'Provision of an environment for easy viewing'; 'Visual connection with nature'; 'Connecting with ecosystems'; 'Dynamic light in the environment'; and the 'Provision of natural materials'. The most important features are;

- Long-term learning spaces with spatial architecture that encourages a visual connection to nature,
- By dividing the library's study/reading area's upper and lower levels into expansive open spaces, it creates a visual link with nature,
- Space design with an extensive open space that permits observation of the courtyard and each floor, and
- The dynamic lighting in the space that has an enhanced natural lighting environment reflects the natural lighting environment. (Lee et al., 2018).

The study explains the importance of direct nature experiences such as light, plants, and water through the openness of the library in the architectural applications of biophilic design in designing a learning space that can experience nature. When we examine the literature, we clearly see that while negative physical and cognitive development occurs in children who have little contact with nature, on the contrary, a positive development has been detected in children who have contact with nature. According to estimates made by Russo et al. (2023), by 2030, 60 percent of urban dwellers in developing nations will be younger than 18 years old. Currently, 25% of the world's population is under the age of 15. As a result, it is essential to ensure connections with nature in cities, especially in the areas around schools where children spend the majority of their time, and schools should be designed using biophilic design principles.

4.5 Result of the Chapter

In this chapter, Biophilic Design, an approach that establishes a relationship between nature and the built environment and integrates this relationship into human experience, is explained. Although studies were first carried out in the field of psychology in the context of nature-human relationships, later architectural studies were carried out to use biophilia in the design of the built environment by including the human-building relationship and nature-human relationship. In this section, the connection between biophilia and architecture and various application studies are examined.

As a result of this chapter, it has been determined that the development of the built environment, which has a significant impact on human behavior, can be achieved by biophilic design parameters. The biophilic design strategies in this section were used for the preparation of the field study and design guide, which is the next section of the thesis.

5. FIELD STUDY ANALYSIS AND FINDINGS

Several research studies that have been mentioned in earlier chapters have also indicated how crucial a connection between children and nature is to both their physical and mental health. In this context, the focus is on the primary school period, which is an important age range where children's pre-adolescent characters and awareness are formed in their minds (Harvey et al., 2020). Establishing a relationship with nature in the design of school environments, which is the built environment where they spend most of their time outside of home, is very important for their development. It is envisaged that designing the learning environments where the learning activity mostly takes place, taking into account biophilic design parameters, will allow students to establish a relationship with nature. The application of biophilic design patterns in learning environments has been evaluated in selected schools, and the literature review and the field study results were used to create the design guide. The concept of Biophilic Design was presented by Browling et al. (2014) in 14 patterns under 3 groups in order to ensure and facilitate applicability, especially for interior architecture. Considering the experience and application of these patterns, their applicability in the learning (classroom) environment, and the learning activity process of the students, some patterns were excluded from the list. Some patterns are associated with each other due to the experience and application style they provide (Figure 47).

5.1 Biophilic Design Patterns and Their Applicability to Learning Environment

5.1.1 Nature in the space

Nature in the Space encompasses the direct physical and temporary existence of nature in a space (Figure 47). It includes plant life, water and animals, as well as sounds, smells, breezes and other natural elements. Landscape works, plants in pots, aquariums and plant roofs can be given as examples. Diversity, movement and multi-sensory interactions and direct interaction with this natural element are necessary to strengthen the experience of Nature in the Space.

The seven biophilic design patterns covered by Nature in the Space are:

1. Visual Connection with Nature; an examination of natural elements, living things, and processes. It was evaluated as applicable in the learning environment.

2. Non-Visual Connection with Nature: Stimuli that intentionally and favorably allude to nature, living things, or natural processes through sound, touch, smell, or taste. It was evaluated as applicable in tactile, auditory and olfactory contexts in the learning environment.

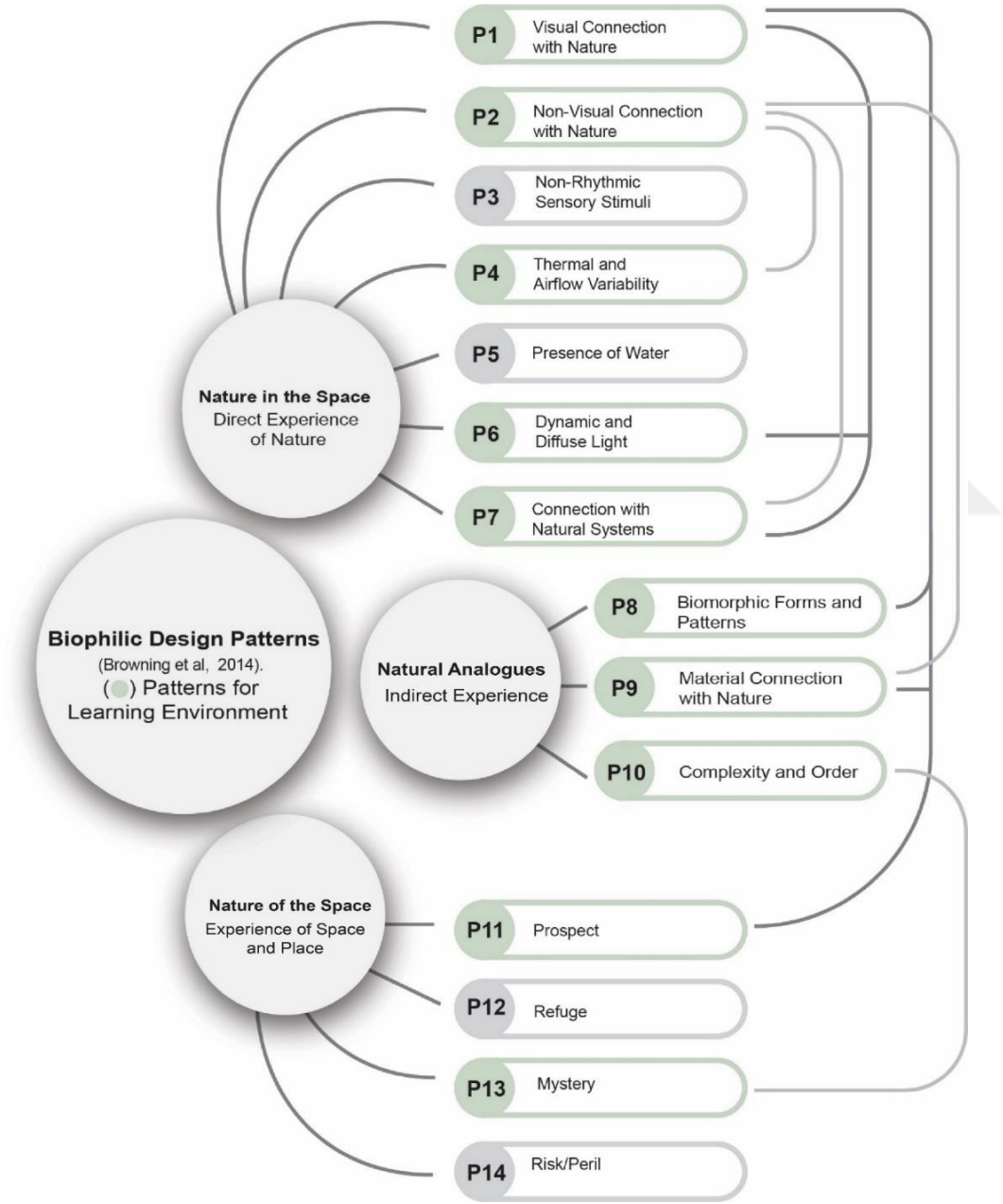


Figure 47: Biophilic Design Patterns (Browning et al, 2014) for Learning Environment (Prepared by the Author).

3. Non-Rhythmic Sensory Stimulus; Temporal and stochastic connections with nature that can be statistically analyzed but cannot be accurately predicted. This pattern was not found to be applicable in the learning environment. Because it is hard to supply this experience in classroom structure.

4. Thermal and Airflow Variability; minute variations in the air's temperature, relative humidity, airflow over the skin, and surface temperatures that resemble those found in natural environments. It is an important pattern needed to ensure the comfort of students and can be applied in the learning environment.

5. Presence of Water; a circumstance that improves the experience of a location by allowing one to see, hear, or touch water. It was found difficult to achieve this pattern in the classroom structure.

6. Dynamic & Diffuse Light; In order to create natural-looking conditions, it makes use of how light and shadow intensities change over time. It was evaluated as applicable in the learning environment.

7. Connection with Natural Systems; understanding of natural processes, particularly the seasonal and temporal changes that define a healthy ecosystem (Figure 48). It was evaluated as applicable in the learning environment. (Browning et al, 2014)

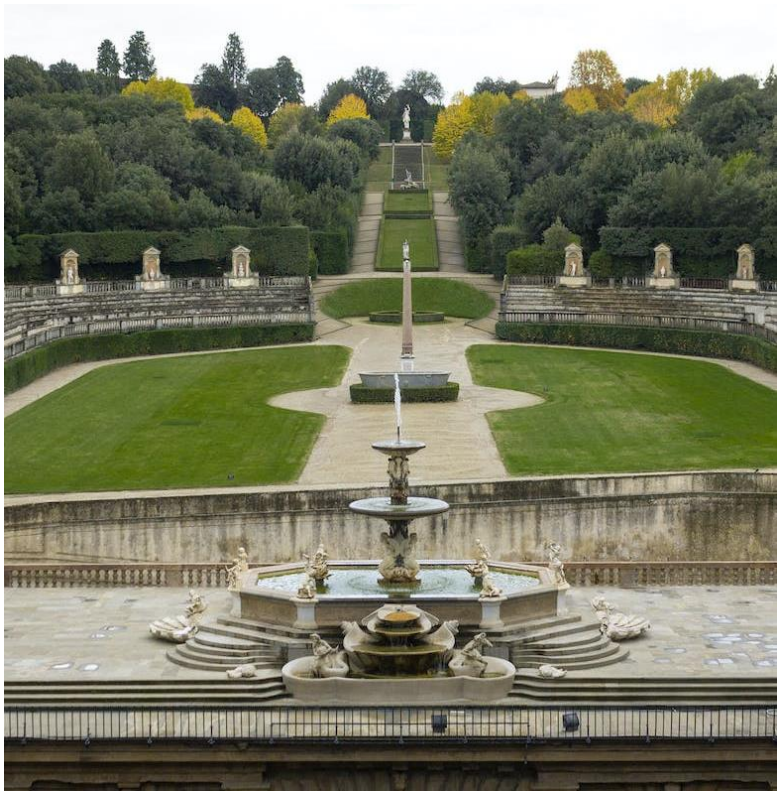


Figure 48: Boboli Garden, Florance/Italy (URL-22)

5.1.2 Natural analogs

Natural Analogs focuses on the organic, inanimate, and oblique meanings of natüre (Figure 49). The built environment includes artwork, ornaments, furniture, decor, and textiles that are made of things, materials, colors, shapes, sequences, and patterns that can be found in nature. The most potent Natural Analog experiences are attained by regularly and occasionally evolving a wealth of information.

There are three biophilic design patterns covered by Natural Analogs:

8. Biomorphic patterns and forms; References that are symbolic to permanent numerical, patterned, or texture arrangements. It was evaluated as applicable in the learning environment.

9. Material Connection with Nature; Minimally processed natural materials and components that, by reflecting regional ecology or geology, create a distinct sense of place. It was evaluated as applicable in the learning environment.

10. Complexity and Order; A spatial hierarchy identical to that found in nature is necessary for the rich sensory information. It was evaluated as applicable in the learning environment.

(Browning et al, 2014)

Figure 49: The Tote / Serie Architects

5.1.3 Nature of space

Nature of Space covers spatial arrangements in the natural world. This encompasses our intrinsic and acquired urge to look past our immediate environment, our fascination with the slightly perilous or unknown, darker views and bright moments, and occasionally even phobia-inducing aspects when they accompany a plausible sense of security. The design of purposeful and engaging spatial configurations combined with the Nature in the Space and Natural Analogs models yields the most potent Nature of the Space experiences.

The four biophilic design patterns covered by Nature of the Space are:

11. Prospect; a clear perspective from a distance for planning and surveillance. It was evaluated as applicable in the learning environment.

12. Refuge; A shelter from the elements or the hub of activity where one can retreat while being shielded from above and behind. It was found difficult to achieve this pattern in the classroom structure.

13. Mystery; the promise of additional knowledge gained through partially concealed visuals or other sensory gadgets that induce a person to explore their surroundings more thoroughly (See Figure 50). It was evaluated as applicable in the learning environment.

14. Risk/Peril; a threat that can be identified and reliable defenses. This pattern was considered inappropriate to implement because the learning environment should make students feel safe and at comfortable. (Browning et al, 2014)

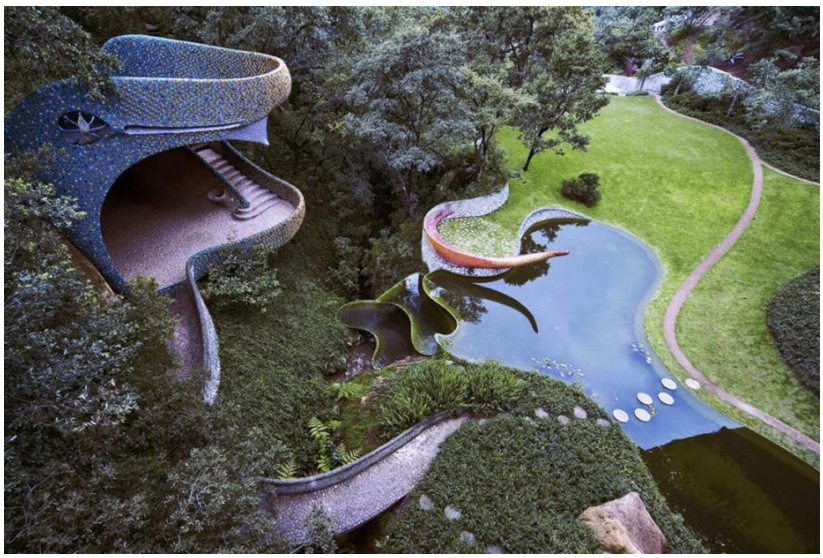


Figure 50: Quetzalcoatl's Nest in Mexico city

5.2 Case Selection Parameters

Within the scope of the field study, one classroom in each of the two schools was examined. The target group is 7–11 years old because it has been hypothesized that exposing primary school students (ages 7–11) to nature will eventually result in long-lasting improvements in their mood and overall well-being (Harvey et al., 2020). The chosen schools for the field study were considered because they embraced principles and architectural designs distinct from Turkey's typical project-based system. Additionally, to establish a direct connection with the garden (green area), classrooms on the ground floor were chosen. Direct access to the garden is available to selected classrooms.

The implementation school affiliated with the Başka Bir Okul Mümkün (BBOM) in Eskişehir project has adopted an education that addresses the philosophy of ecological and sustainable life and has progressed in the design of classrooms to ensure that students establish relationships with nature.

Fide schools are located in Istanbul and were designed by Ddrlp Architecture by adopting a design approach that prioritizes children's interaction with nature and differs from the typical school project system in Turkey. The classrooms examined in both schools are located on the ground floor and there is a door providing direct access to the garden from the classroom.

5.3 Analysis of Classrooms

Firstly, the Uçan Bisiklet Primary School in Eskişehir was examined with their permission within the scope of the field study. The reason why this school is preferred is that it is within the scope of the (BBOM) association and has a structure outside the Turkey typical school-project system. When we examine the classroom, we see a student-centered seating arrangement (Figure 51). While inside the classroom, the entrance and corridor parts of the building, the garden and the playground can be easily observed.

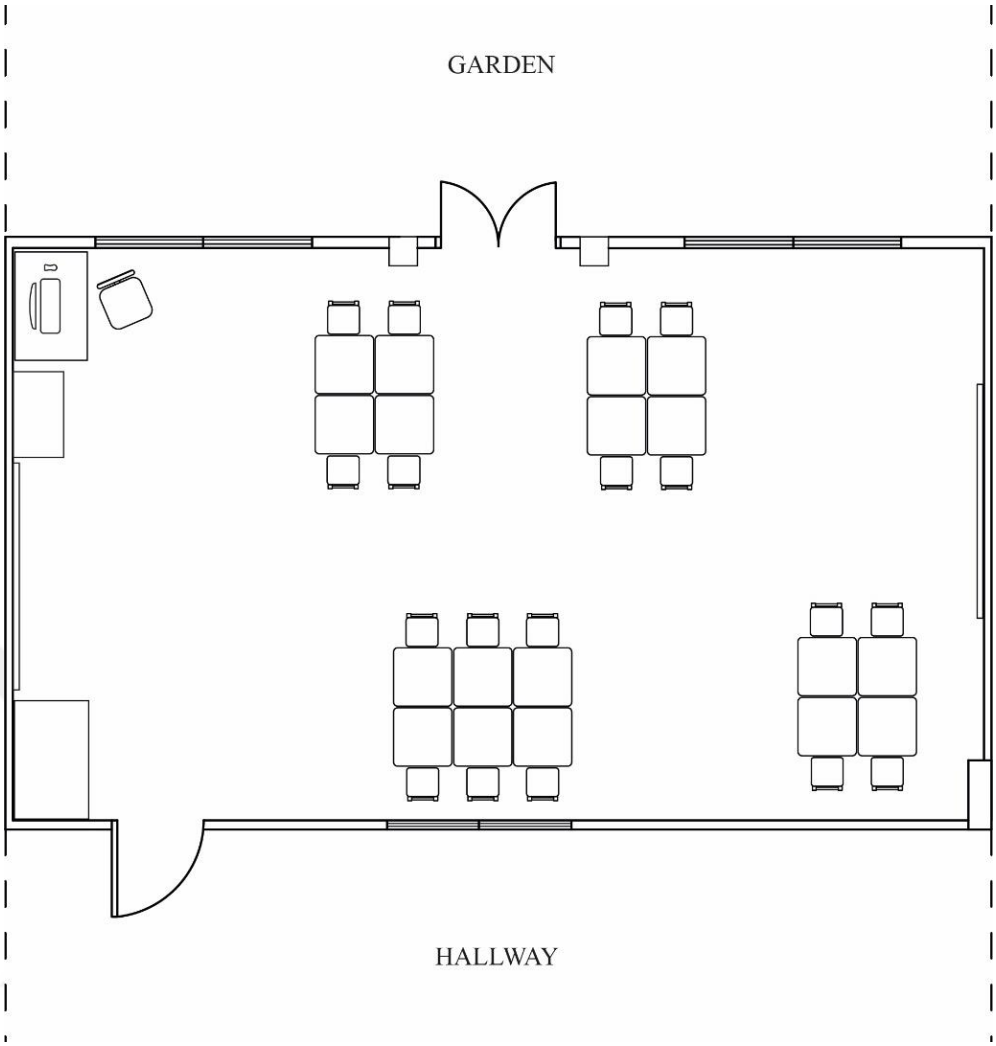


Figure 51: Layout of the Classroom 1, Uçan Bisiklet School (Drawn by the Author).

The School's Mission is to evaluate Nature and its components as "entities" rather than as "resources" offered to the service of humanity and to convey this understanding to students (URL-23). Every Friday, students are taken to the forest and receive practical training there. In the school building and garden arrangement, attention was paid to the use of more natural materials (wood, natural stone, etc.) instead of over-processed artificial materials.

Secondly, Fide schools were preferred as field study. It was designed by Architect Boğaçhan Dündaralp, who works on the architectural design principles of the (BBOM) association. A design other than the current Type project approach was adopted in the school design.

The school was designed within the scope of the transformation project carried out on the land where there is a 2-storey high building made of light steel as a sales office and buildings consisting of single-storey pavilions attached to it, and an approach integrated with nature was applied by creating space arrangements that allow children to realize themselves (URL-23). A teacher-centered classroom order is observed in the classroom design (Figure 52). And there are window and door openings that allow interaction with other areas of the school structure.

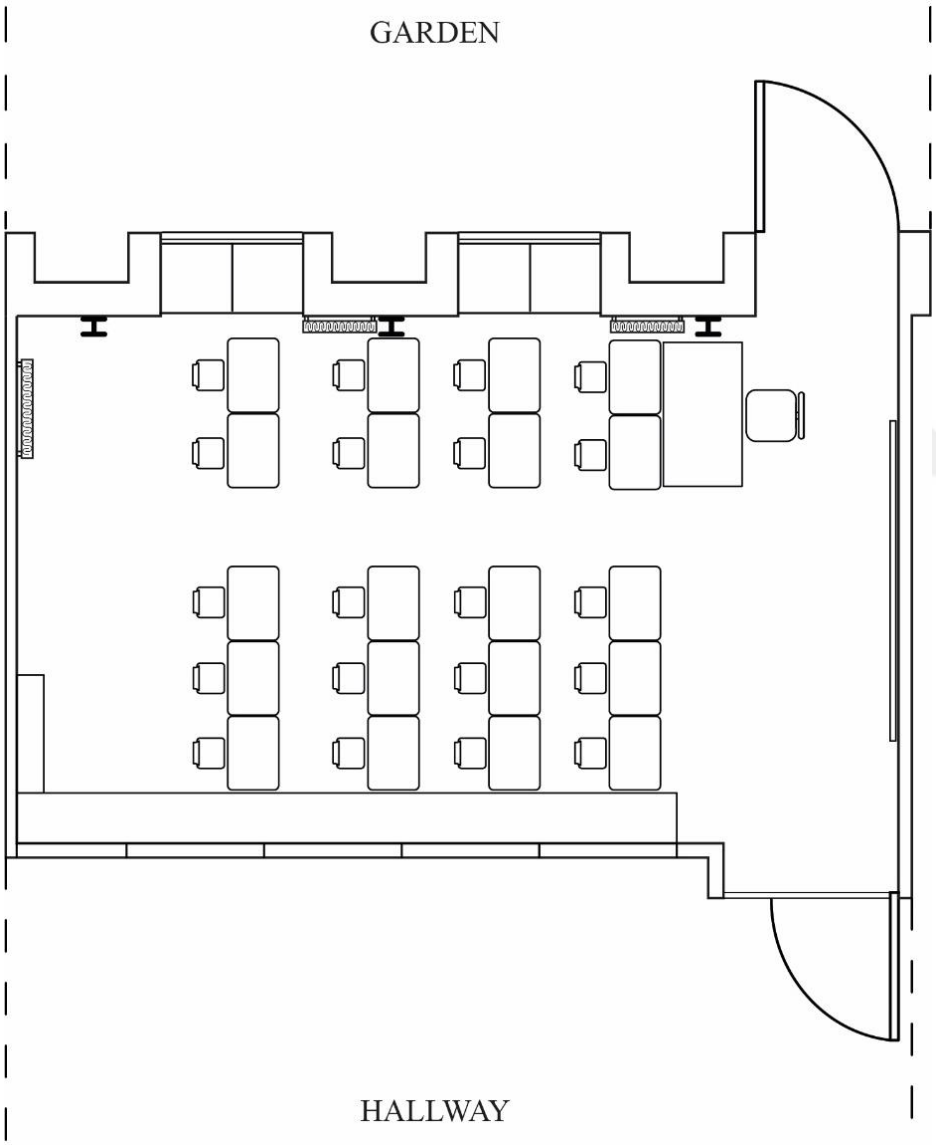


Figure 52: Layout of the Classroom 2, Fide School (Drawn by the Author).

5.4 Findings & Discussion

It has been determined within the scope of the thesis that providing biophilic design parameters in classroom architecture will be an important strategy to improve the relationship between children and nature in the learning environment. Two sample schools selected within the scope of the chosen parameters were examined. Two schools with missions that emphasize the child-nature relationship were chosen for the analysis. As a result of the analysis, although it was determined that most patterns were present in both classroom environments, some patterns were not present, but these patterns were applicable.

Pattern 1 (P1). Visual Connection with Nature was observed in both classrooms. Since the classrooms are located on the ground floor, the outdoors and the garden can be easily seen, and the door opening to the garden provides direct access to the green area. The view observed from the classroom windows is grassy and wooded (See Fig. 53).

Figure 53: Application (Classroom 1 & Classroom 2), (Taken by the author.).

Pattern 2 (P2). Non-Visual Connection with Nature was observed in the first school studied. A tactile experience was provided by choosing natural wood for the desks and the perceptibility of the wooden texture on the surface (See Fig. 54). However, this experience was not encountered in the second school.

Figure 54: Application (Classroom 1), (Taken by the author).

Pattern 4 (P4). It was observed that Thermal & Airflow Variability was achieved thanks to door and window openings to the outdoors in both schools examined (See Fig. 55 & 56). In addition, in the first school examined, fresh air and temperature control were provided in cold weather conditions with the application of the HVAC system.

Figure 55: Application (Classroom 1), (Taken by the author).

Figure 56: Application (Classroom 2), (Taken by the author).

Pattern 6 (P6). It has been observed that Dynamic & Diffuse Light is provided by existing lighting and window openings in both classrooms (See Fig. 57). Since the facade of the first examined classroom is in the north-east direction, it can receive the maximum effect from daylight at certain hours. Since the facade where the second examined classroom is located in the south facade, maximum effect from daylight is provided throughout the day.

Figure 57: Application (Classroom 1 & Classroom 2), (Taken by the author).

Pattern 7 (P7). Although Connection with Natural Systems is a very comprehensive pattern, its simplest and most affordable application is to provide visual access to the existing natural system (Browning, 2014). In this context, the view of the openings to the outdoor space and the view of the natural environment and green area in both schools provided this pattern (See Fig. 58).

Figure 58: Application (Classroom 1 & Classroom 2), (Taken by the author).

Pattern 8 (P8). Biomorphic Forms & Patterns, wooden patterns, and various patterns were applied on the floor, desks, and seating areas in the first class. In the second class, round lines and wooden patterns were preferred in the seating unit (See Fig. 59). In addition, although no natural material was used on the floor, a product with a pattern reminiscent of nature was preferred.

Figure 59: Application (Classroom 1 & Classroom 2), (Taken by the author).

Pattern 9 (P9). Material Connection with Nature: Wooden furniture was preferred in the first class. Although natural wood was not used on the floor and window and door joinery, materials with a wood-like texture were used (See Fig. 60).

Figure 60: Application (Classroom 1), (Taken by the author).

In the second class, although wooden furniture is preferred, wood material is only seen in the seating units (See Fig. 61). As a result, this pattern was achieved by using natural materials in both schools. But it can be improved.

Figure 61: Application (Classroom 2), (Taken by the author).

Pattern 10 (P10) Complexity & Order: Although it is limited to provide this pattern in a classroom environment, it may be possible to experience it with changes in the seating arrangement. If a flexible seating arrangement is provided, this experience can be made physical for students. Additionally, it may be possible to provide this pattern visually with different applications in the learning environment. It can be seen that flexible seating arrangements were used in the first class examined (See Fig. 62).

Figure 62: Application (Classroom 1), (Taken by the author).

Pattern 11 (P11) Prospect: Being able to connect with other parts of the building in the area and providing a wide viewing angle is important in the application of this pattern. In both classrooms examined, there are window openings that provide a visual connection to both the corridor and the garden (See Fig. 63 & 64).

Figure 63: Application (Classroom 1), (Taken by the author).

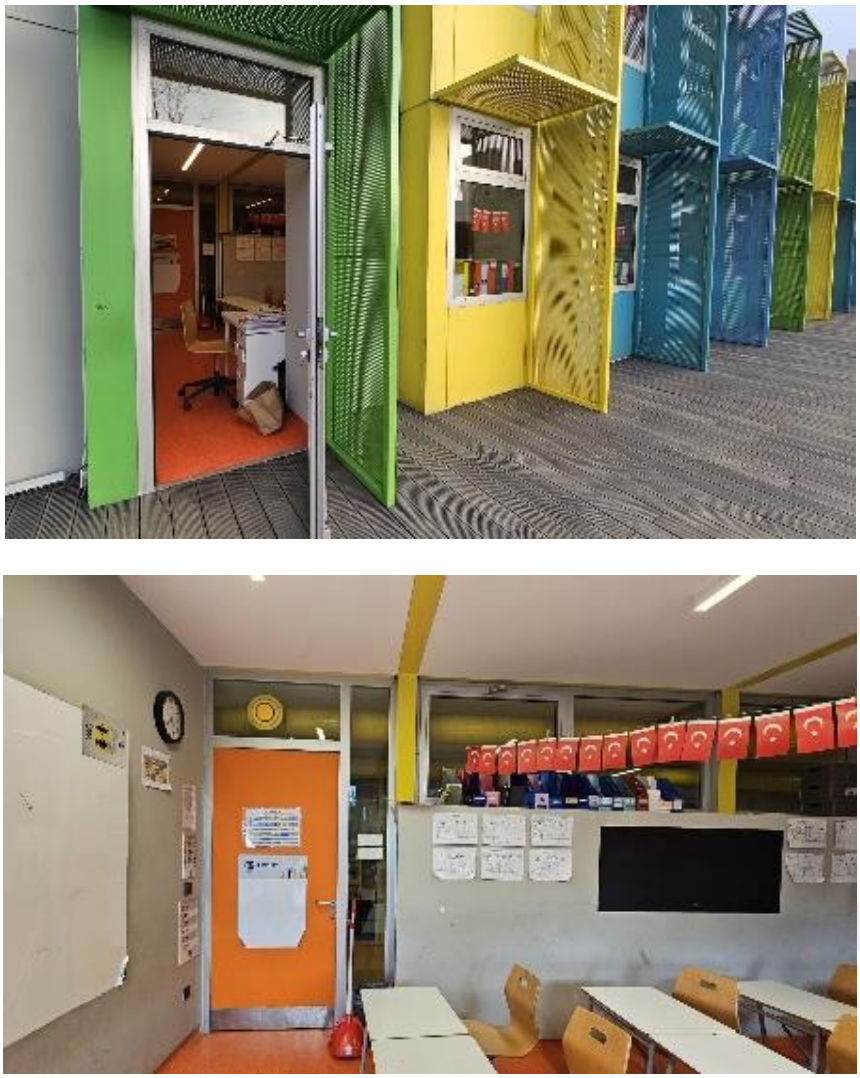


Figure 64: Application (Classroom 2), (Taken by the author).

Pattern 13 (P13). Mystery: Although it is difficult to provide this pattern in a classroom environment, it can be achieved with various design details. No experience or application of this pattern was found in either classroom.

All data for the field study examined through the biophilic design patterns determined within the scope of the learning environment are presented in the Appendix A in the appendices. Applicability and design recommendations are explained in the design guide, using the literature data and field study data obtained for patterns that have not been applied and patterns that have been applied.

5.5 Design Guideline

The components of typical classroom design, have each been separated apart and reconsidered (Figure 65). The extensive literature review and fieldwork conducted for the thesis led to the formulation of the Biophilic Classroom Design Guide, which is displayed in Appendix B.

Initially, the design strategies of biophilic design parameters that can be applied are explained, taking into account the function of each component. A design proposal has been presented within the scope of these strategies. Finally, the benefits of these parameters for well-being are stated.

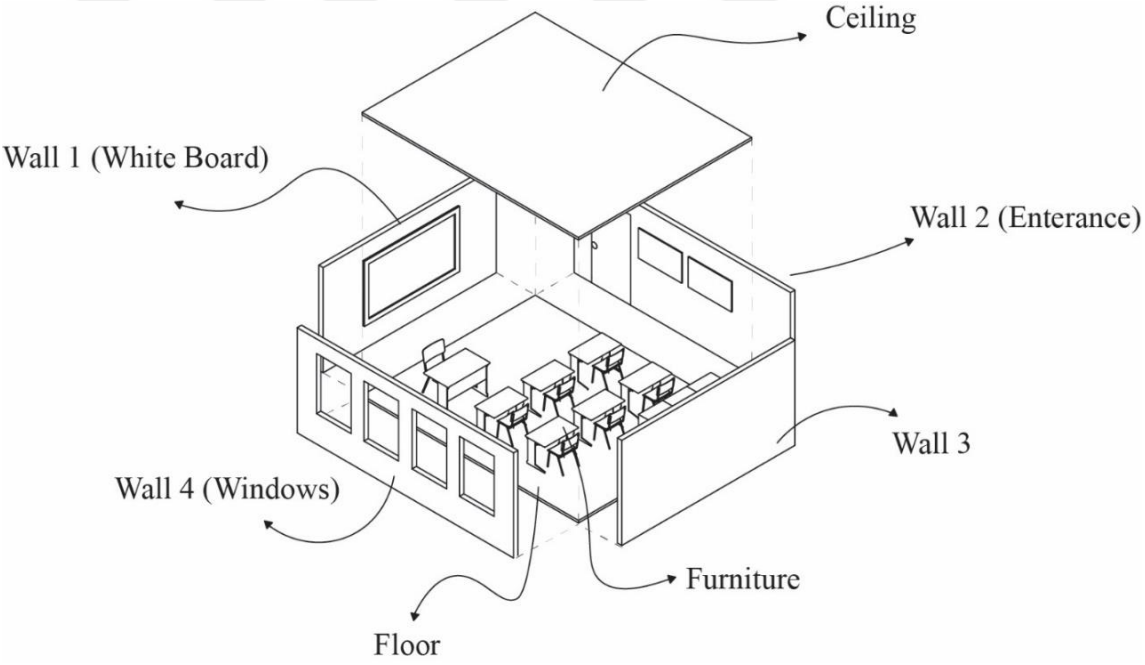


Figure 65: Classroom components was prepared by the author regarding the study of Ekinci (2012).

5.6 Result of the Chapter

A field study was carried out based on the literature review carried out in this chapter. Two classrooms located on the ground floor and with direct access to the garden were chosen to be examined within the scope of the field study. The first school examined is located in Eskişehir. The second school is located in Maltepe, Istanbul. Primary school classes were preferred due to the focused age range. The selection of schools was influenced by the fact that their educational structures were different from existing type projects and their missions included nature-child relationship and ecological approach.

Applications of the determined Biophilic design strategies have been identified in classrooms. Some applications could not be found, but these applications are explained in the design guide. Within the framework of the thesis, a design guide has been provided following the data gathered to demonstrate that it is feasible to take a certain approach that will guarantee the development of child-nature relationships during the design phase of future learning environments.

The next chapter summarizes the theoretical basis of the design guide that was developed by engaging in the conceptual framework that was investigated for the thesis.

6. CONCLUSION

In the presented thesis study, a design guide is provided on the integration of biophilic design in learning environments which highlights the significance of the child-nature relationship and can facilitate the development of the learning activity. The thesis hypothesizes that learning environments that incorporate biophilic design may establish a connection between children and nature. In this context, the structure of the thesis is:

• The concept and process of learning are explained, and the design variations and characteristics of the learning environment in which this process takes place through different learning approaches are examined. The structures of the education process and learning environments in Turkey were examined. Lastly, classroom environments and characteristics of different education systems on a global scale are mentioned.

• The thesis includes the topic of child-nature interaction to comprehend and highlight the significance of nature for children. Investigations have been conducted into the feasibility and significance of ensuring a child's well-being in their learning environment. A review of the literature was done on the studies done in this context to comprehend how interaction with nature affects learning.

• The biophilic design concept, which is a design approach applied to establishing the Building-Nature relationship, is explained. The emergence of this concept, work areas, architectural design practices, and experiences are included. The concepts of child and biophilic design were examined together and the role of biophilic design in child-nature interaction was touched upon.

• Following a comprehensive examination of the literature, two relevant schools were chosen, and a field study was conducted in classroom settings. The field study is based on the Biophilic Design Parameters published by Browning (2014), which describes the applications of Biophilic Design in Interior Architecture. Classroom environments were examined within the scope of these parameters and the results were presented in a table. The thesis concludes with the presentation of a design guide that will facilitate the establishment of child-nature relationships in learning environments.

The built environment has a significant influence on human life. Users' health and well-being can be impacted by the built environment in several ways (Burnard, Kutnar, 2020). This study highlights the need for people to respect and adhere to nature more when building environments.

It is widely accepted that bringing biophilic design into practice in workplaces, medical facilities, educational institutions, and other public areas will benefit everyone on the planet and the global economy (Kellert, 2005; Browning et al., 2014). The goal of the biophilic design concept is to build a space that enhances all ecosystems and ecology by promoting natural lighting, temperature control, and air quality in the built environment (Madison, 2020; Guzzo, et al. 2022).

Due to the effects of intense urbanization, the topic of child-nature relationships has gained importance in psychological and architectural studies (Kellert, 2011). Other than their home, children spend more time in school, and the majority of learning activities take place in a built environment. The physical and cognitive development of a child is greatly influenced by their surroundings; therefore, learning environments should be engaging and provide opportunity for experimentation (Moore, 1987). Wells and Evans (2003) discovered that children who had high levels of interaction with nature were less likely to experience psychological distress after studying 337 kids with an average age of 9.2. This study also found that children who have a high level of exposure to nature are shielded from the negative effects of stress in life (Wells & Evans, 2003). Increasing the relationship with nature in school buildings, which is an important area where children experience stress, will help reduce stress on children and reach a level of well-being.

According to the data collected within the scope of the thesis, the improvement in the level of well-being affects the learning process and academic success in direct proportion. The most effective method to improve the level of well-being is to ensure the nature-human relationship. To ensure this relationship and interaction in the built environment, the application of biophilic design methodology in the design of schools and learning environments has the potential to increase the efficiency of children's learning process.

Biophilic design prioritizes the psychological and emotional aspects of the need to interact with natural elements, whereas green/ecological design approaches in architecture are developed with a physical and material focus (Kayhan, 2017). Spending time in nature helps children's physical and mental development, growth in cognition, and overall health (Sabirah & Shazly, 2017). An ongoing awareness of the need for interaction with nature is ensured in a learning environment developed through biophilic patterns (Barbiero, 2021).

Biophilic design strategies were shown in two classrooms that were investigated in schools that value the connection between children and nature. The consequences of evolving technology and passing time require that the architecture of the learning environment be modified and improved continuously. Children's interactions with nature should be considered in this perspective. As a result of this study, an architectural design guide was created for the learning environment that will support the child-nature relationship. The thesis emphasizes that implementing biophilic design in learning environments could be a useful strategy in school design to develop aware students who can connect with nature and to increase the process of learning activities' physical and mental development.

REFERENCES

Abdelaal, M.S., (2019). Biophilic campus: An emerging planning approach for a sustainable innovation-conducive university. Journal of Cleaner Production 215, 1445–1456..doi:10.1016/j.jcle pro.2019.01.185

Adler, A. (2016). Teaching well-being increases academic performance: Evidence from Bhutan, Mexico, and Peru. (Unpublished doctoral dissertation). University of Pennsylvania.

Allen, E. (2005). How buildings work: the natural order of architecture. Oxford University
Press.

Altbach, P. G., Gumport, P. J., & Berdahl, R. O. (Eds.). (2011). American higher education in the twenty-first century: Social, political, and economic challenges. JHU Press.

Anıktar, S. (2017). Yeni nesil ilkokullarda öğrenme ortamları tasarım destek kılavuzu (Doctoral dissertation).

Arslan, Z. Ç., (2016). Uluslararası Değerlendirme Sistemlerinde Sürdürülebilir Eğitim Yapıları, http://www.ekoyapidergisi.org/107-uluslararasi-degerlendirmesistemlerinde-surdurulebilir-egitim-yapilari.html

Aslan, A. G. D. (2005). Okul öncesi eğitimde Reggio Emilia yaklaşımı. Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 14(1), 75-84.

Aslanapa O.(1989), "Mimar Sinan'ın Medreseleri", Vakıf Haftası Dergisi, Sayı 6: 201-212.

Atchley, R. A., Strayer, D. L., & Atchley, P. (2012). Creativity in the wild: Improving creative reasoning through immersion in natural settings. PloS one, 7(12), e51474.

Aydogan, A., & Cerone, R. (2021). Review of the effects of plants on indoor environments. *Indoor and Built Environment*, *30*(4), 442-460.

Bakır, T., (2016), The role of nature on self-regulatıon and adjustment of children, Master Thesis.

Bakir-Demir, T., Berument, S. K., & Sahin-Acar, B. (2019). The relationship between greenery and self-regulation of children: The mediation role of nature connectedness. Journal of Environmental Psychology, 65, 101327.

Bandura, A., & Walters, R. H. (1977). Social learning theory (Vol. 1). Prentice Hall: Englewood cliffs.

Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. New directions for teaching and learning, 1996(68), 3-12.

Bashir, I., Naseem, A., Sherazi, F., Ghafoor, A., & Malik, A. (2021). Synthesizing Sociocultural and Behaviorist Approaches for Developing Higher Order Thinking Skills. Competitive Education Research Journal, 2(3), 1-12.

Başaran, İ.E. (2005). Eğitim Psikolojisi, 6. Baskı, Nobel Yayınları, Ankara.

Beane, J. A., & Lipka, R. P. (1987). When the Kids Come First: Enhancing Self-Esteem. National Middle School Association, 4807 Evanswood Drive, Columbus, OH 43229-6292.

Browning, W.D., Ryan, C.O., Clancy, J.O. (2014). 14 Patterns of Biophilic Design. New York: Terrapin Bright Green llc.

Chawla, L. (2015). Benefits of nature contact for children. Journal of planning literature, 30(4), 433-452.

Clark, R. E. (2004). The classical origins of Pavlov's conditioning. Integrative Physiological Behavioral Science, 39, 279-294.

Cobban, A. B. (1961). The medieval universities: Their development and organization. New York: Harper.

Corraliza, J. A., Collado, S., Bethelmy, L. (2012). Nature as a moderator of stress in urban children. Procedia-Social and Behavioral Sciences, 38, 253-263.

Crace, John. 2006. "Children Are Less Able Than They Used to Be." Guardian, January 24.

Crisp, R. (Ed.). (2014). Aristotle: Nicomachean Ethics. Cambridge University Press.

Dadvand, P., Nieuwenhuijsen, M. J., Esnaola, M., Forns, J., Basagaña, X., Alvarez-Pedrerol, M., & Sunyer, J. (2015). Green spaces and cognitive development in primary schoolchildren. Proceedings of the National Academy of Sciences, 112(26), 7937-7942.

Dahlberg, G., Moss, P., & Pence, A. (1999). Beyond Quality in Early Childhood Education and Care: Languages of Evaluation. New York, NY: Falmer Press.

Davis, T. R., & Luthans, F. (1980). A social learning approach to organizational behavior. Academy of Management review, 5(2), 281-290.

De Houwer, J., Barnes-Holmes, D., & Moors, A. (2013). What is learning? On the nature and merits of a functional definition of learning. Psychonomic bulletin & review, 20(4), 631-642.

Demir, H. (2017) The Establishment Process of the Ottoman First Period Madrasas and the Teaching of Arabic Language. Bartın University Journal of Faculty of Education, 6(2), 614-622.

Demirel, F. (2012). Osmanlı eğitim sisteminin modernleşmesi sürecinde hiyerarşi. Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 25(2), 507-530.

Diener, E., Oishi, S., & Tay, L. (2018). Advances in subjective well-being research. Nature Human Behaviour, 2(4), 253-260.

Downton, P., Jones, D., Zeunert, J., & Roös, P. (2017). Biophilic design applications: Putting theory and patterns into built environment practice. KnE Engineering, 59-65.

Dreyer, A. S., & Rigler, D. (1969). Cognitive performance in Montessori and nursery school children. The Journal of Educational Research, 62(9), 411-416.

Driver, R., & Oldham, V. (1986). A constructivist approach to curriculum development in science.

Duchesne, S. & McMaugh, A. (2018). Educational psychology for learning and teaching. Cengage AU.

Dündaralp Boğaçhan, (2014), 'Başka Bir Okul Mümkün' e inanmak... Publisher: Ege Mimarlık.

Edwards, C. P. (2002). Three approaches from Europe: Waldorf, Montessori, and Reggio Emilia. Early childhood research & practice, 4(1), n1.

Edwards, C. P., & Gandini, L. (2018). The Reggio Emilia approach to early childhood education. In Handbook of international perspectives on early childhood education (pp.365-378). Routledge.

Epstein, J. L. (2018). School, family, and community partnerships: Preparing educators and improving schools. Routledge.

Evmenova, A. (2018). Preparing teachers to use universal design for learning to support diverse learners. Journal of Online Learning Research, 4(2), 147-171.

Faber Taylor, A. , A. Wiley, F. Kuo, and W. Sullivan. 1998. "Growing Up in the Inner City:Green Spaces as Places to Grow." Environment and Behavior 30:3–27.

Faroqhi, S. (2004). The Ottoman Empire and the world around it. Bloomsbury Publishing.

Fromm E (1964) The heart of man. Harper and Row, New York, USA

Furat, A. (2003). Eğitim-mimari ilişkisi açısından kuruluş dönemi Osmanlı medreseleri. Journal of Istanbul University Faculty of Theology, (8).

Gardner, H., & Hatch, T. (1989). Multiple Intelligences Go to School: Educational Implications of the Theory of Multiple Intelligences. *Educational Researcher*, *18*(8), 4-10.

Ghaziani, R., Lemon, M., & Atmodiwirjo, P. (2021). Biophilic design patterns for primary schools. Sustainability, 13(21), 12207.

Ghaziani, R., Lemon, M., & Atmodiwirjo, P. (2021). Biophilic design patterns for primary schools. Sustainability, 13(21), 12207.

Grendler, P. F. (2003). Renaissance humanism, schools, and universities. In L'étude de larenaissance nunc et cras: Actes du colloque de la Fédération internationale des sociétés etinstituts de la Renaissance. FISIER.

Guzzo, R. F., Suess, C., & Legendre, T. S. (2022). Biophilic design for urban hotels–prospective hospitality employees' perspectives. International Journal of Contemporary Hospitality Management, 34(8), 2914-2933.

Gülbahar, G. (2006). Cumhuriyet dönemi (1920-1950) Türk eğitim sisteminin felsefi temelleri (Master thesis, Kırıkkale Üniversitesi).

Gündüz M., Demirkıran A. M., Yılmaz A., Ergün M., Öztürk C., (2019), Eğitim Tarihi, Anadolu University Publications No: 3087

Harris, F. (2018). Outdoor learning spaces: The case of forest school. Area, 50(2), 222-231.

Harvey, D. J., Montgomery, L. N., Harvey, H., Hall, F., Gange, A. C., Watling, D. (2020). Psychological benefits of a biodiversity-focussed outdoor learning program for primary school children. Journal of Environmental Psychology, 67, 101381.

Hein, G. E. (1991). Constructivist learning theory. Institute for Inquiry. Available at:/http://www.exploratorium.edu/ifi/resources/constructivistlearning. htmlS.

Hewett, V. M. (2001). Examining the Reggio Emilia approach to early childhood education. Early childhood education journal, 29(2), 95-100.

Hildebrand, G. (2000). The Origins of Architectural Pleasure. Berkeley: University of California Press.

Hirtle, J. S. P. (1996). Social constructivism. English Journal, 85(1), 91.

Hohmann, M., & Weikart, D. P. (1995). Educating Young Children: Active Learning Practices for Preschool and Child Care Programs. Ypsilanti, MI: High/Scope Press. https://doi.org/10.1016/j.foar.2021.07.006

Huchingson, R., & Huchingson, J. (1993). Waldorf education as a program for gifted students. Journal for the Education of the Gifted, 16(4), 400-419.

Huitt, W. (2011). Bloom et al., taxonomy of the cognitive domain. Educational psychology interactive, 22, 1-4.

Hutchinson, L. (2003). Educational environment. Bmj, 326(7393), 810-812.

Incebacak E., (2019), The effect of İzmir Economic Congress decisions on the Turkish education system in the modernization process of Turkish education (Master Thesis)

James, W. (1962). Psychology: The briefer course. New York: Collier Books. (Original work published 1892)

Kahn Jr, P. H., & Kellert, S. R. (Eds.). (2002). Children and nature: Psychological, sociocultural, and evolutionary investigations. MIT press.

Kalina, C., & Powell, K. C. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. Education, 130(2), 241-250.

Kaplan, R., & Kaplan, S. (1989). The experience of nature: A psychological perspective. Cambridge university press.

Kaya, M., & Erdem, C. (2021). Students' well-being and academic achievement: A meta-analysis study. Child Indicators Research, 14(5), 1743-1767.

Kayhan, K. S. (2017). Examination of Biophilia Phenomenon in the context of sustainable architecture. International Sustainable Buildings Symposium (pp. 80-101).

Kayıhan, K. S., (2006). Examination and proposal of a sustainable architecture design method of primary schools in half-humid Marmara climate. Ph.D. Thesis, YTU Institute of Science and Technology, Istanbul.

Kayili, G., & Ari, R. (2011). Examination of the Effects of the Montessori Method on Preschool Children Readiness to Primary Education. Educational Sciences: Theory and Practice, 11(4), 2104-2109.

Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. Children and nature: Psychological, sociocultural, and evolutionary investigations, 117151.

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

Kellert, S., Calabrese, E. (2015). The practice of biophilic design. London: Terrapin Bright LLC, 3, 21-46. Kilmer and Kilmer, Designing Interiors (Fort Worth, Harcourt Brace Jovanovich College Pub. 1992) p. 144.

King-Sears, M. (2009). Universal design for learning: Technology and pedagogy. Learning Disability Quarterly, 32(4), 199-201.

Köse, Ç., & Barkul, Ö. (2012). İlköğretim Yapılarında Tip Proje Uygulama Sorunları Üzerine Bir İnceleme. Megaron, 7(2).

Kritchevsky, S., Prescott, E., & Walling, L. (1969). Physical space: Planning environments for young children. Washington, DC: NAEYC.

Kuo, F. E., & Faber Taylor, A. (2004). A potential natural treatment for attention-deficit/hyperactivity disorder: evidence from a national study. American journal of public health, 94(9), 1580-1586.

Kuşci, A. (2021) Turkish education history (1923-1950), (Doctoral dissertation).
Land, S., Jonassen, D. (2012). Theoretical foundations of learning environments. Routledge.

Lasry, N., Charles, E., & Whittaker, C. (2014). When teacher-centered instructors are assigned to student-centered classrooms. Physical Review Special Topics-Physics Education Research, 10(1), 010116.

Lee, H. C., & Park, S. J. (2018). Assessment of importance and characteristics of biophilic design patterns in a children's library. Sustainability, 10(4), 987.

Levi, D., & Kocher, S. (1999). Virtual nature: The future effects of information technology on our relationship to nature. *Environment and behavior*, *31*(2), 203-226.

Maslow, A.H. (1943). "A theory of human motivation". Psychological Review. 50 (4): 370– 96

McNally, S. A., & Slutsky, R. (2017). Key elements of the Reggio Emilia approach and how they are interconnected to create the highly regarded system of early childhood education. Early Child Development and Care, 187(12), 1925-1937.

McNeely, C., & Blanchard, J. (2010). The teen years explained: A guide to healthy adolescent development. Jayne Blanchard.

Merriam, S. B. (2007). Non-Western perspectives on learning and knowing.

Ministry of National Education, (2015), Educational Buildings Minimum Design Standards
Guide,http://erbaa.meb.gov.tr/meb_iys_dosyalar/2016_12/06090414_2015_egitim_yapilari__asgari_tasarim_standartlari___klavuzu.pdf

Miralinikkhou Anoushehsadat, (2021). Impacts of Nature-Deficıt Dısorder in Cities and Educatıonal Facilities Planning. Phd Thesis, Istanbul.

Moore, G. T. (1987). The physical environment and cognitive development in child-care centers. Spaces for children: The built environment and child development, 41-72.

Moore, R. C. (1977). Environmental design of children nature relations: some strands of applicative theory. USDA For Serv Gen Tech Rep NE US Northeast For Exp Stn.

Nagel, D. (2013). Report: The 4 pillars of the fl ipped classroom. Campus Technology. http://campustechnology.com/articles/2013/06/18/report-the-4-pillars-of-the-flipped-classroom.

Nagel, M., & Scholes, L. (2016). Understanding Development and Learning Implications for Teaching. Oxford University Press.

Nelson, M. M., & Schunn, C. D. (2009). The nature of feedback: How different types of peer feedback affect writing performance. Instructional science, 37, 375-401.

Nevzati, F., Demirbaş, O. O., & Hasırcı, D. (2021). Biophilic Interior Design: A Case Study On The Relation Between Water Elements And Well-Being Of The Users İn An Educational Building. Sanat Ve Tasarım Dergisi, 11(2), 450-467.

Nicholson, D. W. (2000). Layers of experience: Forms of representation in a Waldorf school classroom. Journal of curriculum studies, 32(4), 575-587.

Nicol, J. (2010). Bringing the Steiner Waldorf approach to your early years practice. Routledge.

Organisation for Economic Co-operation and Development (OECD). (2010). Education at a glance 2010: OECD indicators. Paris: OECD.

Ortaylı, İ. (2005). İmparatorluğun En Uzun Yüzyılı. İstanbul: İletişim Yayınları.

Özerem, A., & Kavas, R. (2013). Montessori approach in pre-school education and its effects. The Online Journal of New Horizons in Education, 3(3), 12-25.

Özveren, A. (2008). Osmanlı İmparatorluğundan Cumhuriyete Eğitim Sistemimize Tarihin Penceresinden Bir Bakış. Toplum ve Demokrasi Dergisi, 2(3), 225-236.

Park, E. L., &; Choi, B. K. (2014). Transformation of classroom spaces: Traditional versus active learning classroom in colleges. Higher Education, 68, 749-771.

Pauw, J. B. D., & Petegem, P. V. (2013). The effect of eco-schools on children's environmental values and behaviour. Journal of Biological Education, 47(2), 96-103.

Peters, T., & D'Penna, K. (2020). Biophilic design for restorative university learning environments: A critical review of literature and design recommendations. Sustainability, 12(17), 7064.

Phan, H. P., Ngu, B. H., & Alrashidi, O. (2016). Role of student well-being: A study using structural equation modeling. Psychological Reports, 119(1), 77–105

Piaget, J. (1977). The development of thought: Equilibration of cognitive structures.(Trans A. Rosin). Viking.

Rao, R. (2014). Biomimicry in architecture. International Journal of Advanced Research in Civil, Structural, Environmental and Infrastructure Engineering and Developing, 1(3), 101-107.

Rathunde, K. (2001). Montessori schools, adolescent development, and the measurement of quality. NAMTA Journal, 26(1), 1-17

Robinson, C. W., & Zajicek, J. M. (2005). Growing minds: The effects of a one-year school garden program on six constructs of life skills of elementary school children. *HortTechnology*, *15*(3), 453-457.

Robinson, L. and T. Robinson (2009), An Australian Approach to School Design, CELE Exchange, Centre for Effective Learning Environments, No. 2009/03, OECD Publishing, Paris, https://doi.org/10.1787/224575265838.

Rouse, K. A. G. (2004). Beyond Maslow Hierarchy of Needs: What Do People Strive For? Performance Improvement, 43(10), 27.

Russo, A., & Andreucci, M. B. (2023). Raising Healthy Children: Promoting the Multiple Benefits of Green Open Spaces through Biophilic Design. Sustainability, 15(3), 1982.

Sabirah Adams & Shazly Savahl (2017) Nature as children space: A systematic review, The Journal of Environmental Education, 48:5, 291-321, DOI: 10.1080/00958964.2017.1366160

Salingaros, N. A. 2006. A Theory of Architecture. Solingen, Germany: Umbau-Verlag.

Sasson, I., Yehuda, I., Miedijensky, S. (2022). Innovative learning spaces: class management and universal design for learning. Learning Environments Research, 25(3), 725-739.

Schäffer, S. D., &; Kistemann, T. (2012). German forest kindergartens: Healthy childcare under the leafy canopy. Children Youth and Environments, 22(1), 270-279.

Schieren, J. (2012). The concept of learning in Waldorf education. RoSE–Research on Steiner Education, 3(1).

Schmitt-Stegmann, A. (1997). Child Development and Curriculum in Waldorf Education.

Schonert-Reichl, K. A., Oberle, E., Lawlor, M. S., Abbott, D., Thomson, K., Oberlander, T.F., Diamond, A. (2015). Enhancing cognitive and social–emotional development through a simple-to-administer mindfulness-based school program for elementary school children: A randomized controlled trial. Developmental psychology, 51(1), 52.

Schroeder-Yu, G. (2008). Documentation: Ideas and applications from the Reggio Emilia approach. Teaching artist journal, 6(2), 126-134.

Shaw, S. J., Shaw, E. K. (1976). History of the Ottoman Empire and Modern Turkey:Volume 1, Empire of the Gazis: The Rise and Decline of the Ottoman Empire 1280-1808 (Vol. 1). Cambridge University Press.

Skinner, B. F. (1954). The science of learning and the art of teaching. Cambridge, Mass, USA, 99, 113.

Skinner, B. F. (1965). Science and human behavior (No. 92904). Simon and Schuster.

Snowman, J., &; McCown, R. (2014). Psychology applied to teaching. Cengage Learning.

Söderlund, J. (2019). The emergence of Biophilic design.

Söderström, M., Boldemann, C., Sahlin, U., Mårtensson, F., Raustorp, A., & Blennow, M. (2013). The quality of the outdoor environment influences childrens health–across-sectional study of preschools. Acta paediatrica, 102(1), 83-91.

Steffe, L. P., & Gale, J. E. (Eds.). (1995). *Constructivism in education*. Psychology Press.

Sünbül, A.M., (2014). Öğretim İlke ve Yöntemleri, 6. Baskı, Eğitim Yayınları, İstanbul.

Taşçı, B. G., (2014). Analyzing the children-architecture studies and a built environment education program for primary schools (for social studies curriculum), Phd Thesis.

Taylor, A. F., Kuo, F. E. (2006). Is contact with nature important for healthy child development? State of the evidence.

Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2001). Coping with ADD: The surprising connection to green play settings. *Environment and behavior*, *33*(1), 54-77.

Tekin, B. H. (2018). İstanbul'daki Mimar Sinan Eseri Yeniden İşlevlendirilmiş Medreselerin Yeni İşlev Gereği Değişen Mimari Özellikleri. El-Cezeri, 5(2), 331-345.

Terrapin Bright Green. (2012), The Economics of Biophilia. Available online:http://www.terrapinbrightgreen.com/wp-content/uploads/2012/06/The Economics-of-Biophilia_Terrapin-Bright-Green-2012.pdf

Terzioglu, E., (2005). Evaluation of Primary School Buildings in terms of Physical Properties, Doctoral Thesis, Hacettepe University, Institute of Social Sciences, Ankara.

Thompson, J. E., & Thompson, R. A. (2007). Natural connections: Children, nature, and social-emotional development. EXCHANGE-EXCHANGE PRESS-, 178, 46.

Thornton, L., & Brunton, P. (2015). Understanding the Reggio approach: Early years education in practice. Routledge. to Health, Well-being, and Sustainability: A Critical Review. Frontiers of Architectural Research, 11(1), 114-141.

Tsunetsugu, Y., Miyazaki, Y. & Sato, H. (2007), Physiological effects in humans induced by the visual stimulation of room interiors with different wood quantities. J Wood Sci 53, 11–16. https://doi.org/10.1007/s10086-006-0812-5

Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. In Behavior and the natural environment (pp. 85-125). Boston, MA: Springer US.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. science, 224(4647), 420-421.

Unat F.R., 1964. Türk Eğitim Sisteminin Gelişmesine Tarihî Bir Bakış, Ankara.

URL-1 <https://www.gmws.org/

URL-2<https://www.archdaily.com/944063/improving-the-educational-environment-with-the-reggio-emilia-approach?ad_medium=gallery

URL-3 <https://www.archdaily.com/930510/how-to-stimulate-childrens-autonomy-through-architecture-and-the-montessori-method?ad_medium=gallery

URL-4 <https://icampus.mit.edu/projects/teal/

URL-5 <https://hart.amsterdam/collectie/object/amcollect/37986

URL-6 <https://www.kulturportali.gov.tr/portal/tarihin-taniklari-medreseler

URL-7
<https://web.archive.org/web/20210818104602/https://www.yenicaggazetesi.com.tr/yil-1937-turkiyede-bir-ilkokul-276218h.htm

URL-8 <https://libdigitalcollections.ku.edu.tr/digital/collection/AEFA/id/582/

URL-9 <https://naturalpod.com/why-outside-learning-is-a-great-option-even-beyond-covid/uffculme-open-air-school-birmingham-great-britain-classroom/

URL-10 <https://www.messynessychic.com/2016/03/15/classrooms-without-walls-a-forgotten-age-of-open-air-schools/

URL-11 <https://www.cypnow.co.uk/blogs/article/the-benefits-of-forest-schools-for-child-development

URL-12 <Göbekli Tepe - Wikipedia

URL-13 <https://parisianmoments.com/blog-1/2018/hotel-de-soubise

URL – 14 <https://www.archdaily.com/946764/architecture-making-depends-on-good-communication-interview-with-tong-ming?ad_medium=gallery

URL-15 <https://www.archdaily.com/1002238/terra-office-mandviwala-qutub-and-associates?ad_source=search&ad_medium=projects_tab

URL-16 <https://www.archdaily.com/974790/the-biophilic-response-to-wood-can-it-promote-the-wellbeing-of-building-occupants?ad_medium=gallery

URL-17 <https://www.archdaily.com/986471/new-library-magdalene-college-niall-mclaughlin-architects?ad_medium=gallery

URL-18 <https://www.architecturaldigest.com/story/santiago-calatrava-tells-us-process-designing-wtc-transportation-hub

URL-19 <https://www.treehugger.com/amazing-fractals-found-in-nature-4868776

URL-20 <https://inhabitat.com/recyclable-3d-printed-home-is-unveiled-to-the-public/

URL-21 <https://baynature.org/article/bringing-back-kelp/

URL-22 <https://www.uffizi.it/en/boboli-garden/architecture-and-landscape-boboli-gardens

URL-23 < https://ddrlp.com/2020-04fide-okullari-sureyyapasa-kampusu-bi-ozet-2/

URL-24 < https://bogachandundaralp.wordpress.com/tag/baska-bir-okul-mumkun/

Uygur S., Uygur Ö., (2015) İstanbul'da 44 Okul, Yapı Magazine.

Ülgen A.S. (1944), "Üsküdar Mihrimah Sultan Medresesi Plan Ve Kesit Çizimleri - Plan And Section Of Mihrimah Sultan Madrasah İn Üsküdar",Salt Galata Arşivi, İstanbul.

Ward, J. S., Duncan, J. S., Jarden, A., Stewart, T. (2016). The impact of children exposure to greenspace on physical activity, cognitive development, emotional wellbeing, and ability to appraise risk. Health Place, 40, 44-50.

Watson, J. B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of experimental psychology*, *3*(1), 1.

Weinstein, C. S. (1981). Classroom design as an external condition for learning. Educational

Wilson EO (1993) Biophilia and the conservation ethic. In: Kellert SR, Wilson EO (eds) The biophilia hypothesis. Island Press, Washington, DC

World Health Organization. (1978). Declaration of alma-ata (No. WHO/EURO: 1978-3938-43697-61471). World Health Organization. Regional Office for Europe.

World Health Organization. (2004). Promoting mental health: Concepts, emerging evidence, practice: Summary report. World Health Organization.

Wright, P. (2009). Holistic Philosophy and Classroom Practice: An Investigative Study of the Steiner-Waldorf Approach to Teaching Geography (Doctoral dissertation, University of Bristol).

Yaşar Ekici, F. (2015). Comparison of child-centered approaches applied in pre-school education in terms of theoretical basis, educational environment and the role of the teacher. Journal of Academic Social Research/The Journal of Academic Social Science.

Yelkenci Ö. F. (2023), Eğitimde Modernleşme Süreci: Türk Eğitim Reformu, Eğitim Bilimleri Alanında Uluslararası Araştırmalar isimli kitapta yayımlanan bölüm (Eğitim), Platanus Publishing, Ankara.

Zhong, W., Schröder, T. W. A., & Bekkering, J. D. (2022). Biophilic Design in Architecture and Its Contributions

Zhong, W., Schröder, T., Bekkering, J. (2022). Biophilic design in architecture and its contributions to health, well-being, and sustainability: A critical review. Frontiers of Architectural Research, 11(1), 114-141.

APPENDICES

APPENDIX A: Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014).

APPENDIX B: Biophilic Classroom Design Guideline (prepared by the author).

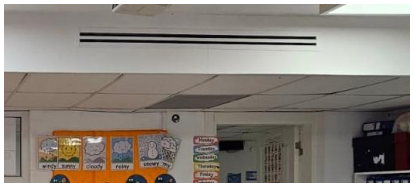
APPENDIX A: Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE IN THE SPACE (Direct Experience)	P 1. Visual Connection with Nature: A view on natural phenomena, living things, and natural processes (natural or artificial).	An environment that has a strong visual connection to nature feels complete, grabs attention, and can be either peaceful or stimulating. It can give insight into the flow of time, weather, and other living things.	Windows and door that connect with the outdoor and green space 	Windows and door that connect with the outdoor and green space 

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE IN THE SPACE (Direct Experienc)	P2. Non-Visual Connection with Nature Olfactory, auditory, tactile, or gustatory stimuli that create a deliberate and positive reference to nature, living systems, or natural processes.	A space with a good Non-Visual Connection to Nature feels fresh and balanced; The environment is familiar and comfortable; The sounds, aromas and textures should be reminiscent of being outdoors in nature.	Natural wood desk, tactile connection 	No experience of " Non-Visual Connection to Nature " in this classroom.

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE IN THE SPACE (Direct Experience)	P4. Thermal and Airflow Variability, Slight changes in air temperature, and relative humidity, mimicking natural environments.	Incorporating airflow and thermal conditions into interior design; Daylight, mechanical ventilation, and/or windows will help distribute variability across space and time.	Openable windows and doors & ventilation system.  	Openable windows and doors & heating system.  

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE IN THE SPACE (Direct Experience)	P6. Dynamic & Diffuse Light: It refers to the conditions occurring in nature by using the intensity of light and shadow that changes over time.	Ensuring that sunlight enters the interior in a controlled manner and lighting design appropriate to the conditions.	Window and ceiling lighting 	Window and ceiling lighting 

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE IN THE SPACE (Direct Experience)	P7. Connection with Natural Systems : An understanding of natural processes, particularly those related to seasonal and temporal fluctuations that characterize a thriving ecosystem.	Providing exposure to natural systems, enabling interactive experiences, such as gardening	Provided view into natural systems by using windows and location of the classroom. 	Provided view into natural systems by using Windows & Door and location of the classroom. 

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURAL ANALOGUES (Indirect Experience)	P8. Biomorphic forms and patterns: refer to the curved, patterned, textured, or numerical configurations that are found in nature on a symbolic level.	Use on two or three layers or dimensions (e.g., furniture windows and soffits; floor, wall, and plane) to increase exposure variety and frequency.	Using patterns in seating areas 	Using patterns in seating areas & floor 

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURAL ANALOGUES (Indirect Experience)	P9. Material Connection with Nature Natural materials and components that, with minimal processing, capture the essence of the surrounding geology or ecology and provide a unique sense of location.	Using organic materials like wood, bamboo, rock, clay, etc., earthy colors and light.	Use of wooden surfaces on floors and furniture.  	Use of wooden surfaces on furniture. 

APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURAL ANALOGUES (Indirect Experience)	P10. Complexity & Order: A space feels engaging and information-rich, an interesting balance between boring and overwhelming.	Allowing modifiable variations of the regular layout by generating different patterns / fractiles.	Seating arrangement 	No experience of " Complexity & Order" in this classroom.

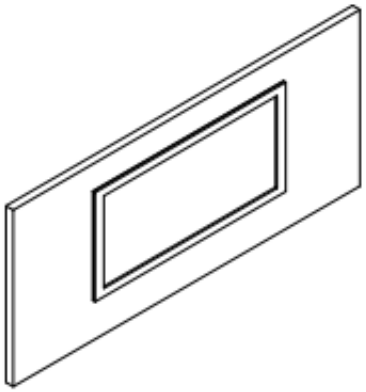
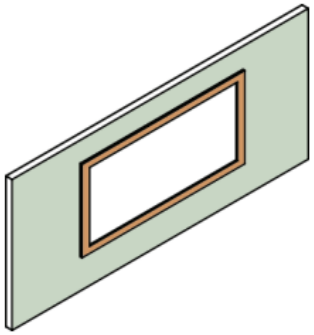
APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE OF THE SPACE (Experience of Space and Place)	P11. Prospect A clear view over a distance for surveillance and planning.	A space that feels open and free, but especially when alone or in unfamiliar environments, gives a sense of security and control.	Window opening between corridor and classroom and easily visible garden.  	Window opening between corridor and classroom and easily visible garden.  

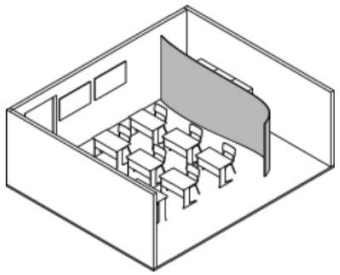
APPENDIX A (continued) : Field Study Results (Aydogan and Cerone, 2021; Abdelaal, 2019; Browning et al., 2014), (prepared by the author).

Pattern Category	Pattertn (P)	Design Considerations	Application (Classroom 1)	Application (Classroom 2)
NATURE OF THE SPACE (Experience of Space and Place)	P13. Mystery Through partially obscured views or other sensory devices that entice the person to go deeper into the environment, mystery is the promise of more information.	Using bending routes, translucent materials, indiscernible sound sources, curved or obscured edges, etc. to create a sense of "mystery."	No experience of "mystery" in this classroom.	No experience of "mystery" in this classroom.

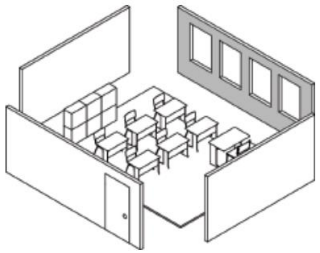
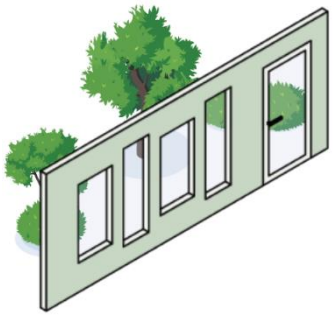
APPENDIX B: Biophilic Classroom Design Guideline (prepared by the author).

Component	Design Strategies	Design Examples	Benefits to Wellbeing
 **Wall 1**	Pattern Group: Natural Analogues (Indirect Experience) P9. Material Connection with Nature The use of natural materials related to the location where the building is located, in a minimally processed form. • Use organic materials like wood, bamboo, rock, clay, etc. • Make use of earthy color combinations like blue, green, and other natural colors. • Think about textures in addition to materials, like color and light. (Kellert, 2018; Browning et al, 2014; Tsunetsugu et al., 2007)	PANTONE Sage Green  Paint application in green tones with health-friendly content.	The natural color palette, especially green, has a positive effect on cognitive performance and creativity (Browning et al, 2014).

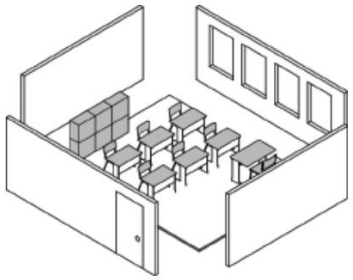
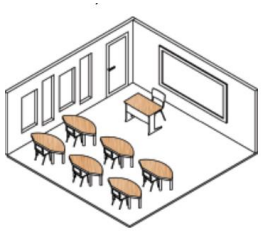
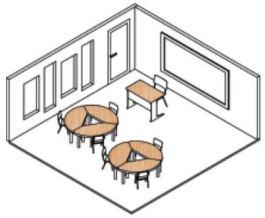
APPENDIX B (continued): Biophilic Classroom Design Guideline (prepared by the author).

Component	Design Strategies	Design Examples	Benefits to Wellbeing
 **Wall 2&3**	Pattern Groups: Natural Analogues (Indirect Experience) P8. Biomorphic Forms & Patterns P9. Material Connection with Nature Pattern Groups: Nature of the Space (Experience of Space and Place) P13: Mystery • Apply biomorphic design principles to building forms, structural systems, components, and interior spaces to emulate the outlines and patterns of living things. • Plant and natural motifs, shells, spirals, organic forms, domes, arches, vaults, and so on are examples of biomorphic elements. • Use bending routes, translucent materials, indiscernible sound sources, curved or obscured edges, etc. to create a sense of "mystery." (Zhong et al., 2022; Kellert, 2018; Browning et al, 2014)	The experience of mystery can be achieved by creating different compartments between functions in the learning environment. Different biophilic patterns can also be included in the design with applications such as biomorphic forms and patterns or natural materials and colors on the surfaces of these compartments.  	P8: Observed preference and reduced stress as a result of the induced shift in focus and improved concentration (Joye, 2007; Browning et al, 2014). P9: Lower diastolic blood pressure & enhanced creative performance (Ghaziani et al., 2021; Browning et al, 2014). P13: Increased curiosity; increased desire to learn more; and higher chances of experiencing additional biophilic states. (Kellert, 2018; Browning et al, 2014).

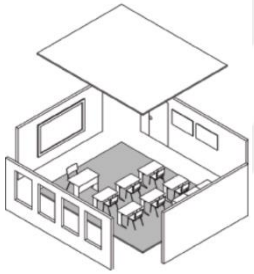
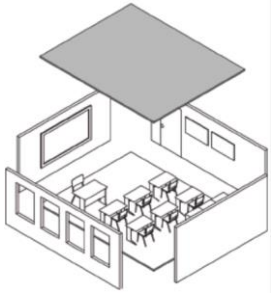
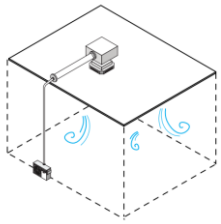
APPENDIX B (continued): Biophilic Classroom Design Guideline (prepared by the author).

Component	Design Strategies	Design Examples	Benefits to Wellbeing
 **Wall 4 (Windows & Outside Door)**	Pattern Groups: Natural In The Space (Direct Experience) P1. Visual Connection with Nature P4. Thermal & Airflow Variability P6. Dynamic & Diffuse Light P7. Connection with Natural Systems Pattern Groups: Natural Analogues (Indirect Experience) P10. Complexity & Order To supply a visual connection with nature, offer real nature priority over artificial nature, and artificial nature over no nature. Large windows that provide a view of the natural environment or pictures representing nature can be used in interior design. Develop airflow naturally by putting in vents, windows that can be opened, smaller structures, etc. Provide day light through glass walls, skylights, windows, reflective colors/materials, etc. (Kellert, 2018; Browning et al, 2014)	Window gaps of various sizes but with a certain repetition, and additionally a door entrance to the garden. 	P1: Reduced blood pressure and heart rate, increased mental engagement / attentiveness, influenced attitude and general happiness (Browning et al, 2014). P4: Improved comfort, well-being, and productivity (Ghaziani et al., 2021; Browning et al, 2014). P6: Students who attend schools with superior daylighting experience higher levels of happy emotions than those who attend schools with ordinary light conditions (Nicklas & Bailey, 1996). P7: Positive health responses according to changed perception of the environment. (Browning et al, 2014). P10: Cognitive and physiological stress responses were positively influenced. View preference was observed (Browning et al, 2014).

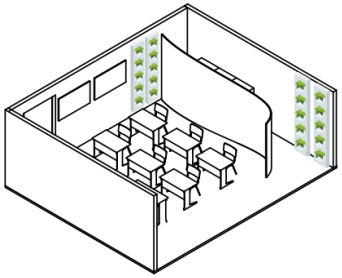
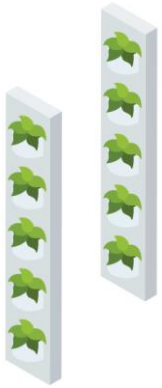
APPENDIX B (continued): Biophilic Classroom Design Guideline (prepared by the author).

Component	Design Strategies	Design Examples	Benefits to Wellbeing
 **Furniture**	Pattern Groups: Nature In The Space (Direct Experience) P2. Non-Visual Connection with Nature Pattern Groups: Natural Analogues (Indirect Experience) P9. Material Connection with Nature P10. Complexity & Order • Use textured materials (stone, wood, fur). • Allow modifiable variations of the regular layout by creating different patterns. (Zhong et al., 2022; Browning et al, 2014)	In cases where the teacher-centered classroom order is not sufficient due to changing curriculum and contents, a transition to a student-centered classroom order should be made (Lasry et al.,2014). The flexibility in this transition provides complexity and order patterns. Natural wood creates a material and non-visual connection with nature (Ghaziani et al., 2021).  	P2: Decrease in stress hormones and blood pressure, positive impact on learning performance, and perceived developments in mental health and well-being (Browning et al, 2014). P9: Lower diastolic blood pressure & enhanced creativ performance (Ghaziani et al., 2021; Browning et al, 2014). P10: Mental and physiological stress responses were positively influenced. View preference was observed (Browning et al, 2014).

APPENDIX B (continued): Biophilic Classroom Design Guideline (prepared by the author).

Component	Design Strategies	Design Examples	Benefits to Wellbeing
 **Floor**	Pattern Group: Natural Analogues (Indirect Experience) P9. Material Connection with Nature • Use less processed natural materials or materials that reflect natural materials (Browning et al, 2014).	Stone or wood texture for the floor. 	P9: Lower diastolic blood pressure & enhanced creative performance (Ghaziani et al., 2021; Browning et al, 2014).
 **Ceiling**	Pattern Groups: Nature In The Space (Direct Experience) P4. Thermal & Airflow Variability • Using moveable windows, vents, air shafts, porches, clerestories, HVAC systems, etc., one can replicate natural ventilation and air flow (Zhong et al., 2022; Browning et al, 2014).	An air flow must be provided to ensure equal heat exchange for all students and to provide fresh air in cold weather conditions when windows cannot be opened. 	P4: Control provided thermal conditions in a classroom can improve learning performance. (Elzeyadi, 2012) Improved comfort, well-being, and productivity (Browning et al, 2014).

APPENDIX B (continued): Biophilic Classroom Design Guideline (prepared by the author).

Component	Design Strategies	Design Examples	Benefits to Wellbeing
 **Wall 2 & 3**	Pattern Groups: Nature In The Space (Direct Experience) P1. Visual Connection with Nature P7. Connection with Natural System • Potted plants and indoor green walls are great ways to bring nature indoors (Zhong et al., 2022; Kellert, 2018).	Students can be allowed to grow plants in the learning environment by locating plant cultivation systems. 	P1 & P 7: Students' teamwork, taking responsibility, strengthening their social relationships, and gaining self-confidence emerge as a result of plant cultivation (Robinson and Zajicek, 2005). Spending time in green spaces is very important as part of raising an emotionally healthy child (Ward et al., 2016).

CURRICULUM VITAE

Name Surname : Meşküre Sena KAYACAN

EDUCATION :

- **B.Sc. :** (2019) Izmir University of Economics, Faculty of Fine Arts and Design, Industrial Design
- **M.Sc. :** (2021-2022) University of Applied Sciences and Arts of Southern Switzerland (SUPSI), Department of Interior Architecture Design, International Masters in Interior Architectural Design
- **M.Sc. :** (2020-2023**)** İstanbul Technical University, Department of Interior Architecture Design, International Master of Interior Architectural Design

PROFESSIONAL EXPERIENCE AND REWARDS:

- Project Based Industrial & Interior Designer 2020-Current
- Graduation Top student of the department, From: Izmir University of Economics, June 2019
- 15. National Packaging Design Student Competition Winner, From: Packaging Manufacturers Association, July 2019
- International AsiaStar Student Competition Certificate Prize, October 2019

PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:

- **Kayacan M. S. & Garip E.** 2022: Bringing Biophilic Design Patterns to the Learning Environment 8th INTERNATIONAL CONGRESS ON ARCHITECTURE AND DESIGN, İstanbul, Turkey.