The Role of Interior Design in Enhancing Learning Ability in a Children's Museum Context

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ABSTRACT

According to the Association of Children's Museums (ACM), more than 341 children's museums exist on 23 countries. The first children's museum was Brooklyn Children's Museum which was established in 1899. (Schofield-Bodt, C. ,1987) The philosophy of children's museum is based on the idea of hands-on learning besides the fact of artifact based traditional museums. The focus of the study, while investigating the interdisciplinary relationship between education and interior design in the context of a children's museum, is to analyse whether the environmental design parameters suggested by the educational approaches used in public institutions for years will contribute to learning in between the 2-11 age group children if used in the design of informal educational institutions. Learning is the main target of education, so the study will search for interior design criteria that can be adapted from formal design to informal context of famous educational approaches selected as Montessori and Reggio Emilia. Selected design criteria are 'recognizability, anthropometric design, social space and outdoor learning space.' To finalize the paper, the architectural drawings and photos of 10 children's museums which has different contents that are 'Boston Children's Museum, Chicago Children's Museum, Incheon Children's Science Museum, Children's Museum of ART, Brooklyn Children's Museum, Houston Children's Museum   Indianapolis Children's Museum, Knock-knock Children's Museum, Muzeiko America for Bulgaria Children's Museum, Papalote Museo Planet Play are found from the previous literature and examined with selected design criteria to be analysed qualitatively in the end. The photos and the architectural drawings of selected cases will be examined one by one by one with the selected criteria. Anthropometric design as an interior design criterion from Montessori approach, will

be used to check the measurements of the interior if it is suitable for the sizes of the user groups not to interrupt learning, social spaces from Montessori approach, will be used to check the gathering places for sharing the knowledge of different age groups. Outdoor learning spaces from Montessori approach, will be used to check the integration of natural environment conditions for play and recognizability parameter from Reggio Emilia approach, will be used to check the existence of identity constructed by a specific architectural language which in turn create a sense of place. As a conclusion, it is expected to observe if the environmental design of place fo children with the principles of Montessori and Reggio Emilia education can be adapted to the selected museums' architecture as Reggio Emilia emphasizes environment as 3rd teacher to enhance the learning process in the selected age group.

Keywords: Montessori Method, Reggio Emilia Approach, Children's Museums, Interior Design, Learning

ÖZ

Çocuk Müzeleri Derneği'ne (ACM) göre 23 ülkede 341'den fazla çocuk müzesi var. Çocuk müzeleri kurma fikri, 1899 yılında Brooklyn Çocuk Müzesi'nin kurulmasından sonra ABD'den yayılmıştır. Çocuk müzelerinin felsefesi, eser temelli geleneksel müzelerin yanı sıra uygulamalı öğrenme fikrine dayanmaktadır. Çalışmanın odak noktası, bir çocuk müzesi bağlamında eğitim ve iç tasarımın disiplinler arası ilişkisini araştırırken, resmi kurumlarda yıllardır kullanılan eğitim yaklaşımlarının önerdiği çevre tasarım parametrelerini, gayri resmi eğitim kurumlarının tasarımında kullanılırsa, 2-11 yaş arası çocuklarda, öğrenmeye katkı koyup koymayacağını analiz etmektir. Öğrenme, eğitimin ana hedefidir, bu nedenle çalışma, Montessori ve Reggio Emilia olarak seçilen ünlü eğitim yaklaşımlarının resmi tasarımdan gayri resmi bağlama uyarlanabilecek çevresel tasarım kriterlerini araştıracaktır. Seçilen tasarım kriterleri 'Tanınabilirlik, Antropometrik tasarım, Sosyal alan ve Dış mekanda öğrenme 'dir.'Boston Çocuk Müzesi, Chicago Çocuk Müzesi, Incheon Çocuk Bilimi Müzesi, Çocuk Sanat Müzesi, Brooklyn Çocuk Müzesi, Houston Çocuk Müzesi, Indianapolis Çocuk Müzesi, Knock-knock Çocuk Müzesi, Muzeiko America içinBulgaristan Çocuk Müzesi, Papalote Museo Planet Play önceki literatürden, internet sayfalarından, farklı içeriklere sahip 10 çocuk müzesinin mimari çizimleri ve fotoğrafları bulunup ve seçilen tasarım kriterleri çerçevesinde incelenip ,çalışmanın sonunda nicel olarak analiz edilecektir. Montessori yaklaşımından bir çevresel tasarım kriteri olan antropometrik tasarım, kullanıcı gruplarının boyutlarının ,öğrenmeyi kesintiye uğratmayacak şekilde tasarlanmış iç mekan ölçülerinin kontrol edilmesinde, Montessori yaklaşımından sosyal mekanlar parametresi, farklı yaş gruplarındaki müze ziyaretçilerinin bilgilerini paylaşmak için toplanma yerleri olarak tasarlanan

mekanların varlığı,Montessori yaklaşımından dış mekan öğrenme alanları, oyun için doğal ortam koşullarının iç mekanla entegre olup olmadığını kontrol etmek için kullanılacak ve Reggio Emilia yaklaşımından tanınabilirlik parametresi, belirli bir mimari dil tarafından inşa edilen mekan kimliğinin varlığını kontrol etmek için kullanılacak ve bu da bir mekansal algı duygusu yaratacağı öngörülerek ,incelenen mekanlar bu çerçevede analiz edilecektir.. Sonuç olarak, Reggio Emilia'nın okuldaki öğrenme sürecini geliştirmek için 3. öğretmen olarak çevreyi vurgulaması ışığında, Montessori ve Reggio Emilia eğitimi çevresel tasarım ilkeleriyle çocuklar için tasarlanan mekânlardaki çevresel tasarımının, seçilen müzelerin mimarisine uyarlandığında bu mekanlarda, öğrenmeye katkı koyması hedeflenir.

Anahtar Kelimeler: Montessori Metodu, Reggio Emilia Yaklaşımı, Çocuk Müzeleri, İç Mimarlık, Öğrenme

To all wounded children with any kind of learning disabilities.

ACKNOWLEDGEMENT

PREFACE

"What you say to me, I forget. I remember what you have shown me. I understand what you make me do." Confucius

I believe that every human being comes to this planet to serve the good of mankind and is responsible during his lifetime with the place he/she lives in it. For me architecture is the art of creating spaces, giving life to them and education is the pruning of mankind without losing his/her authenticity. Here is an interdisciplinary work of education and architecture.

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INTRODUCTION

"If we teach today's students as we taught yesterday's, we rob them of tomorrow."

John Dewey.

This research study analyses learning outcomes of selected children museums with recently used interior design parameters of previous pedagogical philosophies as Montessori and Reggio Emilia.10 children's museums were selected and analysed with the selected design parameters which in turn provides that interior design parameters that were used in interior environments, can contribute to informal learning media.

This introductory chapter first explains the background of the study. After the problem that give rise to this study is marked out in detail, the chapter continues with the purpose of the study which continues the necessities which come together to make this research remarkable, the parameters utilized in this study are interpreted.

1.1 Problem Statement

Children have spent most of their time in built environments either at schools or their homes. The environment and children relationship has been addressed throughout history. Classroom settings, school layouts and their relationships to learning outcomes have been marked as a subcategory of formal education. The physical settings have been addressed in quite diverse ways such as the form of the classroom, the relationship of indoor, outdoor, the furniture selection, the colour, and its effects

on the user but when it comes to informal settings as a branch of education which has visited by too many children in a year all around the World, does not have a field study on 'place-children's learning relationship.'

More than 1,318 million visits to the world's largest children's museum were reported in 2019, setting a new mark for annual attendance. There are more than 300 children's museums in the USA. Since the number of museums and their visitors have been continuously increasing, to examine every aspect of the educational role of children's museums becomes inevitable.

Although there are an outstanding number of research on the design learning relationship in the field of interior architecture, there are extremely limited research on pedagogical directives for classroom settings and their reflections in educational environments, when observing children's museums interior architecture, it is challenging to find enough scientific information. Addressing this problem will have benefits for designers, educators, and all children.

1.2 Aim and Objectives

The main aim of the study is to understand how learning is affected by the interior design of the space in a children's museum context.

The objectives are:

-To search for the evolution of children's museum's architectural space in a perspective of changing educational climate and technology.

-To search for the design parameters of previous educational approaches.

-Evaluate the selected children's museums with that parameter.

1.3 Limitations of the Study

Since the study tries to understand the co-relation between interior design of children's museums and learning outcomes of usergroups, a specific cognitive developmental stage should be selected. The selected group should learn in a concrete way in order to be affected by interior design of the space they spend time in.

-When Piaget cognitive developmental stage theory was examined as shown in table 5, preoperational stage which is in-between age 2-7 and concrete operational stage which is 7-11 were decided as the age limitation of children to benefit from museum learning.

-Since the study searches for interior design of children's museums and their learning relationship, taking a wider range of children's museums with different contents is another limitation of the dissertation for the cases that were selected in order to take more precise results with spaces of different functions.

-According to URL 1, there are 7 preschool approaches that were used which are;

1-Montessori

2-Reggio Emilia

3-Waldorf

4-High scope

5-Bank Street

6-Parent's co-op

7-Religious

This study will investigate only two preschool approaches and their environmental parameters which are Reggio Emilia and Montessori.The reason of selection of those two approaches is because of their sensitivity on environment in their philosophy.

-According to Ceppi, G., & Zini, M., there are 9 criteria that is a guidelinefor constructing environment for children which are;

Central piazza, Horizontality, transformability and flexibility, atelier, school as workshop, school as community, inside-outside relation,communication and transparensy, but in this study which is going to use these parameters to analyse children's museums only Recognizability parameter selected from Reggio Emilia environment directives.

-According to Al S. et al,2012, there are 6 design parameters offered by Montessori method which are, 'articulated classrom, learnig street set up, outdoor learning space, social space, personalized environment and anthropometric design.

This study is limited with 'outdoor learning space, anthropometric design and social space' parameters.

1.4 Methodology of the Study

The aim of the study is to determine the effects of interior design in enhancing learning outcomes in children museums. This study uses a qualitative method. The main purpose of this research method is to gain an understanding of how interior design of the space in a children's museum affect children user's learning outcomes. Since the study is concerned with children inbetween age 2-11, detecting the learning outcomes is a long-term job,so the study uses secondary resources such as internet, scholars, books.The criteria to anaylse the selected children's museums were selected from the

most popular early childhood educations that are used gloabally which are Montessori method and Reggio Emilia Approach. (URL 1)

The interior design of the museum is accepted as contributing to the learning outcomes of users if the museums fulfill the following criteria;

-Recognizability

-Social Space

-Anthropometry

-Outdoor Learning Space

The children's museums that were used in the study were strategically selected from the members of ACM (Association of Children's Museums) shown in Table 6, which have different contents/functions with a logic of analysing wider spectrum of interior spaces to take more precise results.

1.5 Organization of the Research

The study is an interdisciplinary work of education and Interior Design. Throughout the history, some of the known preschool approaches emphasized the importance of environment in the process of learning and especially Reggio Emilia Approach which is one of two educational approaches that was selected and used in this study highlighted the environment as the 'third teacher'.

As shown in the Table 1, the study started with an introductory chapter which involves the 'research question', 'aims and objectives of the study', 'limitations' and 'methodology' of the thesis.

Through the second chapter, the author tried to explain the terminology of the thesis, which are 'Children's Museums, 'Interior Design of Learning environment', 'Learning', 'Reggio Emilia Approach' and 'Montessori Method'. While explaining terminology with different perspectives from different sources, the interior design parameters which will help to analyse the cases selected were decide from the directives suggested by Montessori Method and Reggio Emilia Approach which are 'recognizability', 'social space', 'anthropometric design' and Outdoor Learning Space'.

In the following chapter (chapter 3), theoretical framework of the study was explained in detail and cases were selected which are 'Boston Children's Museum, Chicago Children's Museum, Incheon Children's Science Museum, Children's Museum of ART, Brooklyn Children's Museum, Houston Children's Museum, Indianapolis Children's Museum, Knock-knock Children's Museum, Muzeiko America for Bulgaria Children's Museum, Papalote Museo Planet Play.'

In the last chapter, all findings of the previous chapter were discussed and a research gap for the new researchers were recommended.

Table 1: Organization of The Research

	INTRODUCTION	
Problem Statement		Methodology
Aims & Objectives		Limitations

	TERMINOLOGY	
Learning		Preschool Educational Approach
Interior Design of Learning Environment		Montessori Method
Children's Museums		Reggio Emilia Approach

	ANALYSIS OF THE CASES	
Boston Children's Museum		Houston Children's Museum
Chicago Children's Museum		Indianapolis Children's Museum
Incheon Children's Science Museum		Knock-knock Children's Museum
Children's Museum of Art		Muzeiko America for Bulgaria CM
Brooklyn Children's Museum		Papalote Museo Planet Play

	CONCLUSION	
Findings		Further Recommendation

Chapter 2

MUSEUMS AND LEARNING RELATIONSHIP REVIEW

Throughout history, museums have had a teaching mission. The chapter is going to look after what is a space, museum as a space, what is learning and what stages of childhood learn how, preschool educational approaches and the definition of childhood separately and then combines them in the

2.1 General Definition of Museums

"A museum is the memory of mankind." *Philippe de Montebello*

'The idea of accumulating everything, of setting up a kind of general archive, the will to enclose all times in one place, all epochs, all forms, all tastes, the idea of creating a place of all times that is itself outside time and inaccessible to its effects, this whole concept belongs to our modernity, the dream of organizing in this kind of eternal and infinite accumulation of time in a fixed position' (Foucault 1986: 26) .Museums are the principal link between history, present and future. The existence of ancient historical objects is the key element that differentiates the atmosphere of museums from the environments of other building forms. (Sharif-Askari, H., & Abu-Hijleh, B. 2018). The word "museum" is not new. If it is traced back more than 2000 years, then we can find the term museum used in the Alexandria Museum in Alexandria in 283 BC in its original context. This is a temple house dedicated to the Muses, the learning goddesses. (Bennett, T. ,1995). The following table points out the muses and their area of influence throughout the history.

Table 2: Name of The Muses And Their Area of Influences. Kiersten, F. L., & Simmons, E. J. (2014). Adapted by the Author**.**

Name of The Muse	Area of Influence
Clio	History
Euterpe	Music
Thalia	Comedy
Melpomene	Tragedy
Terpsichore	Dance and choral song
Erato	Lyric and Love Poetry
Polyhimnia	Sacred Song
Urania	Astronomy
Calliope	Epic Poetry

As it is shown in table 2, Ancient Greek believed that each goddess is responsible from a discipline. 'Clio' from history, 'Euterpe' from Music, 'Thalia' from Comedy, 'Melpomene' from Tragedy, 'Terpsichore' from dance and choral song, 'Erato' from Lyric and love poetry, 'Polyhymnia' from Sacred Song, 'Urania' from Astronomy and 'Calliope' from Epic Poetry. According to *Museums of the World*, "there are about 55,000 museums in 202 countries.

Drawings of 9 muses
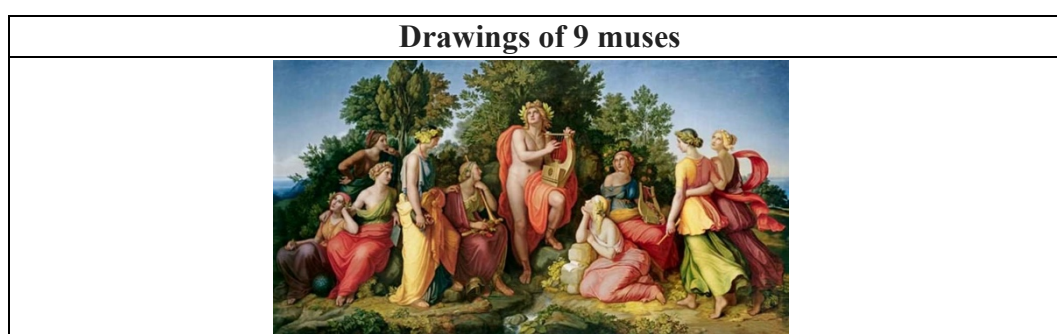
Figure 1:9 Muses

Professional Museums Organizations such as The International Council of Museums (ICOM)which forms 30000 members in 137 countries", The Canadian Museum Association (CMA), The United Kingdom' Museum Associations (MA) Accurate

definitions further from mythologic definitions of museums is chosen by associations

of museums which runs both nationally and globally as shown below.

Table 3: Different Organizations(Latham et al.,2014)

ICOM (International Council of Museums)	The International Council of Museums	''A museum is a non-profit, permanent institution in the service of society and its development open to the public, which acquires, conserves, research, Communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purpose of education, study, and enjoyment. (**ICOM n.d.)** ICOM Statues (adopted from the 21st General Conference 2007)**.**
CMA	The Canadian Museum Association	''Museums are institutions created in the public interest. They engage their visitors, foster deeper understanding, and promote the enjoyment and sharing of authentic cultural and natural heritage. Museums acquire, preserve, research, interpret and exhibit the tangible and intangible evidence of society and nature. As educational institutions, museums provide a physical forum for critical inquiry and investigation''. **The Canadian Museums Association (2003)**
MA	The United Kingdom's Museums Associations	''Museums enable people to explore collections for inspiration, learning and enjoyment. They are institutions that collect, safeguard, and make accessible artefacts and specimens which they hold in trust for society''.

As it is mentioned above in the table 3, from the most known museum organisations over the world like The International Council of Museums, The Canadian Museum Association, The United Kingdom's Museums Associations, there are some common definitions of museums, such as.

-They are public places.

-Their function are education and enjoyment.

-They are non-profit organizations.

-They collect, keep, and show the artifacts.

After defining museums by combining from the common definitions of globally known and accepted organizations of museums, types of museums are explained as follows.

2.1.1 Types of Museums

There may be thousands of ways to classify museums, for example Gibson Good classified museums into two.

- 'By the character of their content'
- 'By the purpose which they are serving.'

Britannica (Museum - Types of museums | Britannica) (URL 3) classified museums into five.

- General Museums
- Natural history and natural science
- Science and Technology
- History Art

- *Classification of museums according to artifacts*

According to **(**URL 4**)**, There are 13 types of museums which are:

- Archaeology museums

- Art museums

- Encyclopaedic museums

- Historic house museums

- History museums

- Living history museums

- Maritime museums

- Military and war museums

- Mobile museums

- Natural history museums

-Open-air museums

-Pop-up museums

-Science museums

- *Classification of museums according to financial supplier*

According to (URL 5) depending on how they are owned, managed, and funded, there are several types of museums. These are:

- National museums

-Local authority museums

- University museums

- Independent museums

- Historic properties and heritage sites

- National Trust properties

- Regimental museums and armouries

- England's unoccupied royal palaces

- *Classification of museums according to the user group*

According to (Latham, et al.,2014), "To be meaningful, museums need someone-visitors- to make meaning out of this resource. As the definition of a museum states, the museum is a place where visitors interact with ideas and concepts about the resource."

A recent survey by Reach Advisors of over 40.000 museum-going households who visited 103 institutions in the United States presents an interesting picture of museum visitors in the United States. (Latham, et al., J. E. ,2014). When separating the user group of children's forms these results, these outcomes come out in terms of age, gender, and educational degree. With 89 percent of visitors under the age of 50 and 64 percent under the age of 40, children's museums naturally attract younger people. Visitors to children's museums are female, with 88 percent of them being young parents with tiny children (typically preschool). At least one college degree is held by 81 percent of these visitors. (Latham, et al. ,2014)

Before examining the children's museums, to delve in childhood concept, which is the combination of children definition, the child rights, the developmental stages of children and the necessities to set up children's museums globally as a theoretical background for the study.

2.2 Definition of Children

In the world of Romanesque formulas, at the end of the 13th century, no special word is used for any children but man with a smaller scale. (Njenga, G. ,2015) To understand 'the children's place in time and place, the interval for 10000 BCE to now is

investigated in the name of world population. It obvious that there is a strike in the population after 1800 AC.
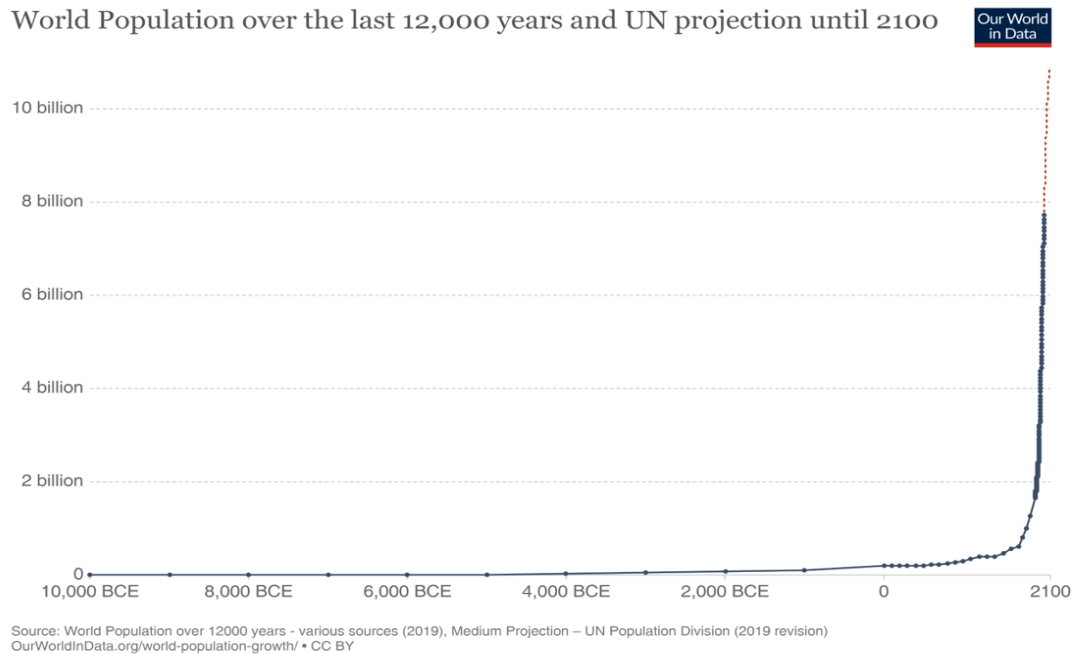
Figure 2: World Population For 12000 Years (URL 6)

What is striking about this graph is that all the development occurred within the last few years. According to historical demographers, the world's population was around 1 billion people around the year 1800. This means that the population developed very slowly on average between 10,000 BCE and 1700 CE (by 0.04 percent annually). This profoundly changed after 1800. (URL 7) Figure 1 used to show the striking increase in population after industrial revolution so children and childhood is a created concept after industrial revolution. With the strikingly increasing population after industrial revolution, education gets more difficult as shown in figure 1.

2.2.1 Social Construction of Childhood

In the past of childhood, there is a claim that childhood is a new phenomenon. As a result, it is a modern construct that has given childhood a unique place in society.

Indeed, some scholars claim that the concept of childhood as a distinct stage of existence did not emerge until the 16th century. Aries (1982) argued that childhood was the product of a social construction method. According to Aries, the definition of childhood is linked to an understanding of the unique essence of childhood. It is possible to distinguish between a child and an adult with this understanding. Aries concludes that this knowledge was missing in medieval paintings, literature, philosophical and religious tracts, and letters after examining medieval paintings, literature, and philosophical and religious tracts and letters. (Norouzi, et al.,2016). It is difficult to reconsider children and childhood. For starters, there is a vast and influential body of expertise on child development and socialization. Its authority was established in part by Talcott Parsons and Piaget (Jenks 1996). We (adults) are potentially more reliably educated about children's growth than ever before, both in the public and private spheres. It is fair to say that the child development industry has a monopoly on child knowledge. Child development theory serves as a foundation for the practice of lawyers, physicians, social workers, educators, and scholars who work on, with, and with children. They do it because it has a high profile, and by doing so, they elevate it even higher. The risk of monopolization is present when a market is cornered. (Mayall, B,2000).

2.2.2 Children's Right

According to UNICEF, 20th November 1920, the conventions of children's rights, education is a child right, every child can benefit. With the strikingly increase in population as shown in figure 1, living in-between adults without having rights becomes a difficult phenomenon. According to the conventions on the rights of the children the rights of children were defined as below:(URL 10)

1. Definition of a child

2. No discrimination

3. Best interests of the child

4. Making rights real

5. Family guidance as children develop

6.Life survival and development

7. Name and nationality

8. Identity

9. Keeping families together

10. Contact with parents across countries

11. Protection from kidnapping

12. Respect for children's views

13. Sharing thoughts freely

14. Freedom of thought and religion

15. Setting up or joining groups

16. Protection of privacy

17. Access to information

18. Responsibility of parents

19. Protection from violence

20. Children without families

21. Children who are adopted

22. Refugee children

23. Children with disabilities

24. Health, water, food, environment

25. Review of a child's placement

26. Social and economic help

27. Food, clothing, a safe home

28. Access to education

29. Aims of education

30. Minority culture, language, and religion

31. Rest, play, culture, arts.

32. Protection from harmful work

33. Protection from harmful drugs

34. Protection from sexual abuse

35. Prevention of sale and trafficking

36. Protection from exploitation

37. Children in detention

38. Protection in war

39. Recovery and reintegration

40. Children who break the law

41. Best law for children applies

42. Everyone must know children's rights

43 to 54. How the Convention works

This article explained how governments, the United Nations – including the Committee on the Rights of the Child and UNICEF - and other organisations work to make sure all children enjoy all their rights. After looking to definition of children, childhood as a social constructed feature within the social life, then children rights, children development should be investigated in detail.

As highlighted in number 28 of children's rights shown above, all children have equal rights to access education.

2.2.3 Children Development

When designing for a specific user group, the better understanding of the specific user group properties will result in better outcomes when considering design. "Development can be seen as the way in which individuals grow and change over the course of their lifespan and this can take place in different domains: biological, which includes features such as physical growth and developments in motor skills; cognitive, which refers to changes in thought processes such as memory, reasoning and problem solving, imagination, and creativity and language; emotional, where the focus is on changes in emotional experience and understanding; and social ,which refers to changes in our understanding of ourselves and other people and how we relate to others." (Crowley, K. ,2017). "In the case of Freud and Erikson, human development is described as the unfolding of an innately determined sequence of stages". (Green, et al., 2015). According to Santrock (2002), development is contextual, lifelong, multidimensional, multidirectional, plastic, and multidisciplinary. Nature of development consists of biological, cognitive, and socioemotional processes.
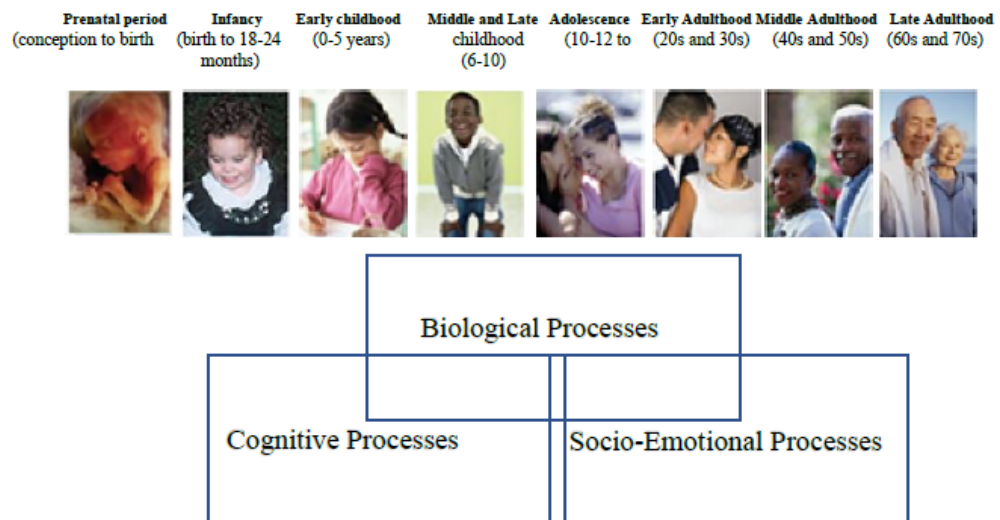
Figure 3: Periods of Development (URL 9) (Adapted by the Author)

Biological development, socio-emotional development and cognitive development are investigated separately. When considering learning, which is the main subject of this study, cognitive development and it should be handled separately. After giving a definition for biological development and social emotional development Piaget's theory and stages of cognitive development explained.

- Biological development

Changes in an individual's physical nature are caused by biological processes. Biological processes that influence development include genes inherited from parents, brain development, height and weight gains, improvements in motor skills, diet, exercise, puberty hormonal changes, and cardiovascular decline. (Santrock, J. W. ,2009)

- Socio-emotional development

Children's brains are quickly evolving during their first few years of life, as is their ability to learn important social and emotional skills. Early childhood social and

emotional growth, also known as early childhood mental wellbeing, refers to children's developing ability to:

- Emotions are experienced, controlled, and expressed in a variety of ways.

- Develop strong and fulfilling relationships with other kids and adults.

- Actively discover and learn about their surroundings. (URL10).

- Cognitive development

From childhood to adulthood, cognitive growth is the creation of thought processes such as remembering, problem-solving, and decision making. (Ahmad, S., Ch, A. H., Batool, A., Sittar, K., & Malik, M. 2016). Piaget claimed that as children grow and their brains develop, they progress through four phases marked by differences in thought processing. He studied children and gave them problems to solve that were linked to object permanence, reversibility, deductive reasoning, transitivity, and assimilation during his study (described below). Each stage progresses. (URL 11).

Table 4: Piaget's Cognitive Development Stages(Santrock, 2009 Adapted by the Author (URL 12))

Piaget's Cognitive Development Theory			
Sensorimotor stage	Preoperational stage	Concrete Operational stage	Formal Operational stage
Birth to 2 years of Age	2 to 7 years of Age	7 to 11 years of Age	11 Years of Age through Adulthood

-Sensorimotor stage (0-2 years): Intelligence is produced by motor activity without the use of symbols during this time (which has six stages). Since it is focused on

physical interactions/experiences, knowledge of the environment is limited (but growing). Around the age of seven months, children develop object permanence (memory). Physical growth (mobility) enables a child to begin developing new cognitive abilities. At the end of this phase, some symbolic (language) abilities are developed. (Huitt, William, and John Hummel,2003)

-*Preoperational stage (2-7 years, toddler and early childhood):* Knowledge is demonstrated using symbols, language matures, memory and imagination grow, but thought is done in a nonlogical, non-reversible manner during this time (which has two substages). The dominant mode of thought is egocentric. (Huitt, William, and John Hummel,2003)

-*Concrete stage (7-11 years, Elementary and Early Adolescence):* Intelligence is demonstrated in this stage (characterized by seven types of conservation: number, length, liquid, mass, weight, area, and volume) by logical and systematic manipulation of symbols related to concrete objects. The development of operational thought (mental actions that are reversible). Egocentric thinking becomes less prevalent. (Huitt, William, and John Hummel,2003)

-*Formal operational stage (11- Age through Adulthood):* Intelligence is illustrated at this point by the logical application of symbols to abstract concepts. There is a return to egocentric thinking early in the period. In developed countries, about 35% of high school graduates receive formal operations; many people do not think formally during adulthood. (Huitt, William, and John Hummel,2003)

After looking to the development for children, to be able to design for children, it should be observed how children perceive environment and do learning environments for children has any common specific properties.

2.2.4 Learning Environment for Children

Schunk quoted as a world widely accepted definition of learning as "Learning is an enduring change in behaviour, or in the capacity to behave in a given fashion, which results from practice or other forms of experience." (Schunk, D. H. 2012)

In several respects, children and adult learners vary, but there are also surprising similarities among learners of both ages. A study of young children serves two purposes: it demonstrates the strengths and shortcomings of the learners that fill America's classrooms, and it provides an insight into the evolution of learning that cannot be seen if only well-established learning habits and expertise are considered. An observer gets a complex picture of learning unfolding over time while observing the growth of children. (National Research Council,2000).
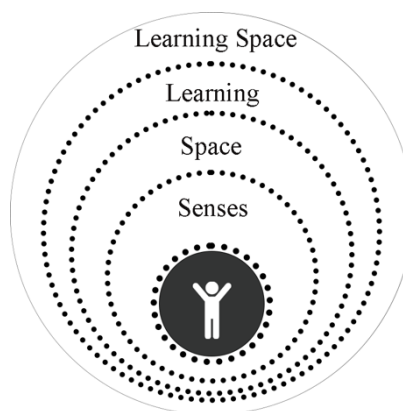
Figure 4: Child, Senses, Learning and Space Relationship Scheme (ATACI, S.,2019)

2.3 Children and Education

Throughout the history, different philosophers and theorists tried to define education in different perspectives. Inglis, F., & Aers, L. (2008) mentioned that ＂Plato's republic was the first to argue for state and not family education (boys only), for public-spiritedness and civic mindedness as paramount, for the centrality of character as much as training of intelligence. Two thousand years later Rousseau in Emilie (1762) took it all back, and argued for a much freer, more playful, and happier kind of education, in which the child's own experience and self-expressiveness would be allowed to find its own best form. Dewey (1986) ＂ The main purpose or objective is to prepare the young for future responsibilities and for success in life, by means of acquisition of the organized bodies of information and prepared forms of skill which comprehend the material of instruction. ＂ According to Wikipedia, Education is the learning process, or the development of information, abilities, values, beliefs, and behaviours. Methods of education include instruction, reading, storytelling, debate, and guided study. "Lifelong learning will encompass the full spectrum of formal, informal and non-formal learning" (EU Commission 2001 p 3). These three, as summarized by UNESCO 2009a, were described as follows (EC 2001 pp 32-33):
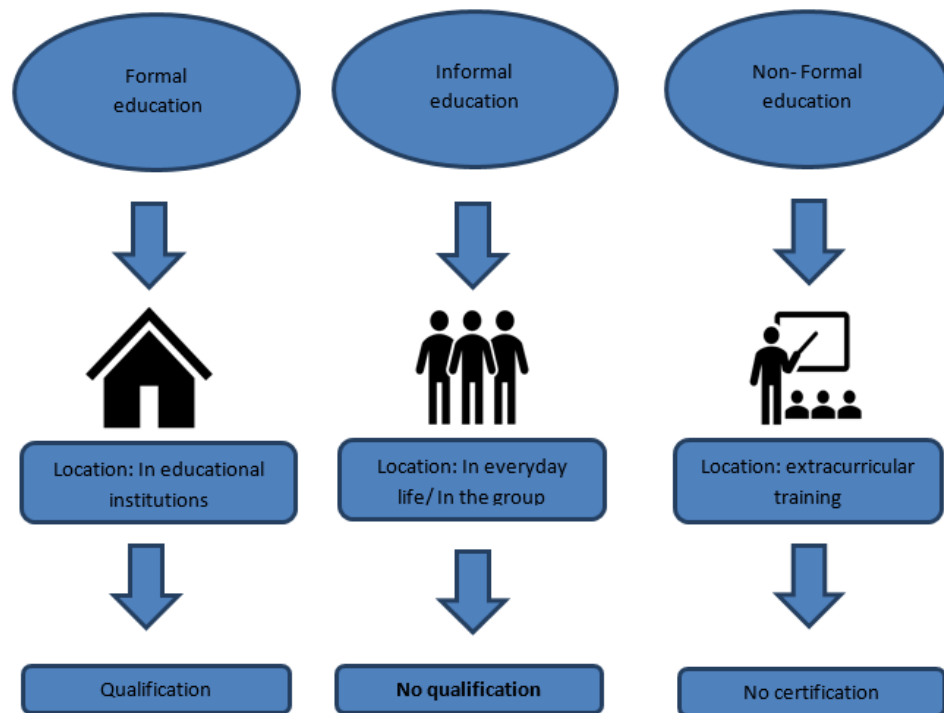
Figure 5: Graphic Explanation of Formal, Informal, Non-Formal Education
(URL 13)

2.3.1 Formal Education

Formal learning: formal learning occurs because of interactions in an institution of education or training, with standardized learning expectations, learning time and support contributing to certification. From the learner perspective, formal learning is intentional (UNESCO 2009a p 27). Formal education is a structured, organized educational model that is constructed and administered according to a set of laws and standards, with a rigid curriculum in terms of aims, content, and methods. It is characterized by a continuous educational process known as "presential education," as described by Sarramona1, which necessitates the participation of the instructor, students, and the institution. (Dib, C. Z. ,1988)

Figure 6: A Photo Showing An Example of Formal Education (URL 14)

2.3.2 Non Formal Education

Non-formal learning is not supported by an institution of education or training and does not usually contribute to certification. It is organized, how- ever, (in terms of learning goals, learning time, or helping to learn). Non-formal learning is intentional from the viewpoint of the learner (UNESCO 2009a p 27). As it can be seen, formal education has a distinct set of characteristics. When one or more of these are missing, we can confidently conclude that the educational process has taken on non-formal characteristics. As a result, we can state that a certain education system has non-formal education features if it is not presential most of the time - non-contiguous communication. Non-formal education qualities are also important. (Dib, C. Z. ,1988)

Figure 7: A Photo Showing An Example of Non-Formal Education (URL 15)

2.3.3 Informal Education

Informal learning stems from work, family, or leisure-related activities in everyday life. It is not standardized (in terms of learning materials, learning time or encouragement for learning), and usually does not result in certification. Informal learning can be deliberate but is non-intentional in most cases (UNESCO 2009a, p 27). Informal education is distinct from formal education and non-formal education, yet it can maintain a tight link with both in some instances. Informal education does not always incorporate the objectives and subjects covered by standard curricula; it does not always adhere to a structured and methodical concept of education. For example, informal education includes activities such as: (a) visiting museums or scientific and other fairs and exhibits, etc.; (b) listening to radio broadcasts or watching television programs on educational or scientific themes; (c) reading texts on sciences, education, technology, and other topics in journals and magazines; (d) participating in scientific contests, etc.; and (e) attending lectures and conferences. (Dib, C. Z. ,1988)

Figure 8: A Photo Showing An Example of Informal Education (URL 16)

-Museums and learning environment

Before approaching museums as a learning environment, the features that a good environment should have, and then the features that the environment designed for learning will be looked at, respectively. As Augustin et al. (2009) mentioned a well-designed space should be;

. Complying

. Communicating

. Comforting

. Challenging

. Continuing

After discussing the properties of a well-designed spaces, the definition of children museums and types of children's museums will be examined as an informal learning environment.

- Children museums

Children museums are, a type of museum which is classified for a specific user group, 'children'. When children are the specific user group for a specialised design target, all aspects of childhood should be observed in detail. There is a special organization of children's museum which is the Association of Children's Museums (ACM) which was founded in 1962 to support children's museums around the world. ACM is the world's foremost professional organisation promoting and lobbying on behalf of children's museums, as well as those who work in and support them. It has over 460 members in 50 states and 19 countries. (URL 17)

The members accredited in the associations which is announced through the website of ACM are explained in the following table in a format of museums name, establishment date and content that will form a step in analysing different content museum buildings. The contents are:

-Animal/Nature

-Arts & Crafts

-Cooking

-Games

-Imaginative Play

-Caregiver Resources

-Literacy and Language Development

-Movement and Exercise

-Music

-Sensory Play

-STEAM (Science, Technology, Engineering, and Mathematics).

The members of the association of children's museums, the date of establishment and the content type was reviewed by the following table.

The Content Type was Reviewed by the Following Table:

Table 5: Members of The A.C.M(URL 18) Adapted By The Author.

No	Name of the Children Museum	Date of Establishmnt	Content Type
1	Above & Beyond Children's Museum	1999	Arts, Crafts, Music, STEAM
2	Adventure Children's Museum	2015	Arts, Crafts, Music, STEAM

3	AHA! A-Hand's on Adventure	2006-2007	Arts, Crafts, Cooking
4	Akron Children's Museum	2016	STEAM
5	Amazement Square	2001	Arts, Crafts,STEAM,Story time
6	Amelia Park Children's Museum	1997	Arts, Crafts, STEAM,Story time
7	aMuse'um Columbia Children's Museum	2009	Arts, Crafts, STEAM, Story time
8	Ann Arbor Hand's- On Museum	1982	Resources, STEAM
9	Bay Area Discovery Museum	———	Resorces, Steam, Literacy
10	Bayou Country	———	Cooking, Movement
11	Beaumont Children's Museum	2008	Arts, Crafts, STEAM, story time
12	Bellaboo's Play & Discovery Centre	2008	Arts, Crafts, Story Time
13	Betty Brinn Children's Museum	1995	Arts, Crafts, Games, Story time
14	Boonshoft Museum of Discovery	1993	A twice daily DYI virtual science programming with materials to download.
15	Boston Children's Museum	1913	Arts, Crafts, STEAM, Story time
16	Bronx Children's Museum	2005	Nature, Music, Arts& Crafts
17	Brooklyn Children's Museum	1899	Animals/Nature, Arts& Crafts
18	Bucks County Children's Museum	2014	Arts& crafts and STEAM
19	Canadian Museum of History	———	Arts, Crafts
20	Cayton Children's Museum bySharewell	1991	Arts, Crafts, Museum and Story time
21	Chabot Space & Science Centre	2000	STEAM
22	Chesapeake Children's Museum	1992	Arts& crafts and STEAM, Story time
23	Chicago Children's Museum	1982	Animals/Natıre, Arts& Crafts & Imaginative Play
24	Chico Children's Museum	———	Arts & Crafts, STEAM
25	Children's Creativity Museum	1998	Arts & Crafts, STEAM
26	Children's Discovery Museum of Main	———	STEAM

27	Children's Discovery Museum	2004	Arts & Crafts, STEAM
28	Children's Discovery Museum of San Jose	1990	Arts & Crafts, STEAM
29	Children's Discovery of the Golden Crescent	1987	Story Time
30	Children's Discovery of the Golden Crescent	2002	Arts, Crafts, Cooking, STEAM
31	Children's Hands on Museum of Northwest Illinois	———	Arts, Crafts
32	Children's Hands on Museum of Tuscaloosa	1986	Movement/Exercise, STEAM
33	Children's Museum& Theatre of Maine	2008	Animals/Nature, Theatre
34	Children's Museum at Holyoke	———	Arts, Crafts
35	Children's Museum at the Paso Robles Volunteer	2007	Arts, Crafts, Story time
36	Children's Museum in Oak Lawn	———	Animals/Nature, Arts& Crafts
37	Children's Museum of Akadlana	———	Arts, Crafts, Cooking, STEAM
38	Children's Museum of Alamance Country	———	Arts, Crafts, STEAM, Story time
39	Children's Museum of Atlanta	2003	Arts, Crafts, Music, STEAM
40	Children's Museum of Brownsville	2005	Arts, Crafts
41	Children's Museum of Denver at Marsico Campus	1984	Arts, Crafts, Cooking
42	Children's Museum of Eau Claire	2000	Arts Crafts, Movement/ Exercise, STEAM
43	Children's Museum of Fond du Lac	2002	Arts, Crafts, Music, STEAM
44	Children's Museum of Greater Fall River	———	Animals/Nature, Arts& Crafts
45	Children's Museum Houston	1992	Music, STEAM, Story time, Theatre
46	Children's Museum of Illinois	1990	Arts &Crafts, Movement/Exercise, STEAM
47	Children's Museum of La Crosse	1999	Arts& Crafts, Music, STEAM, Movement/Exercise
48	Children's Museum of Manhattan	1973	Arts, Crafts, Music
49	Children's Museum of New Hampshire	———	Arts& crafts and STEAM, Story time
50	Children's Museum of Phoenix	2008	Arts Crafts, Movement/Exercise, Story Time

51	Children's of Pittsburg	1983	Arts& crafts and STEAM
52	Children's Museum of Richmond	1977	Arts, Crafts, Story time
53	Children's Museum of Sonoma County	———	Arts, Crafts, STEAM, Story time
54	Children's Museum of South Dakota	2010	Arts, Crafts, Cooking, STEAM
55	Children's Museum of Southeatern Connecticut	1992	Arts& crafts and STEAM
56	Children's Museum of Southern Minnesota	2015	Arts &crafts, Literacy/language Development, STEAM
57	Children's Museum of St. Tammany	2004	Arts Crafts, Story Time
58	Children's Museum of Stockton	1994	Arts& Crafts, Movement/ Exercise, STEAM
59	Children's Museum of Tacoma, A Program of Greentrike	1986	Music, Story time
60	Children's Museum of the Arts	1988	Arts & Crafts, Music, STEAM
61	Children's Museum of the East End	2005	Arts& crafts and STEAM, Story time
62	Children's Museum of The Low Country	2003	Arts & Crafts, STEAM
63	Children's Museum of Virginia	1980	STEAM
64	Children's Museum Tuscon/Oro Valley	1986	STEAM, Story Time, Movement/Exercise
65	Children's Science Centre Lab	2006	STEAM, Story Time
66	Cincinnati Museum Centre	1990	STEAM
67	Cookeville Children's Museum	———	Arts Crafts
68	COSI	1964	STEAM
69	Creative Discovery Museum	1992	STEAM, Story Time
70	Curious Kids Museum	1989	Arts &Crafts, Music, STEAM, Story time
71	Curious Mind's Discovery Zone	———	Animals/Nature, STEAM
72	Delaware Children's Museum	2016	Arts& crafts and STEAM, Story time
73	Des Moines Children's Museum	2017	Music
74	Discovery Centre at Murfree Spring	2002	STEAM, Animals/Nature, Literacy/Language

75	Discovery Centre Museum	1993	Arts Crafts, STEAM, Story Time
76	Discovery Children's Museum	1984	Music, STEAM, Story time
77	Discovery Depot Children's Museum	1996	Arts crafts, Games
78	Discovery Gateway Children's Museum	1978	STEAM
79	Discovery Museum	1934	Animals/Nature, Sensory Friendly, STEAM
80	Discovery Place-Huntersville	2010	Animals/Nature, STEAM
81	Discovery Place- Rockingham	1981	Animals/Nature, STEAM
82	Discovery Science Place	1993	STEAM
83	Don Harrington Discovery Centre and Space Theatre	1976	STEAM
84	Duluth Children's Museum	1930	Arts, Crafts, Cooking, Literacy/Language Development, STEAM
85	DuPage Children's Museum	1987	Music, STEAM, Story time
86	EcoTarlum	_____	Animals/Nature, STEAM, Story time
87	EdVenture	2003	Animals/Nature, STEAM, Story time
88	Edwardsville Children's Museum	2003	Arts Crafts, Story Time
89	Eureka! National Children's Museum	1992	STEAM
90	EverWonder Children's Museum	2011	STEAM
91	expEIREnce Children's Museum	_____	STEAM, Literature/Language Development
92	Explora	2001	STEAM
93	Exploration Place	2000	STEAM
94	Explorations V Children's Museums	1991	Music, Story time
95	Explore & More -The Ralp C. Wilson Jr. Children's	2019	Arts& crafts and STEAM, Story time
96	Explore More Discovery Museum	2002	Arts Crafts, STEAM, Story Time
97	Explorium Denton Children's Museum	2012	Story Time
98	Explorium of Lexington	1990	Arts Crafts, STEAM, Story Time

99	Fairbanks Children's Museum	——	Arts& crafts and STEAM
100	Family Museum	1994	Arts& crafts and STEAM
101	Felix Adler Children's Discovery Centre	1993	Arts& crafts and STEAM
102	Flint Children's Museum	1980	Arts& crafts and STEAM
103	Fort Wort Museum of Science and History	2009	Animals/Nature, STEAM
104	Galveston Children's Museum	2014	Arts crafts, Literacy/language Development
105	Glazer Children's Museum	1986	Arts Crafts, STEAM, Story Time
106	Golisano Children's Museum of Naples	2002	Arts& crafts and STEAM, Story time
107	Grand Rapids Children's Museum	1993	Arts& Crafts, Movement/Exercise, STEAM
108	Great Explorations, Children's Museums	1986	STEAM
109	Greensboro Children's Museum	1999	Animals/Nature, Arts& Crafts, STEAM
110	GyeongGi Children's Museum	2004	Theatre, Cooking, Movement/Exercise
111	Habitot Children's Museum	——	Animals/Nature
112	Hand's On Children's Museum	1987	Story Time, STEAM, Arts Crafts
113	Hands-On House Children's Museum of Lancaster	1987	Story Time
114	Hawaii Children's Discovery Centre	1989	Movement/Exercise, STEAM, Story Time
115	Hongkok Cihldren's Discovery Museum	——	Arts& crafts and STEAM
116	I.d.e.a. Museum	1980	Arts, Crafts, Cooking, Music
117	Imagine Children's Museum	1991	Arts& Crafts, Music, Story time
118	Imagine Nation, A Museum Early Learning Centre	2004	Arts, Crafts, Cooking, Music, Story Time
119	Impression 5 Science Centre	1972	STEAM
120	Interactive Neighbourhood for Kids, Inc. (INK)	——	Arts &Crafts, Imaginative Play
121	Jackson Hole Children's Museum	2011	Arts& crafts and STEAM, Story time

122	Kaleideum-Downtown	2016	Arts& crafts and STEAM
123	Kaleideum-North	2016	Arts& crafts and STEAM
124	Kansan Children's Discovery Centre	2011	Arts& Crafts, STEAM, Story Time, Animals/Nature
125	Kearney Area Children's Museum	1989	STEAM,Arts&Crafts
126	Kentucky Science Centre	1977	STEAM
127	Kid Time Children's Museum	2004	Story Time
128	KidSenses Children's Museum	2004	Animals/Nature,Arts& Crafts,STEAM
129	Kid's Space Children's Museum	1979	Animals/Nature,Arts& Crafts,STEAM
130	Kid'S Play Children's Museum	2012	Arts&Crafts, Story Time
131	kidSTREAM	2016	STEAM
132	KidsQuest Children's Museum	2005	STEAM,Story Time
133	Kidzeum of Health and Sicence	1992	Animals/Nature,Arts& Crafts,STEAM,story time
134	KidZone Museum	1992	Animals/Nature,Arts& Crafts,STEAM
135	Kidzu Children's Museums	2006	Arts&Crafts,STEAM,St ory time
136	Knock Knock Children's Museum	2018	Arts& crafts and STEAM,Story time
137	Koch Family Children's Museum of Evansville	2006	Animals/Nature,Music, Story Time
138	Kohl Children's Museum of Greater Chicago	1985	Arts& crafts and STEAM,Story time
139	LaunchPAD Children's Museum	2016	Story Time,STEAM
140	Lincoln Children's Museum	1989	Animals/Nature,Arts& Crafts,STEAM
141	Lindsay Wildlife Experience	1955	Animals/Nature,Arts& Crafts
142	London Regional Children's Museum	1978	Music,STEAM
143	Long Island Children's Museum	1993	Animals/Nature, Arts & Crafts, STEAM
144	Longview World of Wonders	2009	Arts & Crafts, STEAM
145	Louisiana Children's Discovery Centre	2010	Story Time

146	Louisiana Children's Museum	——	Caregiver Resources, Imaginative
147	Lynn Meadows Discovery Centre	1915	Story Time
148	Magic City Discovery Centre	——	Arts & Crafts, STEAM
149	Maine Street Children's Museum	1976	Arts & Crafts, Story Times
150	Maine Discovery Museum	2001	Arts & Crafts, STEAM
151	Manitoba Children's Museum	1986	Arts & Crafts, STEAM, Story Time
152	Marbles Kid's Museum	1990	Animals/Nature, Arts & Crafts, Imaginative Play
153	Maybon Museum Complex	2004	Animals/Nature, Arts & Crafts, STEAM
154	McKenna Children's Museum	——	Arts & Crafts, Movement/Exercise, STEAM
155	Miami Children's Museum	1983	Arts & Crafts, Cooking, Music, Story Time
156	Mid-Michigan Children's Museum	——	Arts & Crafts, STEAM, Story Time
157	Minnesota Children's Museum	1981	Arts & Crafts, Music, Sensory Play, Story Time
158	Mississippi Children's Museum	1994	Literacy/Language Development, Movement/Exercise, STEAM
159	Mobius Children's Museum and Science Centre	2012	Cooking, STEAM
160	Montana Science Centre	2001	STEAM
161	MOSI (museum of Science and Industry)	——	STEAM
162	Mountain Top Children's Museum	2001	STEAM
163	MOXI,the wolf museum of exploration and Innovation	——	STEAM
164	Muncie Children's Museum	1975	GAMES
165	Museo De Los Ninos Costa Rica	1994	STEAM
166	Museum of Discovery	1927	STEAM
167	Museum of Discovery and Science	1976	STEAM
168	Museum of the Southwest: Fredda Turner Durham	1965	Literacy/Language Development, Movement/Exercise,

169	MUZEIKO:America for Bulgaria Children's Museum	2008	Animals/Nature, Arts & Crafts, STEAM, Story Time
170	National Children's Museum	1974	STEAM, Story Time
171	Neighbourhood North: Museum of Play	——	STEAM
172	New York Hall Of Science	1964	STEAM
173	New York Transit Museum	1976	STEAM
174	North County Children's Museum	——	STEAM
175	Northwood Children's Museum	1998	Music,Story time
176	Nutrien Wonderhub	——	Arts & Crafts, Movement/Exercise, STEAM, Story
177	Ohio Valley Museum of Discovery	——	STEAM
178	Omaha Children's Museum	1976	Arts&Crafts,STEAM,Story Time
179	Otter Cove Children's Museum	——	Arts & Crafts, Music, Story Time
180	Papalote Museu del Nino	1993	Music, Story Time, Arts and Crafts, Cooking
181	Pensacola Children's Museum	——	Arts & Crafts, STEAM
182	Peorla Playhouse Children's Museum	——	Arts & Crafts, STEAM, Resources, Literacy/Language
183	Pelph's Youth Pavilion (Waterloo Center for the Arts)	——	Arts & Crafts
184	Planet Play	1997	Movement/Exercise
185	Play Africa.	2002	Story Time, Caregiver Resources
186	Port Discovery Children's Museum	1976	Arts & Crafts, Music, Story Time
187	Portland Children's Museum	1946	Animals/Nature, Arts & Crafts, STEAM
188	Pretend Children's City Museum	2009	STEAM, Movement, Arts & Crafts, Story Time
189	Providence Children's Museum	1977	Arts & Crafts, STEAM, Story Time
190	Sacramento Children's Museum	2005	Music, Story Time, Movement/Exercise
191	San Diego Children's Discovery Museum	2001	Animals/Nature, Arts & Crafts, Music, STEAM, Story
192	San Luis Obispo Children's Museum	1990	Arts & Crafts, STEAM

193	Santa Fe Children's Museum	1985	STEAM, Arts & Crafts
194	Schoolhouse Children's Museum and Learning	2001	Story Time
195	Science City at Union Station	1999	Animals/Nature, Arts & Crafts, STEAM
196	Science Museum of Minnesota	1907	Animals/Nature, Arts & Crafts, STEAM
197	Science Center	1969	Animals/Nature, Movement/Exercise, STEAM
198	SciTech Hands on Museum	1988	STEAM
199	Scott Family Amazeum	2015	Animals/Nature, Arts & Crafts, STEAM
200	Seoul Children's Museum (Seoul Sangsang Nara)		Cooking, STEAM
201	Shenandoah Valley Discovery Museum	1996	Animals/Nature, Arts & Crafts, Imaginative Play
202	Southern California Children's Museum	2013	Arts & Crafts, Literacy/Language Development, Story
203	St. George Children's Musem	2013	Arts & Crafts, Music, STEAM
204	State Island Children's Museum	1976	Animals/Nature, Arts & Crafts, Music, STEAM, Story Time
205	Steppingstone Museum for Children	2000	Arts & Crafts, Music, Movement/Exercise, STEAM
206	tag! Children's Museum of St. Augustine	———	STEAM
207	TELUS spark	2011	Arts & Crafts, STEAM
208	Thanksgiving point	2014	Animals/Nature
209	The Building for Kids Children's Museum	1991	Animals/Nature, Arts & Crafts, Movement/Exercise
210	The Children's Museum in West Hartford	1927	Arts & Crafts, STEAM, Story Time
211	The Children's Museum At La Habra	1977	Animals/Nature, STEAM
212	The Children's Museum at Saratoga	1990	STEAM, Story Time
213	The Children's Museums in Easton	1986	Arts & Crafts, STEAM
214	The Children's Museum of Cleveland	1981	Cooking, Music, STEAM, Story Time
215	The Children's Museum of Green Bay	2012	Arts & Crafts, Movement/Exercise, Music, Sensory
216	The Children's Museum of Indianapolis	1925	Arts & Crafts, Movement/Exercise, STEAM, Story

217	The Children's Museum of Memphis	1990	Arts & Crafts, Games
218	The Children's Museum of the Upstate	———	Arts & Crafts, Movement/Exercise, Music, STEAM
219	The Children's Museum of THE Wilmington	1997	Animals/Nature, Arts & Crafts, Imaginative Play
220	The Children's Playhouse	2020	Arts & Crafts, Music, STEAM
221	The Doseum San Antonio's Museum for Kids	1995	Arts & Crafts, STEAM, Story Time
222	The Field Museum	———	Animals/Nature, STEAM
223	The Imperial Center	2005	Arts & Crafts, Movement/Exercise
224	The Iowa Children's Museum	———	Arts & Crafts, STEAM
225	The Lawrence Hall of Science	1968	Animals/Nature, Arts & Crafts, STEAM
226	The Magic House, St. Louis Children's Museum	1979	Animals/Nature, STEAM
227	The Muse Knoxwille	2013	Arts & Crafts, Literacy/Language Development, STEAM
228	The New Children's Museum	2008	Arts & Crafts, Cooking, Caregiver Resources, Story Time
229	The Science Zone	———	STEAM
230	The Strong	1982	Animals/Nature, Arts & Crafts, Story Time
231	The Woodland Children's Museum	———	Story Time, Theatre, Arts & Crafts
232	Treehouse Children's Museum	1992	Arts & Crafts, Music
233	Tulsa Children's Museum Discovery Lab	2007	Music, STEAM
234	Valley Children's Museum	2002	Animals/Nature, Arts & Crafts, STEAM
235	Virginia Discovery Museum	1981	Arts & Crafts, STEAM
236	Westchester Children's Museum	2001	Animals/Nature, Arts & Crafts, STEAM, Story Time
237	Wise wonders Science and Discovery Centre	2009	STEAM
238	Wonder Universe: A children's Museum	———	STEAM, Story Time
239	Wonder Works Children's Museums	2002	Story Time
240	Wonderfeet Kid's Museum	2012	Movement/Exercise

241	Wonderscope Children's Museum of Kansas City	1989	Movement/Exercise, Music, Story Time
242	WOW! Children's Museum of Kansas City	1996	Cooking, Story Time
243	Young At Art Museum	1989	Arts & Crafts
244	Zing Zumm Children's Museum of Jacksonville	2018	Arts & Crafts
245	Zoom Kinder Museum	1994	Arts & Craft, STEAM
246	Healthworks! North Missisipi	2009	Movement/Exercise, STEAM, Story Time
247	Madison Children's Museum	1991	Animals/Nature, Arts & Crafts, STEAM
248	Orpheum Children's Science Museum	1994	STEAM
249	Thinkery	2013	Arts & Crafts, STEAM, Story Time

In the webpage of association of children museums, there exist more than 350 members for the association.

- *Integrating formal educational approach parameters into informal education*

In the study, two major educational approach was covered which are Montessori Approach and Reggio Emilia Approach. Reggio Emilia, a 140,000-strong city outside of Milan, is renowned for providing high-quality care and education to children from birth to age six. Since 1963, the city government has overseen operating the schools that were founded by the parents after WWII, as well as opening new ones. Reggio Emilia's schools are based on a social constructivist system influenced by John Dewey and, Jean Piaget, Lev Vygotsky, Jerome Bruner (Gandini 1993, Dodd-Nufrio, A. T. 2011). Early Reggio Emilia educators were ardent followers of John Dewey, according to Lella Gandini (1993), a world expert on the Reggio Emilia method. Greenberg (1993) makes a connection between Dewey, Malaguzzi, and Reggio Emilia with the statement. (Gandini 1993, Dodd-Nufrio, A. T. 2011). One of the founding values of

the Reggio Emilia schools is a strong belief in the child's positive picture. It is premised on the idea that every child seeks to interact with others, learn new things, and form relationships with those around them. John Dewey founded the Chicago Laboratory School on the idea that a child is a developing and changing being who requires constant attention. Gandini 1993, Dodd-Nufrio, A. T. 2011). The influence of instructive space is highly valued in Reggio schools. It is deliberate in the arrangement of systems, objects, and events, while also providing opportunities for interactions, contact, and relationships. The atmosphere is pleasing to the eye, welcoming, and conducive to a variety of discovery and problem-solving activities. At all stages, communication is encouraged. (Desouza, J. M. S. (1999). The rights of children, parents, and educators are recognized and supported in this program. Children have the right to an education that allows them to reach their full potential, parents have the right to be active in their children's academic lives, and teachers have the right to professional development. Daily, parents play a significant advisory role in the administration of the school. And regularly engage in special activities, excursions, and celebrations. Another crucial consideration is the function of space. (Desouza, J. M. S. (1999).

When it comes to Montessori, another approach came to life again in Italy is Montessori Method. Montessori, a genius figure, and Italy's first woman physician developed a method that reflected a late-nineteenth-century vision of mental growth and theoretical kinship with the great European progressive educational philosophers, Jean-Jacques Rousseau, Johann Pestalozzi, and Fredrich Froebel (Edwards, 2002, Edwards, 2003 and Edwards, C. P. 2006). Montessori believed that children's natural intelligence included rational, scientific, and spiritual elements from the outset. She

founded her Casa de Bambini (Children's House) in 1907 for children aged 4–7 in a housing project in Rome's poor slums, building on the work of Edouard Seguin and Jean Itard to invent a technique for dealing with children with disabilities. Her educational movement (which included highly original ideas for curriculum materials, child-sized furniture, classroom layout, mixed-age grouping of children, and teaching strategies) spread to other countries, especially after Mussolini's Fascist regime denounced Montessori's methods and she left Italy to live the rest of her life abroad. (Edwards, C. P. 2006)

The study will investigate the Montessori and Reggio Emilia learning environments and their design criterions in children's museum context.

2.4 Educational Approaches of Reggio Emilia and Montessori

"Reggio Emilia is a town in the northern Italian region of Emilia Romagna. This region of Italy is wealthy and has become a model of economic development for the rest of the country due to the presence of 45,000 small and medium-sized enterprises which are involved in manufacturing, food. production and processing. Many towns are known for their own specialities such as parma for ham, Modena for Ferrari cars and machinery, and Reggio Emilia for cheese (Richards, 1995). However, Reggio Emilia has also become noted for its development of an early-years system of education known as the 'Reggio Experience' which has been epitomized by the following elements." (Hall, K. et al.,2014). Young children are encouraged to explore their surroundings and express themselves using all their 'expressive, communicative, and cognitive languages' accessible to them... There has been an explicit awareness of the link or collaboration between parents, educators, and children since the beginning...

The approach offers new perspectives on the nature of the kid as a learner, as well as the role of the teacher. (Edwards et al., 1998, pp.7-8)

According to New, R. S. (2007), there are five features of Reggio Emilia's approach to early education which are;

- A view on teachers as researchers

- Curriculum as long-term activities

- The importance of symbolic languages in the development and advocacy of children

- The significance of the environment

- A view of parents as collaborators in the educational process

Figure 9: Loris Malaguzzi(URL 19) Figure 10: A Reggio Emilia Classroom URL20)

"Montessori education is an educational approach developed by Italian physician and educator Maria Montessori. Montessori education is practiced in an estimated 20,000 schools worldwide, serving children from birth to eighteen years old. This philosophy was dominated by the principle of individual self-guided activity and child entered approach. Her ideas generated not only new didactic materials but also valuable concepts for the design and organization of living space for children (Borrelbach, 2009). Montessori system is different from anti-authoritarian systems where it is left up to the children to decide what to do. It attempts to make abstract knowledge more

concrete, more applicable in practice and more physical. The method seeks mainly to make the school more part of the world and therefore more accessible." (Al, S., et al.,2012). According to Hertzberger, (2008), general features of Montessori classrooms are as follows;

- In a classroom, students are of varying ages, ranging from three to ten years old.

- Montessori and her partners created specialized instructional materials.

- Everything that students utilize is laid out in an open and welcoming manner.

- Many distinct activities take place at the same time in the Montessori System.

- Because each kid is distinct in the Montessori concept, each child's growth is unique as well. The child is free to choose activities, and his sensitive times will guide him to the task that he is ready for and needs at the time.

- A constructivist or "discovery" paradigm is one in which students learn concepts through hands-on activities rather than through direct instruction.

- The teacher's desk is replaced with a 'help desk', a teacher station or enquiry counter where the children come for help and present their work, and classrooms are organized in 'rafts' to facilitate individual and small group learning.

- Blocks of time are reserved for work.

After investigating characteristics of Montessori and Reggio Emilia classroom's structure, the environmental design parameters of the preschool educational approaches mentioned will be explored.

Figure 11: Montessori (URL 21)   Figure 12: Montessori (URL 22)

2.4.1 Reggio Emilia Approach Environmental Design Criteria

Childhood is often the first place to start imaginatively seeing and using the environment. (Kytta,2002). The Reggio Emilia approach to education speaks of three teachers at any time as being in the classroom: the teacher, the child, and the environment. Over the years, Reggio Emilia 's municipal infant-toddler centres and preschools have built valuable mutual experience between educators and architects in developing schools for young children. This experience has contributed to a range of understandings and points of reference relating both to the allocation of space and to the planning and organizational decisions, providing guidelines for the design of environments based on parameters with a clear pedagogical identity as well as the physical arrangement of the space. For architects and designers, a set of detailed guidelines have been established that also have a clear theoretical and pedagogical connotation (Ceppi, G., & Zini, M. 1998). According to G. Ceppi and M. Zini, these guidelines are as follows.

-Recognizability

Recognizability requires the development of an architectural language and a specific identity ambient atmosphere. Though a school must be highly flexible and able to continuously relate to the society's new "languages" hence also the change in

appearance over time- it is important that it keeps its own specific identity. This does not mean simulating a home or representing a school in the traditional sense but a new identity with recognizable elements that allow the school to be identified as such immediately. (Ceppi, G., & Zini, M. 1998). As Izadpanah mentioned (2011, p.37) "The first impression of interior space is the visual impression. Visual identity is the first stage of defining the identity in interior space. Understanding visual art is possible for any person. It does not need to know the artist's language or character. The image tells the story ". (As cited from Laer&Pentak,2005) As Izadpanah stated (2011, p.38) " the identity of interior space is the nonverbal communication between users and the interior environment. Interior space communicates with the users with its elements. Sink in the Kitchen talks about the washing action and curtains speak the amount of light and level of visibility. " (As cited from Augustin,2009).

Figure 13: Vittra School Södermalm
(URL 23)

Figure 14: Vittra School Södermalm
(URL 24)

Figure 15: Plan View of Vittra School Södermalm (URL 25)

-*Horizontality*

> "Architecture is a kind of language, one that most designers, builders, and decorators speak, sometimes fluently and sometimes clumsily, and that all of us hear. In many ways it is a more universal language than words, since it uses three dimensional shapes, colours and textures rather than words." (Lurie, A. ,2014).

Buildings can metaphorically express an attitude about what is going on within, like how our clothes, hair style and length, automobiles, and residences distinguish us from our neighbours. (Sanoff, H.,1995). The horizontal layout of the school building underlines the conscious choice not to create hierarchies between the different spaces: the service areas, the work areas for adults and children, the classrooms and offers all play an important and shared role. Therefore, horizontality is the physical expression of a function society, equal equality, and sociality. This preference has been kept over time and still is true in the Reggio Emilia infant-toddler centres and pre-schools, although it has been incorporated with a new sensitivity and attention to the volumetric

46

complexities of the different spaces, with the goal of supplying more learning opportunities (Ceppi, G., & Zini, M. 1998).

Figure 16: A Photo Which Shows The Horizontality of Yoshi Nursery By Tatta Architects

Figure 17: An Interior Photo of Yoshi Nursery By Tatta Architects (URL 26)

-Central piazza

Another significant aspect is the inclusion of a wide main area called the piazza (town square), facing the school's main spaces. The piazza is a meeting area, a public place of the school that plays the same function as the piazza in the city in the school building. Here too, the option has a pedagogic connotation in terms of spatial distribution and layout:

The piazza facilitates the development of relationships, symbolizing the 'relationship pedagogy' in the sense that it enables interactions, group interaction, tales, social relationships, and the assumption of a public identity by children. At the same time,

the use of a central piazza removes the need for corridors, and this is another distributive factor based on a pedagogical choice: the rejection of spaces dedicated solely to distribution and connection, and therefore those that are not easy to use. (Ceppi, G., & Zini, M. 1998).

Figure 18: A Photo Showing The Central Piazza Example Of Early Childhood School In San Felice Designed By ZPZ Partners (URL 27)

-*Transformability and flexibility*

The second setting must lend itself to the exploitation and transformation of children and adults alike and must be available to multiple uses. To be constantly modelled and re-designed because of the experimentation of children and teachers, the school should be able to adapt during the day and during the year. Where proper, both short and long-term changes should be taken into consideration in the construction of the design school. Transformability in the short term can be achieved by using:

-Of partitions,

-Giving components that may include other materials and equipment,

-Movable panels for walls

-Screens for play and projection of shadow,

-Movable, rotating, or wheeled furniture.

In the long term, transformability entails:

-The physical alteration capacity of spaces, i.e., technological systems (electrical heating, plumbing) and structures that allow changes over time.

Expandability, which means the possibility of extending the school, adding spaces over time (workshops, classrooms, other spaces) and through successive refinements and changes to create the overall project.

-The varied use of rooms. The preference was to prioritize the group's consistency over time in the Reggio Emilia preschools. This ensures that during their infant-toddler centre or school experience, each group of children (divided by age) retains the same teachers but switches classrooms, each year using the room set up for their age group. In this way, the rooms will have features explicitly dedicated to the various ages of children. (Ceppi, G., & Zini, M. 1998).

Figure 19: Photo Showing London
School's Transformable Curtains. Wheels

Figure 20: Photo Showing London
Schools' Furniture With Wheels
(URL 28)

-*Atelier*

Every child-toddler centre and preschool are fitted with a studio space called the
atelier, which is contemporary rather than a replacement for the classrooms and adult
workspaces. The workshop is used to investigate, experiment, and manipulate a range
of materials. A special instructor named 'atelierista' in preschools, with a background
in visual languages, works in partnership with teachers in the classroom with an
emphasis on seeing and encouraging the learning and artistic processes of children.
Together the atelier and classrooms become a hands-on facility and an evaluation and
documentation hub. This idea has been further evolved over the years in the Reggio
Emilia preschools by incorporating 'mini-ateliers' in each classroom. (Ceppi, G., &
Zini, M. 1998).

Figure 21: A Photo Showing An Atelier From A Reggio Inspired School (URL 29)

-*School as workshop*

While some spaces (like the atelier) are clearly organized for direct inquiry and
experimentation, the whole school is used as a workshop for autonomous learning for
children.

With this basic concept in mind, each space is structured and is therefore fitted with materials that ease exploration. It is necessary for all school spaces, according to their unique characteristics, to be open and available to the children, including the kitchen and office, to be occupied and used. (Ceppi, G., & Zini, M. 1998).

-School as community

A fundamental concept of the Reggio Emilia infant-toddler centres and preschools is the close relationship between the school and the town. In terms of osmosis with the surrounding aesthetics and culture, and in the distribution of space, schools of architecture and design should embody this concept. The school building should be equipped for use outside of our school and for various activities that may not be strictly 'school-based': from teacher meetings and professional development seminars to parent-teacher meetings, parties and extraordinary events, meetings of the parent advisory board, and neighbourhood activities. (Ceppi, G., & Zini, M. 1998).

-Inside-outside relationship

The strong relationship between the inside and outside of the school building is another significant element. A school should be a place that senses what happens outside from the weather to seasonal changes, from the time of day to the city's rhythms, precisely because it exists in a particular place and time.

This inside-outside relationship is fostered by several elements:
-'filter' spaces (porches, verandas, canopies)

-Interior courtyards and conservatories (open or covered)-specific use of outdoor areas:

Hillocks, equipment for play, pathways, particularly equipped areas

-Installations for making the conduct of physical forces visible (wind, water, etc.)

-The entrance, which supplies information about the school and activities, the place of welcome and greetings.

-Transparency

In the Reggio Emilia schools for young kids, the idea of 'transparency' has grown over the years. Originally, the concept was related to the exposure of the building elements and technology, to the declaration of the static position of the individual components, giving these components a positive meaning. The value of the principle of openness, but more at the spatial level in terms of the succession of observable spaces, continues to be underlined, i.e. The tendency to glance from one room to another, which is at least partly understandable. Transparency does not exclude opacity but focuses on providing a sense of field depth and spatial perception.

-Communication

Communication is a basic premise for any operation that requires study, exchange of ideas and debate, both within the school and with the outside, and is therefore an essential element of the educational project in Reggio Emilia's infant-toddler centres and preschools.

Project pedagogy, listening, subjectivity and communication are focused on the relationship between three topics: students, teachers, and parents.

This 'relationship pedagogy' was built with the participation of parents as active mem

bers of the school, with the increased need for broad spaces for inside   and outside

contact and recording, including adults and children, parents and teachers, the city

and other cities and cultures, and the places where culture is pushed.

Over the years, the teacher's position has changed along with the evolving concept of

teaching, which now includes detailed observation and recording systems (viewed as

interpretation and narration). These structures form the basis on which teachers

represent and improve their understanding of the person and community strategies of

children in the learning and affective processes and provide a valuable tool for the

continued professional development of teachers as well as for contact and discussion

with others. Communication has grown to become a 'second skin' that covers the

school as the manifestation of these needs and functions, a kind of architecture that

overlays the basic architecture, like photos, sketches, children's work, videotapes,

computer printouts, items. Posters, paintings, pictures. The doors of the classroom, a

prominent place of passage, often serve as communication support and exploration for

the children (e.g., mirrors hung at child height). A variety of basic features should be

kept in mind within the framework of continuous communication.

-The walls should allow for wide-ranging presentations of several types (two-

dimensional and three-dimensional) so that the atmosphere represents and shares with

the children the life of the school and the activities carried out. Specific types of

communication include certain areas, such as the entrance, the staff room, and the

kitchen, where the display structures should be modifiable as required.

-Filter zones located outside but close to the classrooms are often required to allow a simple and unhurried exchange of information in the daily contact with the families. Adequate resources are needed for in-depth observation and documentation: tape recorders, cameras, video cameras, slide projectors and overhead projectors, instruments that have become indispensable for work and communication.

-The room should be structured effectively to record the work and projects carried out with the children, to ensure easy teacher consultation and to establish administrative and educational archives.

2.4.2 Montessori Environment Criteria

According to **(URL 30)** 'There about 20,000 Montessori schools around the world, including 5,000 in the U.S., of which more than 500 are public schools — district, magnet, and charters.

Each school operates independently, but there are several national organizations schools can join and seek accreditation with if they choose. The two largest organizations are the Association Montessori Internationale-USA (AMI-USA) and the American Montessori Society (AMS, URL 31**)**. As Al S., Reyhan S. M., Kahya C.N. (2012) mentioned, articulated space, learning street, outdoor learning space, social spaces, personalized environment, and anthropometric design are the design parameters used in Montessori method. As Herzberger H. points out, "Not only does the school become like a city; with learning expanding beyond the school curriculum, it is important that our entire. environment is educational."

-*Articulated Classrooms*

The unidirectional transfer of information that is the foundation of teacher-led lessons works best in an unarticulated rectangular classroom. This primitive model provides teachers with the best possible description of their students. An articulated room, on the other hand, is more difficult to survey and offers more opportunities for distinct groups or individuals to participate in different activities at the same time. The more articulated or modelled a room is, the more opportunities it offers for differential learning. (Herzberger H. ,2008).
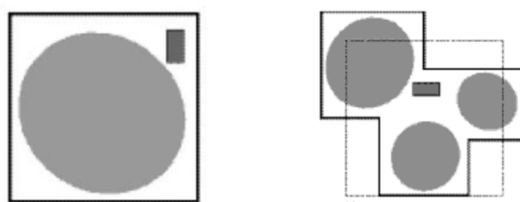
Basic Classroom   **Articulated Classroom**

Figure 22: A Schematic Example Of Basic Classroom And Articulated Classroom (Herzberger H. ,2008).

-Learning Street

There are school buildings where learning and teaching are not limited to classrooms, where there is as much going on outside the classrooms as there is within, and where there are no longer any corridors with coats hung everywhere and bags and rucksacks strewn about. What used to be a place to walk through is now a place to stay. As a result, as shown in Figure 23, it is critical to plan this zone to promote the most number and variety of places where you can work attentively and without being unduly disturbed, whether alone, in pairs, or in a larger group. These locations must have an elevated level of exposure, allowing others to come along and either join in or participate in their own operation. Workplaces should also have some protection and cover while remaining open enough for you to see and be seen by others.

Consequently, the most important task facing the architect is to achieve this balance between spatial conditions. Apart from the program's space allocations, which do not actually include enclosed spaces and are mostly only used for a portion of the time, the main problem is to build as many designated offices or corners as possible, giving people an opportunity to stay, even if only for a brief time. This welcoming quality quickly necessitates additional space, at the very least more space than is needed for circulation alone. It does have. What were once simple circulation corridors have been turned into a true learning environment where people can walk while working and passers-by can be attracted to the staff without distracting them. Here, rather than anything else, the spatial qualities decide whether you feel at home or lost, and whether you are inspired to continue exploring the World you are in. As you progress through the school, you can become more interested with what the other students are doing and more eligible for the variety of choices available. This should foster your interest and provide you with some ideas. The more resources available, the more the school becomes a model of the world that children can comprehend. By comparison with the promenade architectural Le Corbusier would have imagined when he thought of the sequence of experiences acquired when traveling through a space with its shifts in lighting, perspectives, vistas, height, and colour, a journey through the school becomes an educational promenade. (Herzberger H. ,2008). Displaying children's work provides an opportunity to contribute to the playroom's educational environment. When children's methods and products are displayed, their learning is visible, allowing them to relive their creative experience. (Sanoff, H. ,1995).

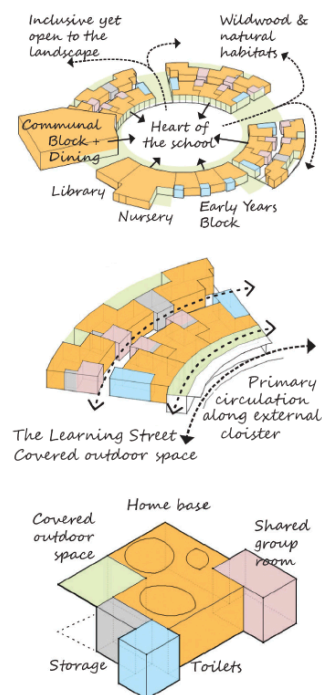Figure 23: A Photo View From Polygoom Primary School, Almete (Herzberger H. ,2008).

Figure 24: A Photo Showing An Example Of Learning Street In The University Of Cambridge (URL 31)

 -*Outdoor learning space*

The outdoor climate, according to dr. Montessori, is a natural extension of the classroom. Children will build on their classroom awareness through sensorial experiences of nature and regular interaction with the seasons and the natural world in our outdoor environments. Children become more aware of nature as they grow older, and they are better able to comprehend the needs of the world around them and how they can help. **(URL 32)** A person is both at the heart of his environment and a part of

it. As a result, he is both influenced by and impacts his environment through his

activity. In this way, he shapes his actions. As a result, the environment and behaviour

are intertwined, and the physical environment influences behaviour and learning

through various affordances (Acar, 2009). According to Department of Education and

Skills (DES,2006),

> "Learning outside the classroom manifesto, the potential for learning is maximised if we use the powerful combination of physical, visual, and naturalistic ways of learning as well as our linguistic and mathematical intelligence. By helping young people apply their knowledge across a range of challenges, learning outside the classroom builds bridges between theory and reality, schools, and communities, young people, and their futures. Quality learning experiences in 'real' situations have the capacity to raise achievement across a range of subjects and to develop better personal and social skills."

As Meier, et al. mentioned in 2013,

> "a key component of effective, early childhood education is building and strengthening connections to other humans, to content knowledge, and the broader world surrounding young children. At a cognitive level, strong connections increase the effectiveness of memory and allow for more complex and abstract levels of understanding and problem-solving. From a social emotional stance, connection is how people build feelings of stability and safety that support emotional resiliency and the ability to move toward self-regulation. Connection with nature needs to be considered within this broader construct of how young children make meaning of their place in the world."

-*Social space*

In comparison to conventional classrooms, Dewey believed that schools and

classrooms should reflect real-life environments, enabling children to engage in

learning experiences in a variety of social settings interchangeably and flexibly.

(Dewey, 1938; Gutek, 2014 Williams, M. K. ,2017). Constructivism, a learning

philosophy based on the work of Jean Piaget, Lev Vygotsky, and Jerome Bruner,

asserts that learners deliberately construct information rather than having it

"transferred" from some source of instruction. It is founded on the premise that

"experience generates information and meaning" and that "knowledge is both person and social" [10]. Since learning is a self-driven process, learning environments should encourage the learner to exercise as much self-control as possible. Cobb claims that information is created in two ways: through social contact and in the mind of the person. (Williams, M. K. ,2017). Montessori approach is providing convenient places for students to socialize with one another. (Al, S., Sari, R. M., & Kahya, N. C. 2012)

-Personalized environment

Allowing users to personalize their space is one way to build a sense of belonging in a community. Personalization is a territorial activity in which one person, or a group of people decorate and/or modify their surroundings with personal objects to represent individual and collective expressions of identity. (Harris & Brown, 1996; Wells, 2000; Wells & Thelen, 2002). The room ''becomes an extension of the sense of self, offering a physical support of the self-image and a vehicle for experiencing the sense of self'' when it is personalized. (Harris & Brown, 1996). The desire to express oneself in the world begins in childhood and continues throughout one's life. Parents and educators, on the other hand, often make the mistake of attempting to build a customized atmosphere for children rather than allowing them to do so for themselves (Cooper-Marcus, 1992).

-Anthropometric design

Substantial changes in body proportions, body strength, competence, and other physical and psychological factors characterize the 18-year period between birth and early adulthood. We weigh 312 kg and are about 50 cm tall when we are born. The trunk accounts for 70% of the total length. In the two decades that follow, body length triples or quadruples, while weight triples or quadruples. (Elbert et al.,2018).

Anthropometry is a science primarily concerned with measurement of the human body to identify differences in persons, classes, etc. (Panero, et al. 1979). Equipment should be built according to anthropometry, biomechanics, and hygiene principles (Grieco, 1986) and can help minimize injuries and overuse syndromes to improve efficiency. Education is the most productive way of guaranteeing economic growth and national development in countries. (Odediran, S. et al 2015). Efficient teaching can be done in classrooms in a safe and stress-free environment. (Zeimet al.,2011).
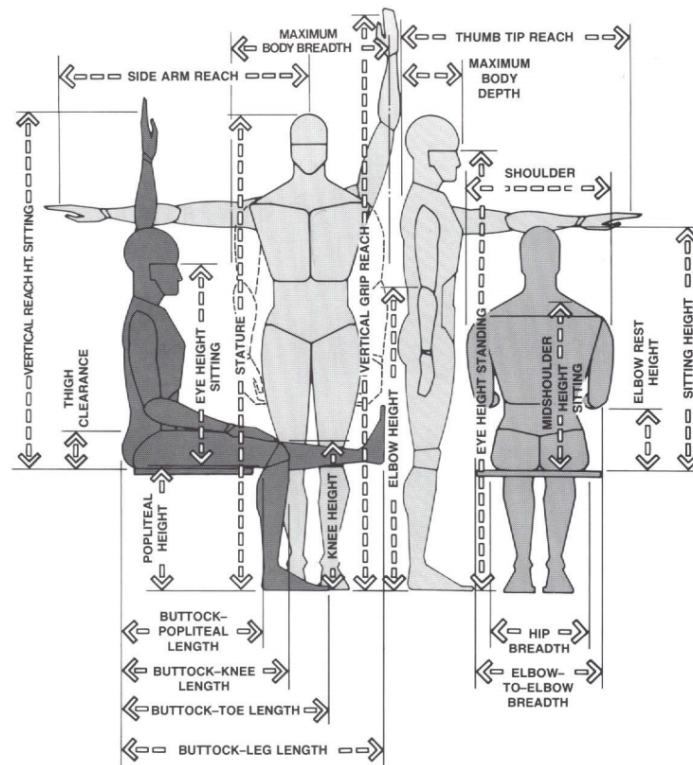
Spaces Figure 25: Most Preferred Body Measurements By The Designer Of Interior Spaces (Panero, J., & Zelnik, M. ,1979).

Figure 26: Peaceful Pathways Montessori Academy In The USA Showing Furniture Designed With Children's Size (URL 33)

2.5 Chapter Conclusion

The effects of space on learning have been the subject of many disciplines researching learning for years. In this study the effects of space on learning are used as the desired result, and the environmental design parameters of educational philosophies (Montessori and Reggio Emilia) are used as analysis tools. Reggio Emilia and Montessori have been studied under 17 sub-titles. Recognizability, horizontality, central piazza, transformability and flexibility, atelier, school as workshop, school as community, inside-outside relationship, transparency, communication, articulated classroom, learning street set-up, outdoor learning space, social space, personalized environment, and anthropometric design. In this study, the design parameters to be used for analysis were chosen with the principle of not visiting the space everyday but instead visiting space periodically. Anthropometric design, social space, outdoor learning space, and the recognizability in design are the selected criteria. Anthropometric design examines the suitability of the space for the child's body to provide constant attention span, social space is like squares in urban design is used as a parameter to measure if there exist a social sharing of learning for different

educational background children and different age groups. Indoor outdoor learning environment is to emphasize the importance of nature when constructing some knowledge. Outdoor environment is a wealthy resource for learning as well.

Chapter 3

A REVIEW OF SELECTED CHILDREN'S MUSEUMS

In this chapter, general information on the selected case studies will be given and the interior spaces of children's museums will be discussed according to the defined design parameters in chapter 2 and at the end of the chapter, the selected interior spaces from children's museums will be investigated and analysed in the light of learning.

3.1 Proposed framework for analysing Selected Examples

The selected children's museums globally will be analysed with 4 environmental design criteria used by 2 known preschool approaches-Montessori and Reggio Emilia. Three of the criteria are from Montessori approach, which are 'anthropometric design, social space, outdoor learning space' and the one is from Reggio Emilia approach which are 'recognizability.' Selected children museums interior spaces from photos and architectural buildings will be analysed with the parameters of anthropometric design, social space, indoor/outdoor learning space and recognizability.

Table 6: Sample Format Template for Analysis of Selected Children's Museums3.2.

	Location: Architect: Content:
Recognizability	-
Social space	-
Anthropometry	-
Outdoor Learning Space	-

3.2 Selected Examples

Boston Children's Museums with a content of arts& crafts, STEAM, story time, Chicago Children's Museum with a content of animals & nature, arts& crafts, imaginative play, Incheon with a content of science, Children's Museum of Art with a content of arts, Brooklyn Children's Museum with a content of animals and nature, arts& crafts, Indianapolis Children's Museum with a content of Arts &Crafts, movement,/exercise ,STEAM, storytime, Knock-knock children's museum with arts & crafts, STEAM and story time, Muzeiko; animals and nature, arts & crafts, STEAM, story time, Papalote Children's Museum with a content of music, story time, arts&crafts, cooking were selected as cases of the study. Cases were selected from secondary resources and the important criteria to select the cases are;

. *Having accessible architectural information from secondary sources*

. Having different contents

3.2.1 Boston Children's Museum
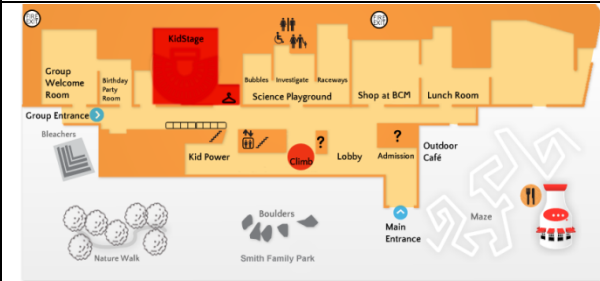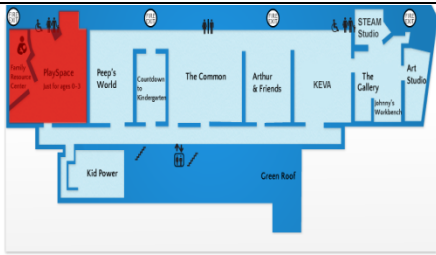
The Boston Children's Museum is the second-oldest children's museum in the United States. The Boston Children's Museum is situated on the Fort Point Channel in Boston. (Beaumont, L., 2010). It was established in 1913 as a hub for the sharing of materials and ideas to advance the teaching of science by the Science Teachers' Bureau, a

community of visionary educators committed to providing new opportunities for both teachers and students. It has been engaging chi for over a century. Play is used as a tool to spark children's natural innovation, curiosity, and imagination in the Museum's displays and programs, which emphasize hands-on interaction and learning through experience. Exhibits geared toward children and families include science, history, environmental awareness, health and wellness, and the arts. Educators at museums create a variety of programs and events that focus on literacy, the performing arts, science and math, the visual arts, languages, and health and wellness. The Museum also has a collection, making it one of the few children's museums in the world to do so. Americana, Natural History, Global Culture, Native American, Dolls and Dollhouses, and Japanese objects are all included in the Museum's collections. Boston Children's Museum, one of the largest children's museums in the world, also offers museum consulting services and produces award-winning traveling exhibitions, staff training curriculum, and display kits for museum professionals. **(URL 34)**

Table 7: Boston Children's Museum, establishment time and content

Name of The Museum	Date of Establishment	Content
Boston's Children's Museum	1913	Arts/crafts Storytime STEAM

Table 8: Boston Children's Museum, floor maps and photo

First floor plan (URL 35)	Second floor plan (URL 36)
Third Floor Plan (URL 37)	**Photo from front elevation (URL 38)**
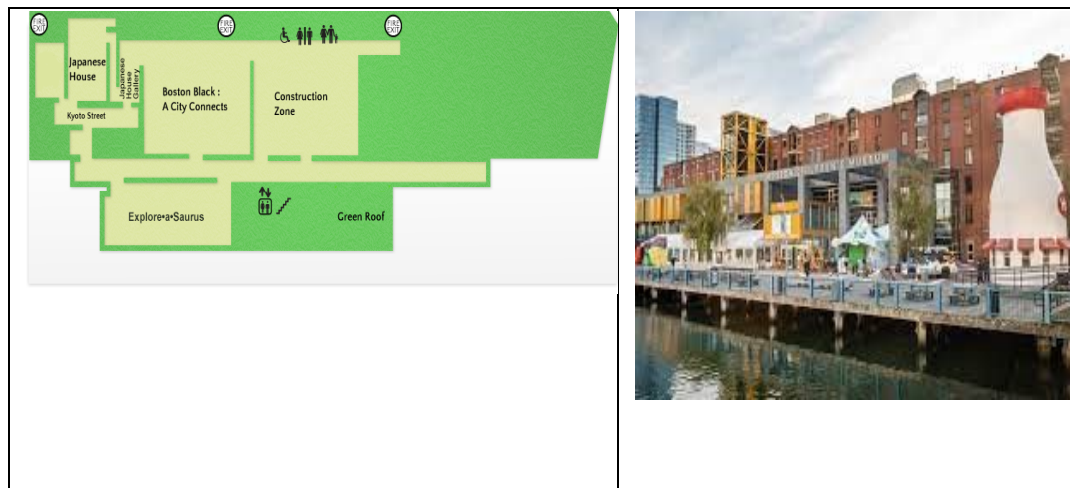
Recognizability

As it was mentioned in the second chapter, as a learning criteria of Reggio Emilia approach, recognizability is related to speaking a specific architectural language which means using interior design elements in a rhythmic way. In Boston children's museum, there is a milk bottle designed uniquely for only this building and there is a special climbing sculpture designed for this museum. These two specially designed objects are designed only for Boston children's museum, and it is accepted as an identical feature of the museum, which helps to create a 'sense of place' by the user group.

Table 9: Photo view of Boston Children's Museum Which Shows Recognisability

Social Space

Boston Children's Museum (URL 41)
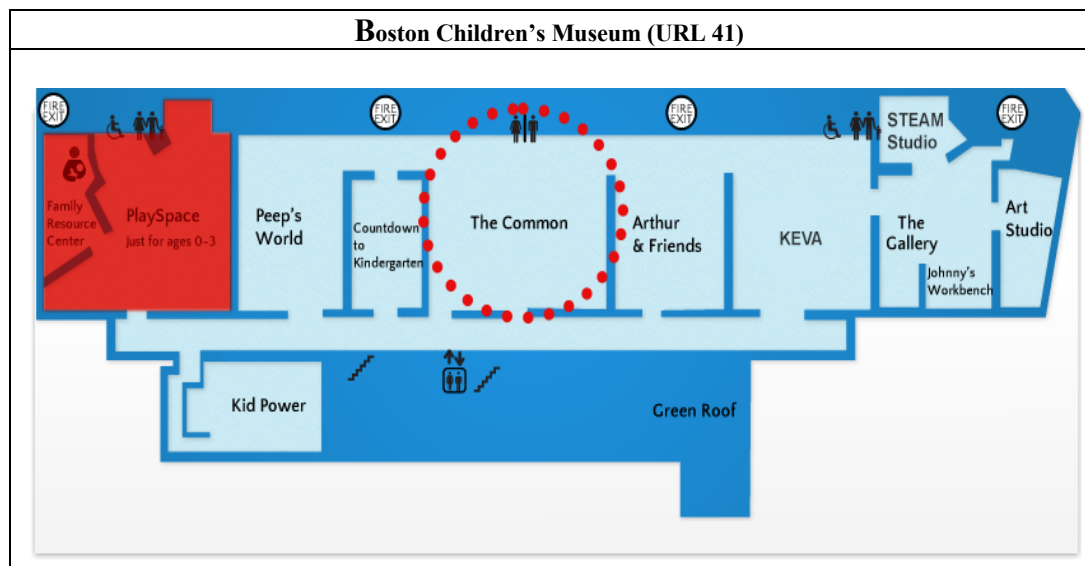
Figure 27: Peaceful Pathways Montessori Academy In The USA Showing Furniture Designed With Children's Size

- As it was seen from the floor plan there is a place called 'the common,' which is created to place a social place that all user groups can met without a specific age group. As it is remembered from second chapter, Montessori offered a common place to contribute sharing knowledge to enhance learning output.

Anthropometric Design

Boston Children's Museum interior

| (URL 42) | (URL 43) | (URL 44) |
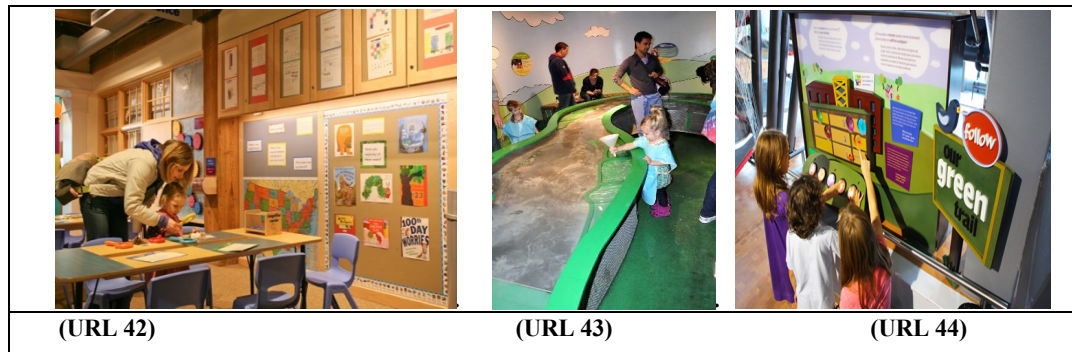
Table 10: Photo view of Boston Children's Museum which shows Anthropometric Design

As it was stated in Dr. Montessori's Own Handbook

"The special characteristic of the equipment of these houses (children houses of Montessori) are that it is adapted for children not adults. They contain not only didactic materials specially fitted for the intellectual development of the child, but also a complete equipment for the management of the miniature family".

(p.14, 2011) As it was observed from the photos of Boston Children's Museum,

- All chairs and tables are designed suitable for the user groups dimensions. They can sit, stand without interrupting design components.

-Shelves are designed as reachable for children measures.

-The playgrounds are designed in an appropriate anthropometric measure for safety.

-Eye levels of users were thought while designing the exhibition places.

Both Approaches highlighted the importance of environment in learning

Outdoor learning space

| Boston Children's Museum |

(URL 45)

Figure 28: Plan view of Boston Children's Museum which shows Outdoor Learning Space

- Museum's new front façade and the boardwalk with the branches of public harbour which passes in front of the museum, the children's plaza constructs a space of variety and texture which in turn combines the senses with the mind.

-In front of the building, a new landscape designed which directs the users to the entrance.

According to dr. Montessori, "it is not the work and actual produce of the garden but the activities of 'living naturally' that enhances the child's development ". (Montessori, M. ,2013).

- **Evaluation of Boston Children's Museum**

Table 11: Evaluation of Boston Children's Museums with Selected Parameters

	Location: Boston, Massachusetts **Architect:** Adapted Building **Content:** Arts, Crafts, STEAM, story time
Recognizability	✔
Social Space	✔
Anthropometry	✔
Outdoor Learning space	✔

68

As shown in table 8, all parameters, recognizability, social space, anthropometry and social space were fulfilled while designing Boston Children's Museum.

- **Interpretation of Boston Children's Museum**

As it is predicted above in table 8, Boston Children's museums interior design is very suitable in in terms of environmental parameters offered by Reggio Emilia and Montessori approach used in this study. It is recognizable because of the milk bottle is an iconic feature. For Boston Children's Museum. "The Milk Bottle was built in 1934 by Arthur Gagner of Taunton, Mass., to dispense the homemade ice cream he produced. Standing 40 feet tall and weighing in at 15,000 lbs., the Milk Bottle was one of America's first fast-food drive-in restaurants and an authentic example of the "Coney Island" style of architecture. If real, it could hold 58,620 gallons of milk. " (URL 46)

There is a space called common space seen in the second-floor plan, that gives the museum a 'social space' in order to gather different users. All the furniture, playgrounds, shelves, and exhibition cabinets were designed based on the recommended user group's body dimensions as an anthropometric design parameter which is fulfilled by the design and there is an outdoor learning space which was designed by Michael Von Valkenburg. The Outdoor landscape connects the museum front with the walkway of harbour in front of the museum. The landscape elements used that is to say textures, materials and benches selected in a way to stimulate the senses of children and engage their minds and senses.

3.2.2 Chicago Children's Museum

The Chicago Children's Museum is in Chicago, Illinois, along Navy Pier. It was formed in 1982 by the Junior League of Chicago in response to Chicago Public Schools

programming cuts. Initially situated in two halls of the Chicago Public Library, it quickly expanded to include trunk presentations and traveling exhibits in response to overcrowding. The museum relocated several exhibits. (URL 46) The goal of the Chicago Children's Museum is to enhance the lives of children by building a community where play and learning are intertwined. (URL 47)

Story of Chicago Children's Museum

In 1982, a group of Junior League of Chicago members saw cuts to children's arts programs all over the city and decided to act. They created Express-Ways Children's Museum, which would later become Chicago Children's Museum, in collaboration with the Education Resource Centre, Columbia College, and Loyola University. CCM has expanded from that museum, located in a few hallways in what is now the Chicago Cultural Centre, to what it is today: a location that has delivered arts programs, STEM experiments, creative play, and more to over 11 million children and their parents and caregivers over the last three decades. (URL 48)

Table 12: Chicago Children's Museum Floor Maps and Photo (URL 49-50-51-52)

First floor plan (URL 49)	Second floor plan (URL 50)
Third Floor Plan (URL 51)	Photo from front elevation (URL52)

Recognizability

Zoom room (URL 53)	Cloud blaster (URL 54)

Skyline (URL 55)	Tinkering lab (URL 56)
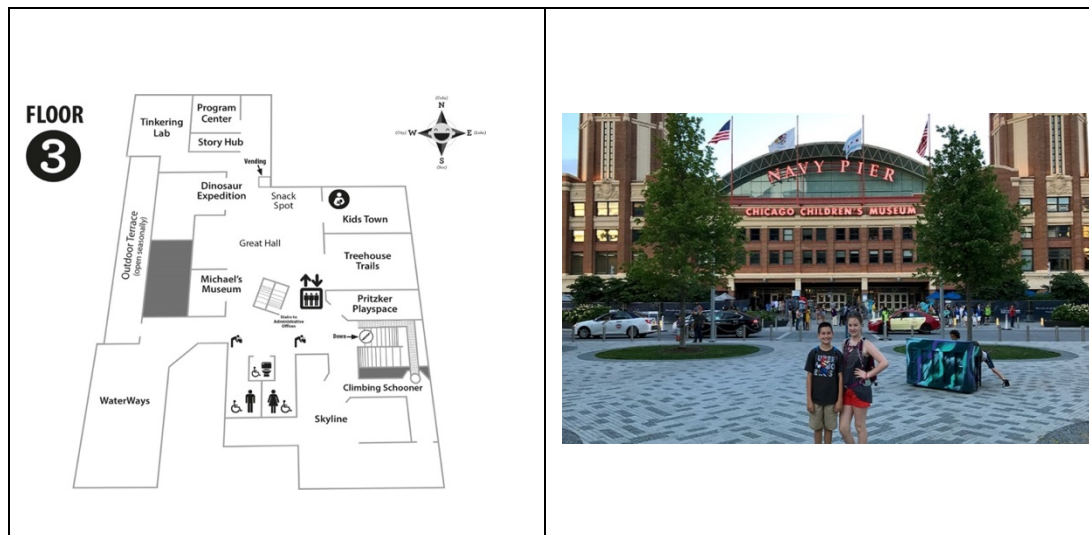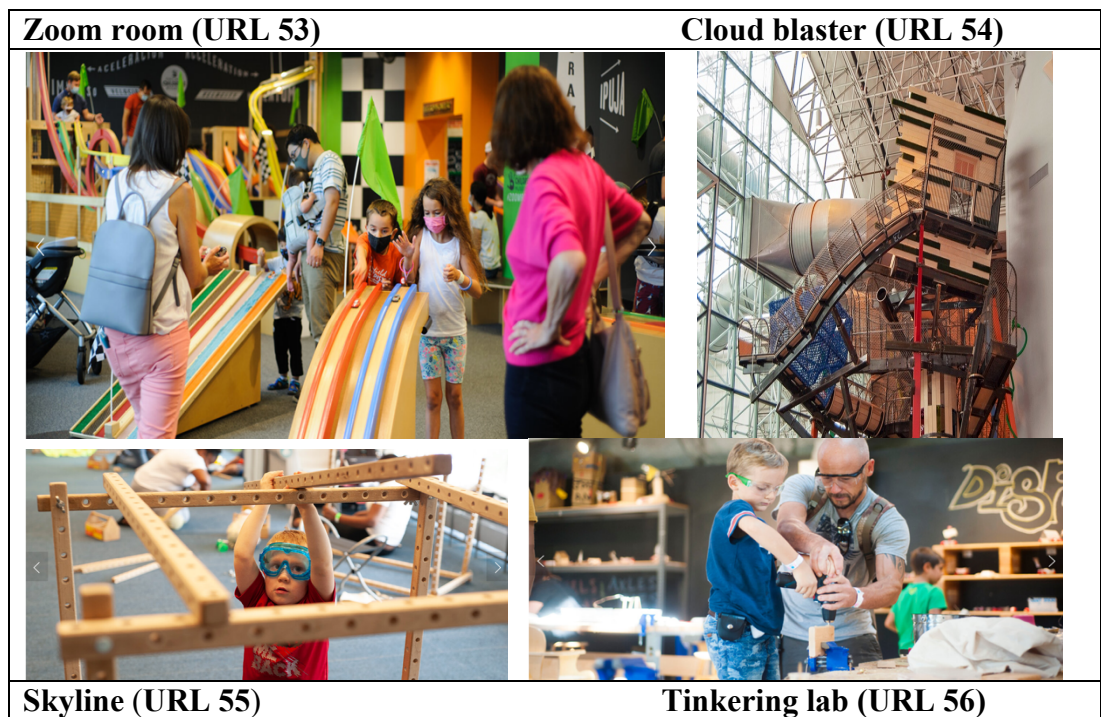
Table 13: Photo view of Chicago Children's Museum which shows Recognisability

While designing the museum, exhibits were categorized by 2 subgroups. One of them is with age the other is space. In age group, the categories were divided into three sub-headings.

-Babies and toddlers
-Ages 4-8
-Ages 9 plus.

In space group categories

- 'Cloud baster designed for MUSEUM climbing. It is one of the identical features of Chicago Children's Museum.

- In Zoom room teen take driver's sit and send toy cars to curves, loops, and experience crash sites.

- In 'Skyline exhibits 'teens experience to build skyscraper of their sizes, which enhances their problem-solving skills.

- In 'Tinkering Lab,' the users can use drills, Hammes and other tools to create contraptions.

This identical feature is especially important of factor while establishing a spatial identity.

As it was highlighted in Reggio Emilia Approach, forming a unique architectural language is important for children to enhance learning.

Social Space

Table 14: Plan view of Chicago Children's Museum which shows Social Space

Chicago Children's Museum (URL 57)	(URL 58)
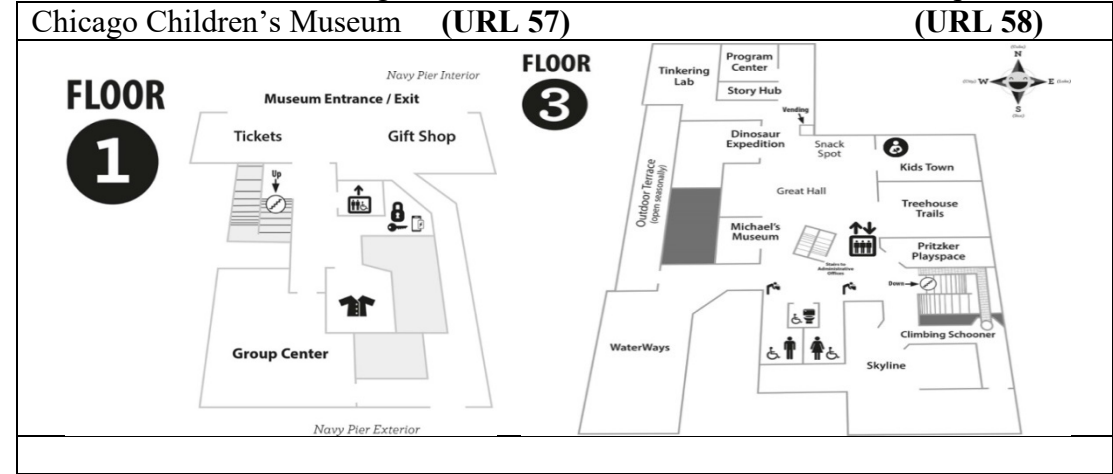
- As it is observed from the building plans, one called 'group space' in ground floor plan, and the other called 'great hall' in the 3ʳᵈ floor plan, there are two gathering places as a social place where the different user groups from birth to after 9 exists and can be used as a gathering place to visit identified places. Dr. Montessori offered social meeting places to contribute sharing their knowledges.

Anthropometric Design

Table 15: Photo view of Chicago Children's Museum which shows Anthropometric Design

(URL 59	Chicago Children's Museum	(URL60)
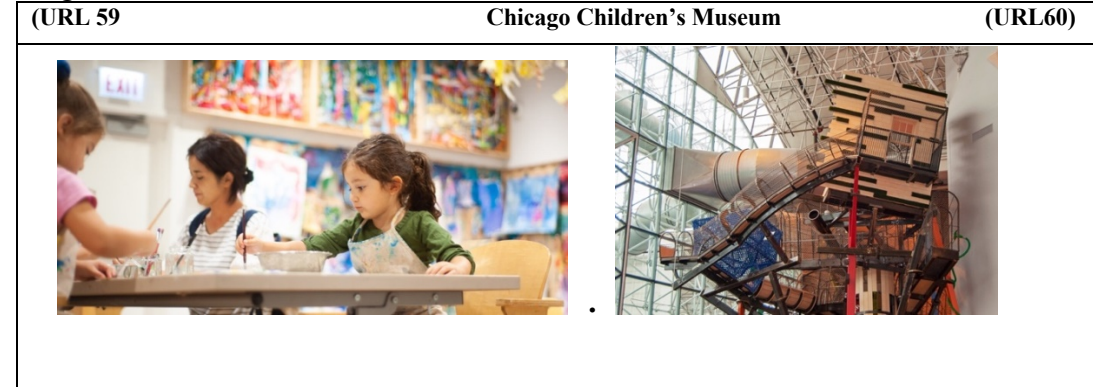
(URL 61)   **(URL 62)**

"Montessori created a school environment to make up for the impoverished conditions of many of the children's homes. She determined that to be comfortable, young children need furnishings their own size and tools that fit their small hands. Because such things were not available at the time, Montessori made many of her own materials." (Mooney, C. G. ,2013). In the Chicago Children's Museum;

- All the chairs and tables were designed by the principle of anthropometric measures of targeted age groups.

- Frames on walls were arranged for eye level to the user groups ages.

- Shelves in the playgrounds were designed that, users can reach and take the things they need safely.

- The width of the climbing net tunnel is arranged with suitable body measures of targeted ages for safety.

- The atelier furniture, height of the tables, distance of stool from tables and their height and width were designed by taking body measures of user group.

Outdoor Learning Space

Chicago children's museum Indoor/Outdoor Learning Space (URL 63)
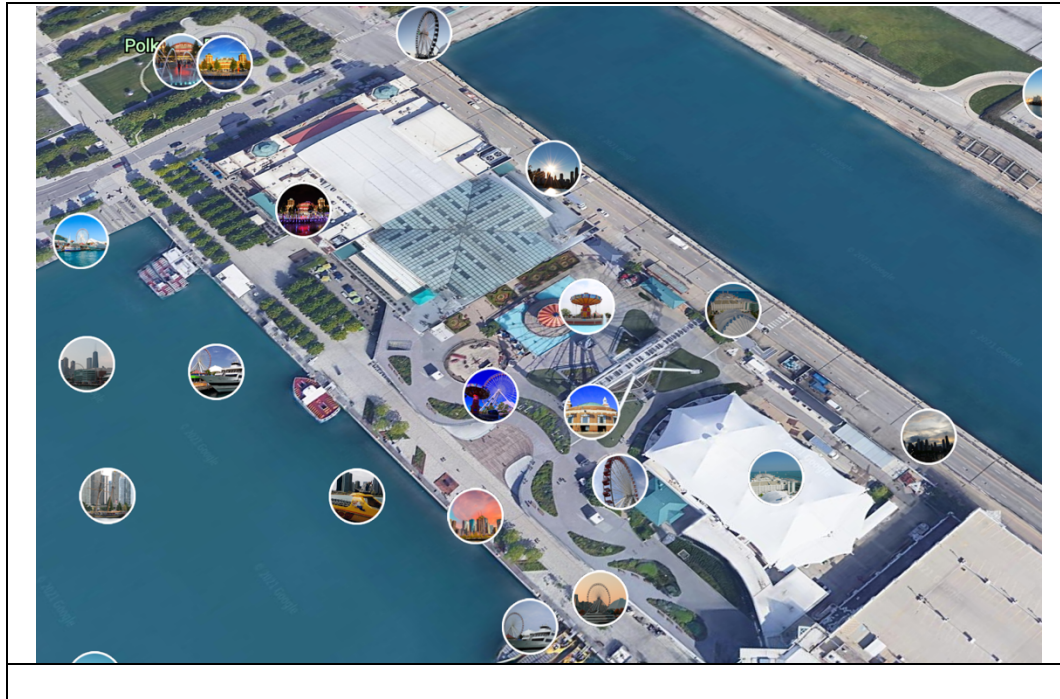
Figure 29: Plan View Of Chicago Children's Museum Which Shows Outdoor
Learning Space

Maria Montessori states that, "A child, who more than anyone else is a spontaneous observer of nature, certainly needs to have at his disposal material upon which he can work ". (Montessori, M. ,2013). While analysing Chicago Children's Museum is in terms of indoor/outdoor learning space, the followings were observed.

- As the location of Chicago's children's museum is observed from google earth, there is no specially designed learning environment for the museum but since it was built in Navy Pier region in Illinois as a wisely chosen location, the outdoor environment gives access to the park and the park served as an outdoor environment for museum and provides an outdoor environment to children who visits the museum to experience playing at nature.

- **Evaluation of Chicago Children's Museum**

In the following table, there is a general look for the analysis of selected museum with the selected parameters. Hey will be explained in detail one by one in the following text.

Table 16: Evaluation of Chicago Children's Museums with Selected Parameters

	Location: Chicago/Illinois **Architect**: Krueck & Sexton Architects **Content**: Animals/Nature, Arts Crafts& Imaginative Play
Recognizability	✔
Social Space	✔
Anthropometry	✔
Outdoor Learning Space	✔

- **Interpretation of Chicago Children's Museum**

As it is observed from the photographs and architectural drawings, 4 design parameters are fulfilled successfully. Recognizability by the help of identical features which is nourished from 'role modelling' feature of 'learning.' Two rooms as' great hall' and 'group space' existed to full fill the 'social space.' Since the primary teaching method offered is via 'role modelling' in this museum while constructing spaces as 'cloud blaster,' 'zoom room,' 'skyline exhibits,' 'tinkering lab' they provided playgrounds and spaces perfectly designed with anthropometric measures of recommended age groups. Since the museum was established in Navy Pier region, it gives opportunity to visitors to experience nature because of the location of museum.

3.2.3 Incheon Children Science Museum

Table 17: Incheon Children's Museum, Establishment Time and Content

Name of The Museum	Date of Establishment	Content
Incheon Children's Science Museum	2011	Arts/crafts Storytime STEAM

The Incheon Children's Science Museum is situated at the foot of KyeYang Mountain in Bang Chug-Dong, Kyeyang-gu, Incheon, where nature and city merge. After ten years of planning, Incheon City asserts that this project is the first children's specialized science museum ever established in Korea. As a result, the concept of a "Sponge that embraces children's dreams" was developed based on the geographical context of a location that connects the city to nature, the primary users of children and scientific exhibition, and the program context. From start to end, the concept of 'Sponge' was used as a term in all design domains, resulting in an integrated environment of architecture, exhibition, and design. (URL 64)

Since its beginning in May 2011, the Incheon Children's Science Museum has established itself as a science and culture place where children may study the principles of science embedded in everyday life in a simple and enjoyable manner.

Children acquire scientific knowledge through seeing things with their five senses and exploring on their own. (URL65)

Table 18: Evaluation of Incheon Children's Museum by the Decided Parameters

Site Plan (URL 66)
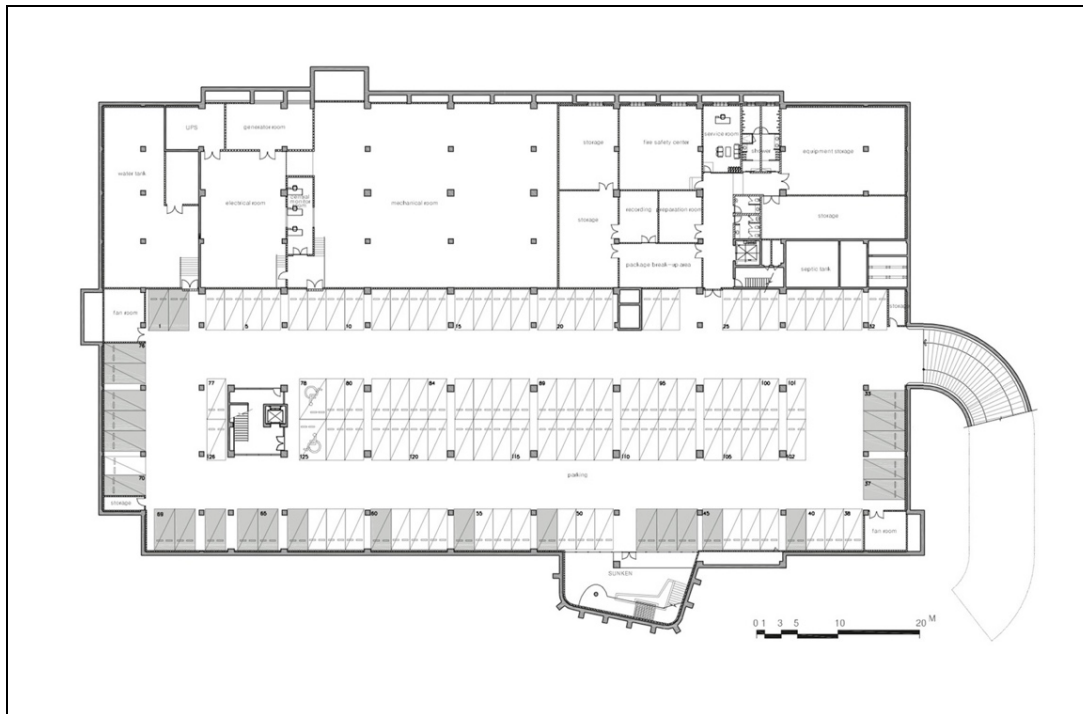
Basement Floor Plan (URL 67)
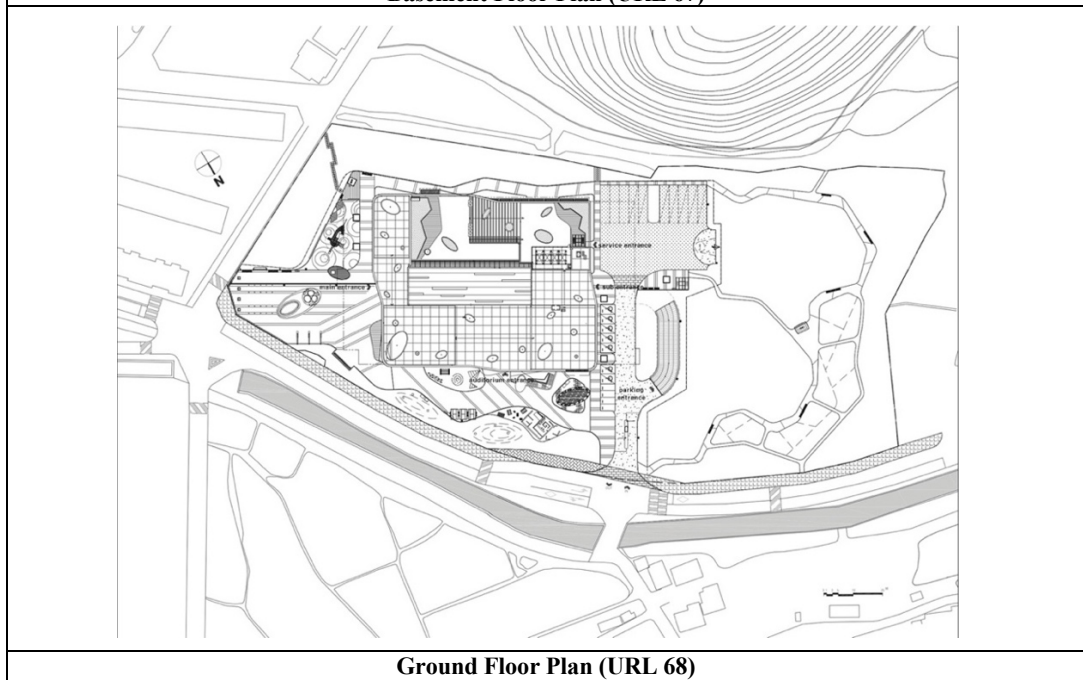
Ground Floor Plan (URL 68)

78
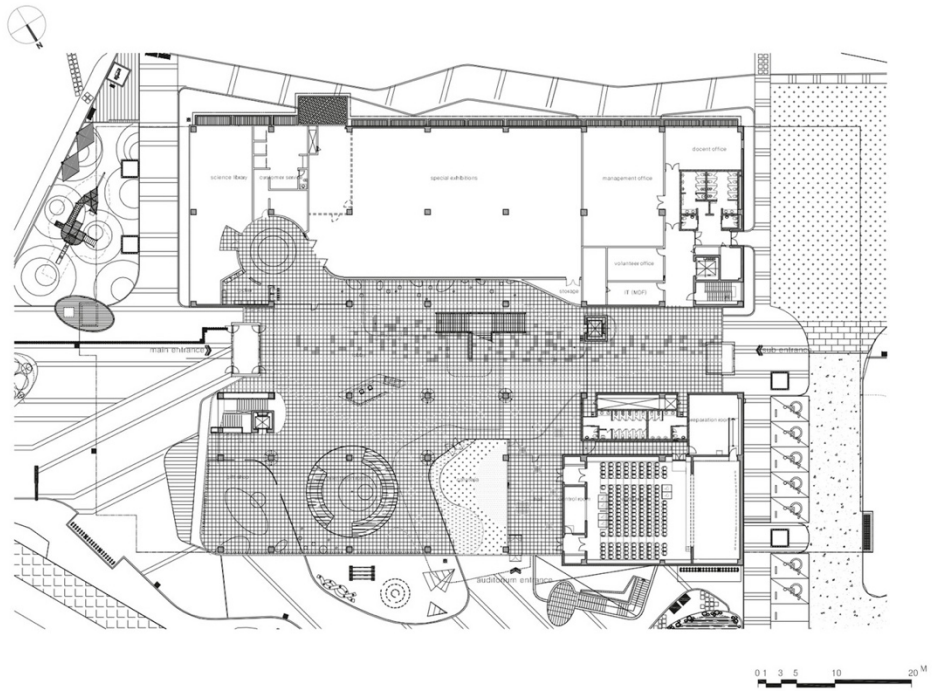
First Floor Plan (URL 70)
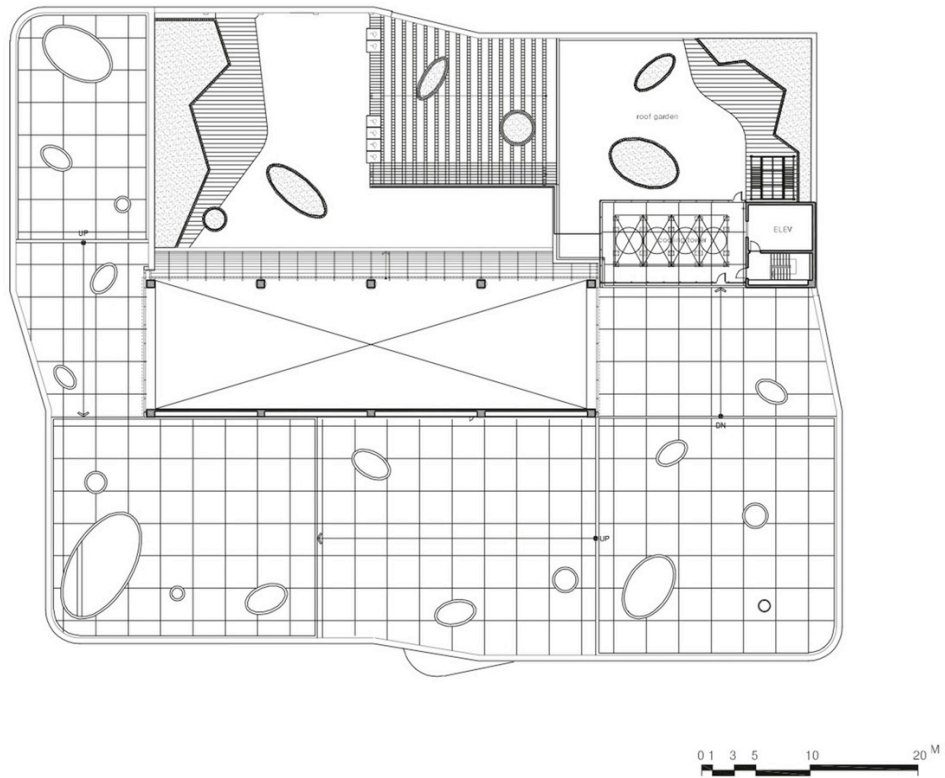
Roof Floor Plan (URL 71)

Recognizability

Table 19: Photo View of Incheon Children's Museum Which Shows Recognizability

| (URL 72) | (URL 73) |
| (URL 74) | (URL 75) |

- From start to end, the concept of 'Sponge' was used as a term in all design domains, resulting in an integrated environment of architecture, exhibition, landscaping, and interior design. The project began with the question of how to define children, a user, and what shape a science museum should take. It was noted that children had good abilities in that they learned knowledge with their minds and bodies based on intuitive experience rather than learning as if a sponge absorbed water and expressed everything they absorbed as if water was squeezed from a sponge. (URL 76)

All design parts from interior to exterior includes holes to emphasize the general concept of halls.

Incheon Children Science Museum Main Hall

(URL 77)

Figure 30: Photo view of Incheon Children's Museum which shows Social Space

There is a main hall in between the different purpose exhibition halls which is illuminated by natural light, and it is a gathering place for different user groups to meet and share their experiences. Dr Montessori offered in her method a 'social gathering place' and in Reggio Emilia, the name is 'Central piazza' which is a place which houses different age group pupils or visitors to share their knowledges.

Anthropometric Design

Table 20: Photo View of Incheon Children's Museum Which Shows Anthropometric Design

Incheon Children Science Museum	
(URL 78)	**(URL 79)**

- All the furniture and interior components are designed to fulfil the recommended age group body dimensions.

- Permanent exhibitions which are 'rainbow village, human body village, secret village, earth village, urban village, secret village,4-D visual room' are only accepting a specific age group and offer a time limit for experiencing the exhibition hall.

- Permanent exhibitions were designed according to body dimensions of user group.

- Exhibition cabinets where artifacts are exhibited are designed for the eye levels of visitors for specific age group.

In Montessori method, the environment is created with the anthropometric measures of pupils.

Outdoor Learning Space

Table 21: Photo View of Incheon Children's Museum Which Shows Outdoor Learning Space

Incheon Children Science Museum
(URL 80)   **(URL 81)**

"The outdoor climate, according to Dr. Montessori, is a natural extension of the classroom. Children will build on their classroom awareness through sensorial experiences of nature and regular interaction with the seasons and the natural world in our outdoor environments. Children become more aware of nature as they grow older, and they are better able to comprehend the needs of the world around them and how they can help." (Al, S., et al., 2012).

Incheon children's museum has;

- An outside playground which was designed for children, but no plants or soft landscape is observed from secondary resources.

- The museum looks like an extension of nature and the city.

Evaluation of Incheon Children's Museum

Table 22: Evaluation of Incheon Science Centre by the Decided Parameters

	Location: Chicago/Illinois **Architect**: **Museum** by Haeahn Architecture **Content**:
Recognizability	✔
Social Space	✔
Anthropometry	✔
Outdoor Learning Space	✘

Interpretation of Incheon Children's Museum

- It is observed that a big effort was put to construct a spatial identity in a concrete way by using a sponge theme to symbolize children. There is a main hall in between the exhibition halls to give chance to visitors to meet and share their knowledge with each other. Every exhibition hall suggests a time limit to visit and planned with strict anthropometric measures as it is observed from the photos except the main hall as a gathering place. The connection with nature and rest of the city was tried to be established via transparent glass walls but the museum offers a better inside experience.

3.2.4 Children's Museum of Art

The Children's Museum of the Arts ("CMA") is in the South Village section of Manhattan, New York, United States. Kathleen Schneider founded CMA in 1988, and it moved into its larger 10,000-square-foot building in October 2011. Children ages 0–15 collaborate with teaching artists at the CMA to produce art in a variety of media, including drawings, sculpture, sound art, textiles, and stop-motion animation.

Table 23: Plan and Section View from the CMA

Children's Museum of Art
Mezanine and Ground Floor of Children's Museum of ART (URL 82)
Longitudinal section of CMA showing the colour wheel representing different function. (URL 83)
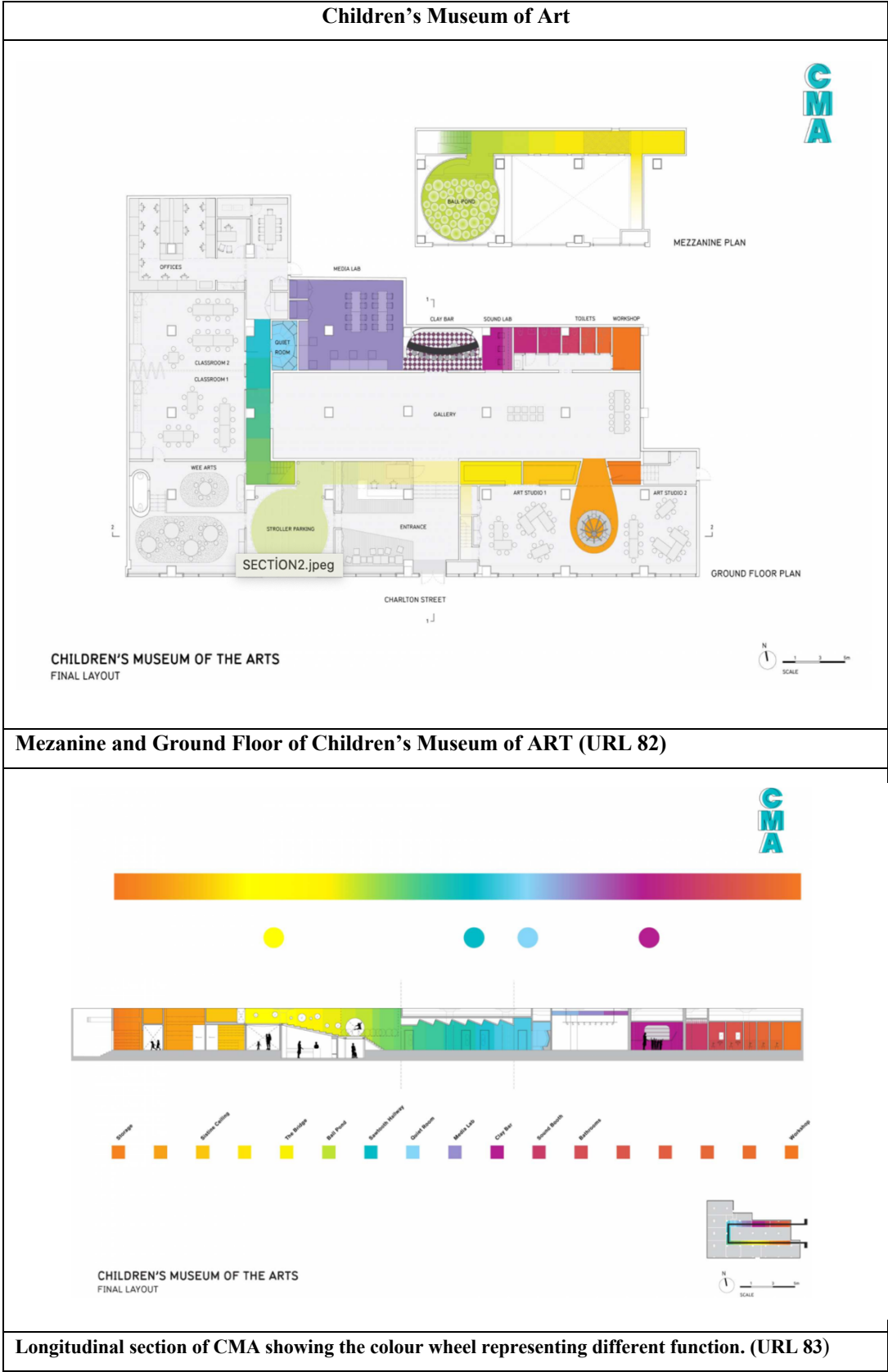
Recognizability

Table 24: Photos of Children's Museum of ART Which Shows Recognisability

Children's Museums of ART (URL 84)	**(URL 85)**

According to Reggio Emilia's 'recognizability criterion' a strong architectural language was observed in Children's Museum of Arts.

The visual language used in interior architecture of building was inspired by a colour wheel.

Each colour defines a function and a specific user group.

As a concept of interior design, 'colour-wheel was used to separate the functions and user groups, because the museum targets the children who developed differently. Each color in the colour wheel used in the design stands for different function.

-Red: Kids bathroom

-Orange: for sink-o-rama, which is designed as a 'washing station'.

-Yellow: bridge for graffiti art.

-Green: stair-slide and ball-pit.

-Blue: upholstered 'quiet' room.

-Purple: 'clay bar' where a bartender serves modelling clay and advice the kids clay-motion projects.

Social Space

. There is no Social Space and it is strongly against the main philosophy of Children's Museum of Art.

Anthropometric Design

Table 25: Photos and Sections of Children's Museum of ART Which Shows Some Examples for Anthropometric Design

Children's Museums of ART (URL 86)

- All the furniture and components were designed with the children's anthropometric measures and strong colour theme was used to point out distinct functions and targeted different age group. Like Montessori method, the museum embraces all children with different developmental processes.

Indoor/Outdoor Learning Space

. Unfortunately, no outdoor indoor connection was observed from the design**,** from the secondary resources.

Evaluation of Children's Museum of ART

Table 26: Evaluation of Children's Museums of ART by the Decided Parameters

	Location: Manhattan/USA Architect: Work AC Content: Arts/Crafts
Recognizability	✔
Social Space	✖
Anthropometry	✔
Outdoor Learning Space	✖

Interpretation of Children's Museum of ART

- Since all children with any developmental cycle is targeted, strong visual language was used to be able to communicate each user. No social space was observed as a gathering place. It is observed that, it is important to be understandable for each user, that's why anthropometric measures were taken into consideration deeply. No outdoor learning space or a connection of indoor /outdoor space was observed.
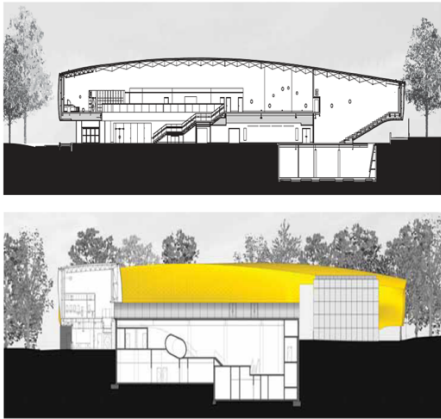
3.2.5 Brooklyn Children's Museum

The Brooklyn Children's Museum (BCM), which opened in 1899 as the world's first children's museum, is New York City's largest cultural institution dedicated to families. BCM, which is proudly situated in Crown Heights, Brooklyn, serves 300,000 children and caregivers each year via exhibitions and activities that are based in the visual arts, music and performance, natural science, and international cultures. (URL 87)

Although the collecting, presentation, and investigation of items was a major focus of The Brooklyn Children's Museum in its early years, active engagement of children was also a key priority. Exhibits of specimens were complemented by study models,

research and collection projects, and targeted, supervised activities that encouraged students to observe and investigate the world. (McLean, K. ,1987).

Table 27: Photos and Architectural Drawings of Brooklyn Children's Museum

| Photo (URL 88) | Sections (URL 89) |

Recognizability

Table 28: Photo Views of Brooklyn Children's Museum Which Shows Ecognizability

Brooklyn Children' Museum permanent exhibitions

| Nest (URL 90) | Totally Tots (URL 91) |

Collection Central (URL 92)

Sensory Room (URL 93)

Neighbourhood Nature (URL 94)

Science Inquiry Centre (URL 95)

World Brooklyn (URL 96)   **Colour Lab (URL 97)**

Dependent on the recognizability parameter of Reggio Emilia approach, the architectural design of the building should be formed from a consistent architectural language.

These were observed from the museum.

There exists a 7 permanent exhibition with a colour lab, all specially designed for here as identity features.

. Yellow colour used in the elevations and interior of the building is another identical feature of Brooklyn Children's Museum.

Social Space

Table 29: Plan View of Brooklyn Children's Museum Which Shows Social Space

Brooklyn Children's Museum

| Ground floor plan (URL 98) | Second floor plan (URL 99) |
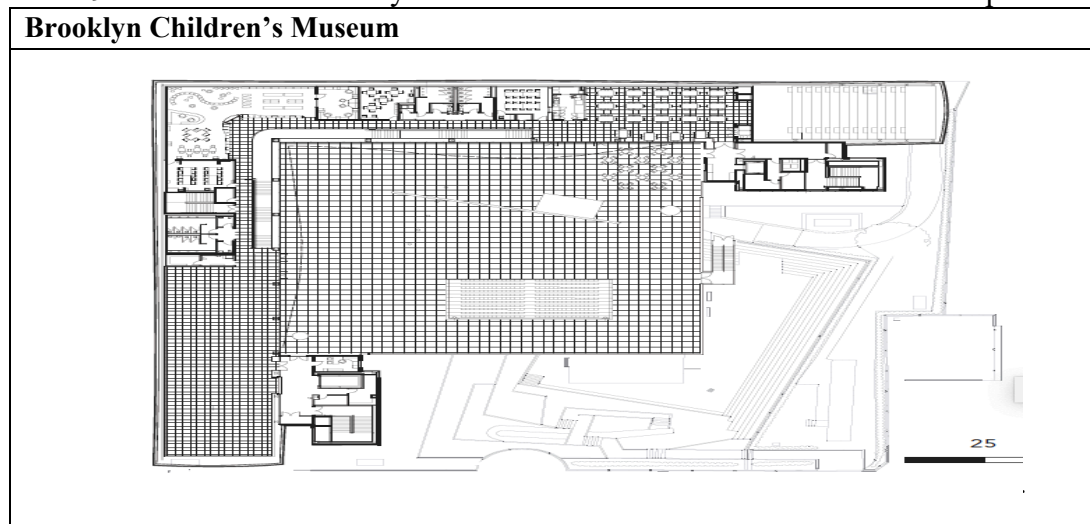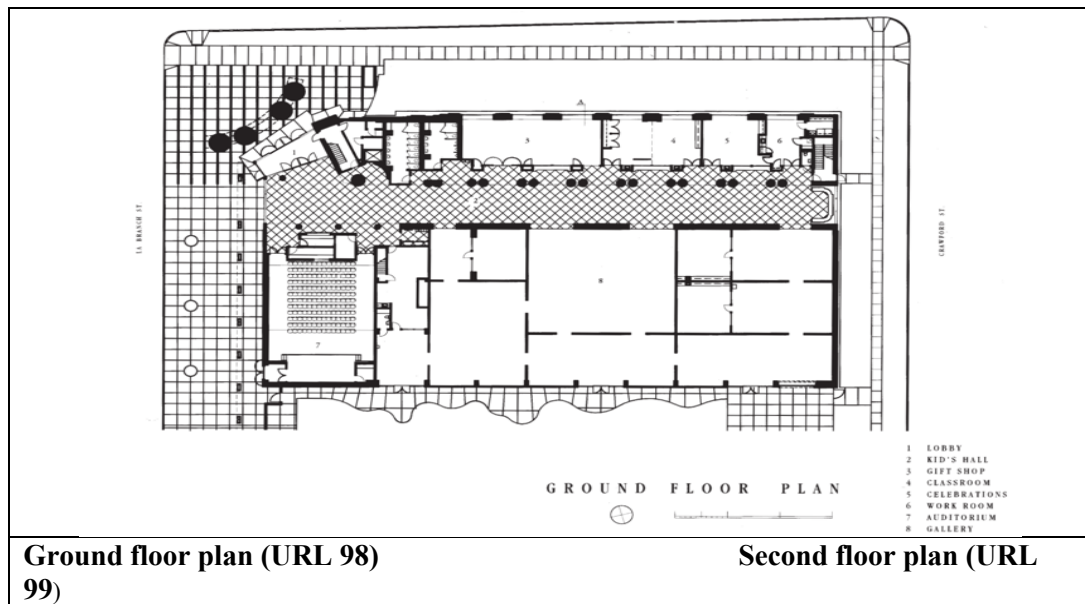
In Montessori method, dr.Montessori offered a social place to house different pupils to share their knowledges. In Incheon Museum, it was seen.

A spacious lobby and a café as a gathering place for different age groups, from the plans and photos of the building.

Anthropometric Design

Table 30: Photo View of Brooklyn Children's Museum Which Shows Anthropometric Design

Brooklyn Children's Museum
(URL 100)   (URL 101)

Dr. Montessori, while designing the Montessori method took the body measurements of the pupils one by one to create an effective environment to be safe and help learning.

In the photos of Brooklyn Children's Museum;

- 7 permanent exhibitions and colour lab for art was designed by taking ergonomic into considerations.

- While designing for children, safety is the most important subheading of ergonomics, and it is observed that all play areas, exhibition areas, art rooms were designed with anthropometric measure of targeted user groups.

Outdoor Learning Space

Brooklyn Children's Museum
(URL 102)

Figure 31: Photo view of Brooklyn Children's Museum which shows Outdoor Learning Space

Both Montessori method and Reggio Emilia approach emphasize the importance of Outdoor learning space. Outdoor learning spaces help pupils/visitors to invent nature, and to perceive their selves as a piece of big ecological system. In an aerial photo of Brooklyn children's museum, it was observed;

- A L-shape building form which is mostly preferred to be able to embrace the outdoor area. It is observed from the drawings and photos that the integrity of indoor and outdoor space was done perfectly.

While investigating the contents of the museum;

-There found 7 permanent exhibitions in which 3 of them targets to integrate nature education with indoor education.

Evaluation of Brooklyn Children's Museum

Table 31: Evaluation of Brooklyn Children's Museum By The Decided Parameters

	Location: Brooklyn, New York City Architect: Raphael Viñoly Architects Content: Animals/Nature, Arts & Crafts
Recognizability	✔
Social Space	✘
Anthropometry	✔
Outdoor Learning Space	✔

Interpretation of Brooklyn Children's Museum
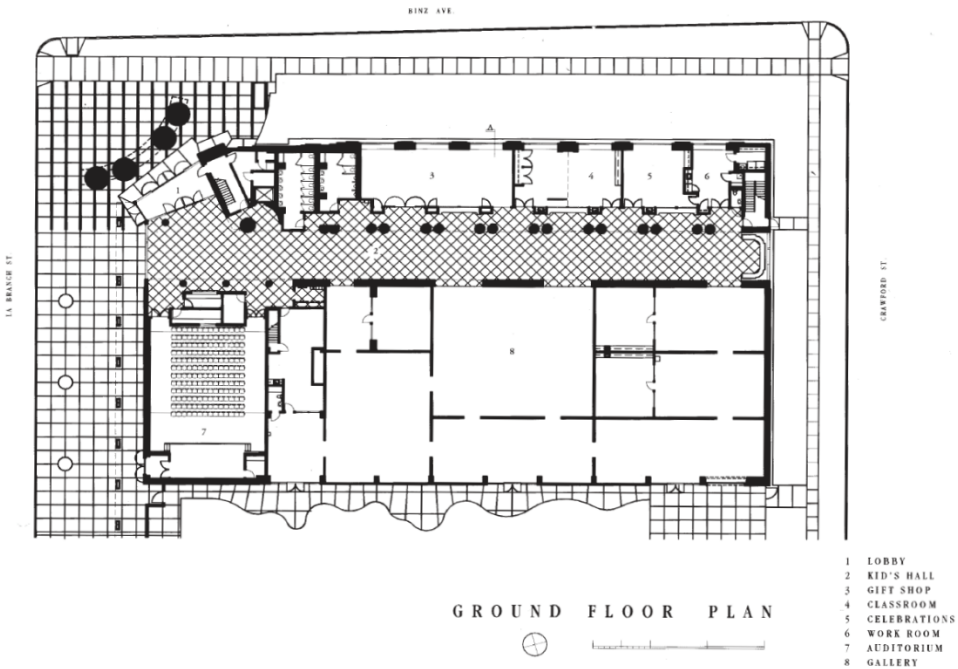
Since the museum was the oldest museum in USA, the experience in being the first children's museum can be observed through all design.

Recognizability is clearly observed with used several identical elements as explained above. There is no social place especially designed for gathering place, but they tried to cover it by creating a spacious lobby and adding a café function for providing places people to meet. In terms of Anthropometry, all playgrounds indoor/outdoor together with art studios and exhibition cabinets were designed by taking body measures of user groups.

3.2.6 Houston Children's Museum

The Children's Museum of Houston (CMH) is a children's museum located in Houston's Museum District. It was founded in 1980 and is housed in a building designed by Robert Venturi. It offers a variety of creative exhibitions and multilingual learning activities for children ranging in age from birth to twelve years. It serves about 1,400,000 people each year and is governed by a Board of Directors as a 501(c)(3) organization.

Table 32: Photos and Architectural Drawings of Houston Children's Museum

Ground Floor Plan of Houston Children's Museum (URL 103)
A Photo of Houston Children's Museum (URL 104)

Recognizability

Table 33: Photo View of Houston Children's Museum Which Shows Recognizability

Houston Children's Museum		
(URL 105)	**(URL 106)**	**(URL 107)**

"The Children's Museum is itself a decorated shed. For exhibits to be dismantled, rearranged, and resigned, a large exhibition space is all that is required for the interior space. The exterior, however, must attract viewers with a 'sign'. The children's Museum features a 'sign' composed of a temple front, Greek columns, and caryatids." (Venturi, R.)

-Since the building is a symbol of Postmodernism and an example of Decorated Shed, it has very strong symbols. The outside of building was painted with a bright yellow colour. There are colourful carya kids besides like in Greek temples. There is a colourful kid's hall in the interior of the building. So, while forming an architectural

language as explained in chapter 2, designers used identical features in the design of the building and as seen above, there are very strong identical features in this building.

Social Space

Houston Children's Museum (URL 108)
Kids Hall

Figure 32: Photo View Of Houston Children's Museum Which Shows Social Space

Dr Montessori mentioned the importance of social meeting place to share the knowledges of different pupils in her Montessori method.

-While exploring the architectural drawings and photos of the Houston Museum, a 'kids hall' was found which fulfils the parameter of social space which helps to enhance learning.

Anthropometric Design

Table 34: Photo view of Houston Children's Museum which shows Anthropometric Design

Houston Children's Museums		
(URL 109)	**(URL 110)**	**(URL 111)**

Dr. Montessori offered an environment designed with the help of body measures taken by her-self and recorded in order to set up a productive environment. When observing the photos and architectural drawings of Houston Children's Museum, it was observed that;

-There exist 20 different permanent exhibitions which different age groups can experience different lively experiences. All permanent exhibitions were designed and recommended for different age group. The planned exhibition avenues were designed suitable for the recommended age group.

Indoor/Outdoor Learning Space

Table 35: Photo view of Houston Children's Museum which shows Outdoor Learning Space

Houston Children's Museum	
(URL 112)	**(URL 113)**

"The environment is an essential element for human beings. The environment around children has an important role on their development. According to psychologists Bloom and Deutsch, especially in their early childhood children's environments and experiences have an important effect on their intelligences and developments." (Acar, H. ,2014).

When photos and architectural drawings of Houston Children's Museum was observed;

It is found that, a permanent exhibition called 'eco-station' which explains all living creatures are a part of an ecosystem and we are sharing the ecosystem with plants and animals as an outdoor learning space exists.

Evaluation of Houston Children's Museum

Table 36: Evaluation of Houston Children's Museum By The Decided Parameters

	Location: Houston, TX **Architect:** Jackson & Ryan Architects in association with Venturi, Scott Brown and Associates, Inc **Content**: Music, STEAM, Story Time, Theatre
Recognizability	✔
Social Space	✔
Anthropometry	✔
Outdoor Learning Space	✔

Interpretation of Houston Children's Museum

Houston Children's Museum is an especially important piece of Post-modern architecture designed by Venturi. The identity content is very strong because of the period the building was belonged. There is a kid's hall which can be accepted as a social space and 20 professionally designed permanent exhibit designed with anthropometric measures. The designers seemed to think to integrate nature with built

environment and they involved and eco –station to emphasize the visitors the importance of nature besides other facilities.
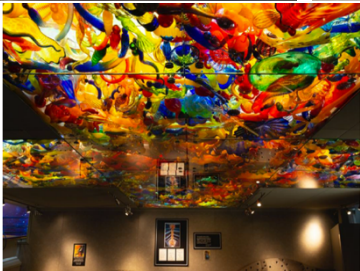
3.2.7 Children's Museum of Indianapolis

Table 37: Photos and Architectural Drawings of Children's Museum of Indianapolis

Site Plan (URL 114)	Exterior view (URL 115)
Interior View (URL 116)	Exterior view (URL 117)

Recognizability

Table 38: Photo View of Children's Museum of Indianapolis Which Shows Ecognizability

Children's Museum of Indianapolis (URL 118)	(URL 119)	(URL 120)
(URL 121)	(URL 122)	(URL 123)

According to Reggio Emilia Approach, recognizability was defined as a consistent architectural language used in interior design and there should be an identical feature of interior design which becomes the character of the building. When observing the architectural drawings and photos of the children's museum of Indianapolis, it is found that;

-The building both internally and externally uses strong symbolic visual languages. Each permanent exhibition has specific identical features. Dinosaurs are the most common identical features. There is a bumble bee and a glass sculpture is also observed from the photographs as identical features of the museum.

Social Space

Children's museum of Indianapolis
(URL 124)
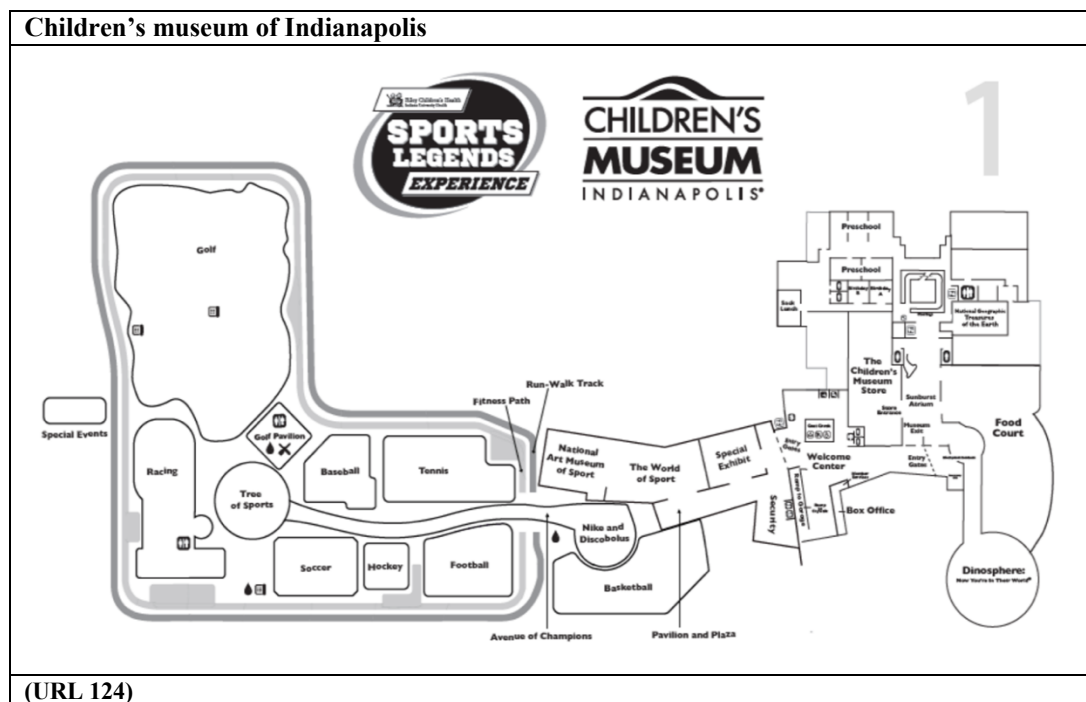
Figure 33: Photo View Of Children's Museum Of Indianapolis Which Shows Social Space

According to dr. Montessori, social places are important to share knowledges in-between different users.

101

-Although Children's Museum of Indianapolis is the biggest museum of the world, no social space was observed from the museum maps.

Anthropometric Desig

Table 39: Photo view of Children's Museum of Indianapolis which shows example of Anthropometric Design

Children's Museum of Indianapolis	
(URL 125)	**(URL 126)**

Both of the approaches of Montessori and Reggio Emilia highlighted the importance of environment in the process of learning. When exploring the photos and webpages of Children's Museum of Indianapolis, it was found that;

-There are 30 permanent exhibitions in Indianapolis Children's Museum. They are categorized as 'Indoor exhibition, Outdoor exhibition, museum exhibition, sport experience and future exhibition.' Dependent of the observations from secondary resources, all exhibition cabinets are designed with the eye levels of recommended age group. Another exhibition like sports and future play areas were designed with the anthropometric measures of user groups.

Children's Museum of Indianapolis
(URL 127)

Figure 34: Photo View Of Children's Museum Of Indianapolis Which Shows Outdoor Learning Space

The integration of nature and built environment can be perceived while observing the exhibit selection. Above picture belongs to an exhibit called 'Dino sphere' which is strongly helping the children's experience the nature while playing.

Evaluation of Children's Museum of Indianapolis

Table 40: Evaluation of Children's Museum of Indianapolis by the Decided Parameters
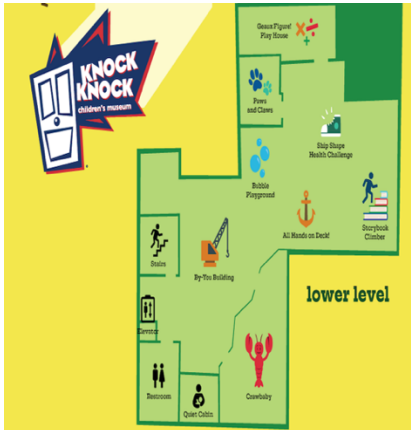
	Location: Indiana, USA Architect: RATIO Architects Content: Arts & Crafts, Movement/Exercise, STEAM, Story Time
Recognizability	✔
Social space	✘
Anthropometric Design	✔
Outdoor Learning Space	✔

Interpretation of Children's Museum of Indianapolis

Except from the 'Social Space' parameter, the other parameters were seemed to be perfectly fulfilled by the interior and exterior design of the building.

3.2.8 Knock-knock Children's Museum

The 26,000-square-foot facility is located on Knock-knock Hill in Baton Rouge, Louisiana, with a view of City-Brooks Community Park. It is ideal position on six acres of existing parks allows it to serve all of Baton Rouge's neighbourhoods as well as the surrounding nine parishes. (URL 128) Designed with a regional flair to encourage early literacy skills and STEM education interest. (URL 129)

Table 41: Photos and Architectural Drawings of Knock-knock Children's Museum

Museum map level (URL 130)	Museum map level 2 (URL 131)
Photo from outside the building (URL 132)	Photo from the inside of the building (URL 134)

Table 42: Photo View of Knock-knock Children's Museum Showing Recognizability

Knock-knock Children's Museum	
(URL 134)	**(URL 135)**

Reggio Emilia talks about a consistent architectural language via creating an indoor environment with interior architecture and an identical figure which gives the character to the building.

When observing the webpage and photos of the Indianapolis children's museum, it was observed that there exists a story tree and story book climber.

-The story tree and the story book climber of knock-knock children's museums are two identical features of learning zones of knock-knock children's museum.

Social Space

Table 43: Photo View of Knock-knock Children's Museum Which Shows Social Space

Knock-knock Children's Museum	
(URL 136)	**(URL 138)**

No Social Place is observed in the museum maps floor plans.

Anthropometric Design

Table 44: Photo View of Knock-knock Children's Museum Which Shows Anthropometric Design

Knock-Knock Children's Museum		
(URL 138)	**(URL 139)**	**(URL 140)**

The permanent exhibits called learning zones in knock-knock children's museums are designed with the body measures of users as offered by Montessori Method.

Knock-Knock Children's Museum
(URL 141)

Figure 35: Photo View Of Knock-Knock Children's Museum Which Shows Outdoor Learning Space

According to many environmental researchers, including dr Montessori and Loris Malaguzzi, the importance of outdoor environment was highlighted. While observing the plans and architectural drawings of the museum it was seen that;

-The building is constructed at the centre of a forest in Baton Rouge under the oak trees**.** No specially designed outside learning zone or playing area is observed but the building was designed with a rhythm of opaque and big transparent walls to integrate nature to the building.

- **Evaluation of Knock-Knock Children's Museum**

Table 45: Evaluation of Knock-knock Children Museum by the Decided Parameters

	Location: Baton Rouge, LA, USA Architect: Cambridge seven Content: Arts & Crafts, STEAM, Story Time
Recognizability	✔
Social Space	✖
Anthropometry	✔
Outdoor Learning Space	✔

- **Interpretation of Knock-Knock Children's Museum**

There is no concrete concept of building which is symbolized by the design. There are some identical features but not as strong as observed from the previous museums. No social place was observed. The design of spaces, furniture, play areas and other components are designed with body dimensions of recommended age group. No outdoor play area or exhibition are is observed but to integrate indoor and outdoor, there are big glass walls on the front elevation.

3.2.9 Muzeiko America for Bulgaria Children's Museum

Muzeiko, Bulgaria's first children's museum and the largest in South-eastern Europe, is located in Sofia, the country's capital. Visitors can explore three floors of exhibits in the 35,000-square-foot (3,250-square-meter) building, which is theoretically organized as a journey across time and space. On the lowest level, children investigate "the past" through archaeology, geology, and palaeontology exhibits. (URL 142). Children's museums, which were traditionally an American invention, are increasingly becoming an American export. One of the first children's museums in Eastern Europe is being funded by the America for Bulgaria Foundation, a Sofia-based non-profit financed by the US government. (URL 143).

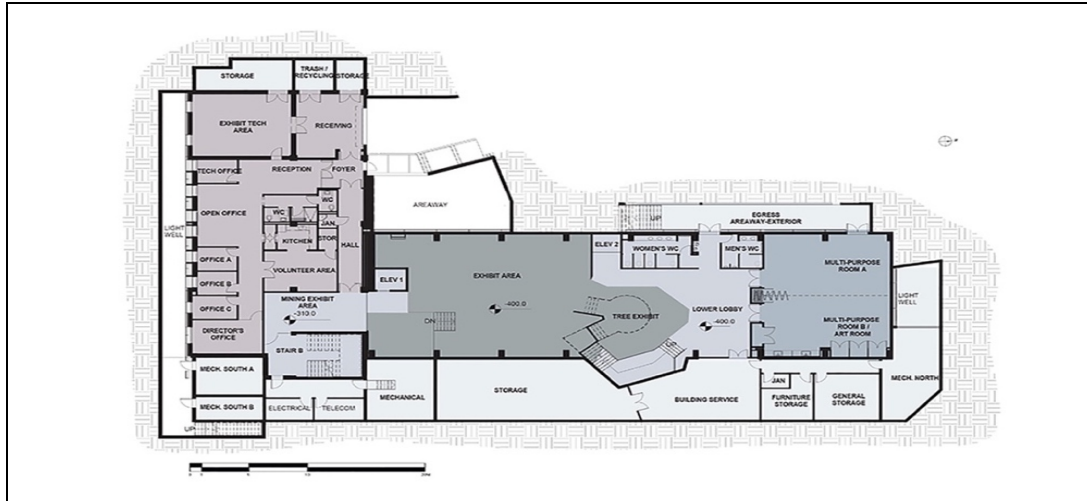Table 46: Floor Plans of Muzeiko America for Bulgaria Children's Museum
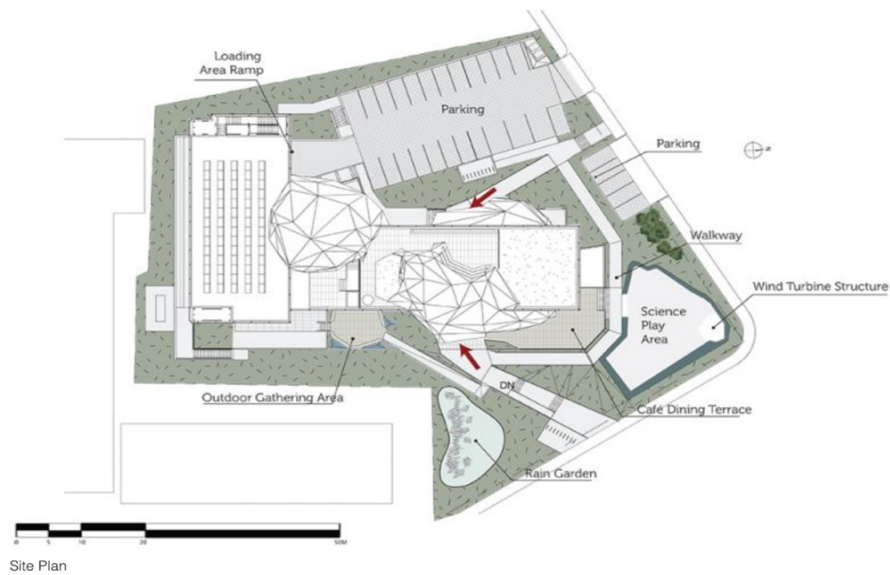
Site plan (URL 144)
First floor plan (URL 145)
Second floor plan (URL 146)
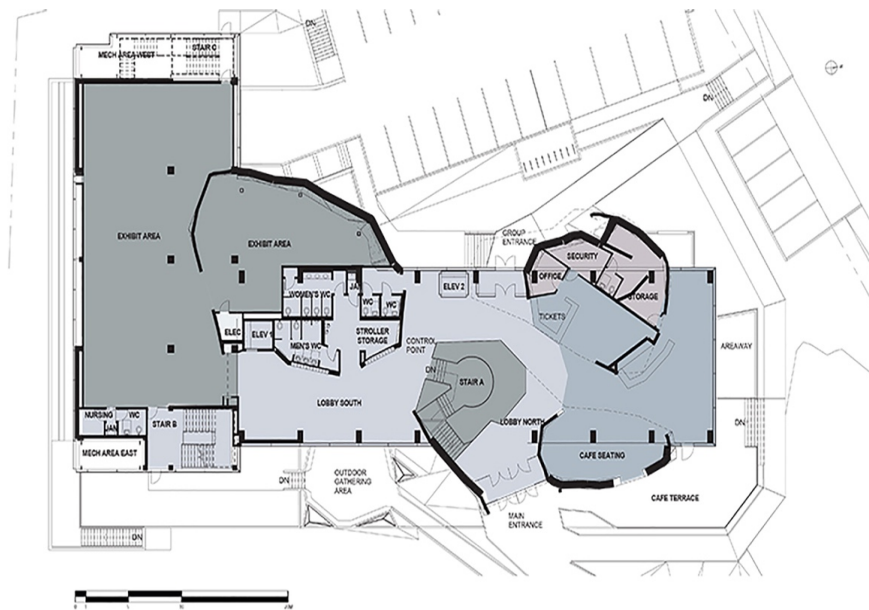
Recognizability

Muzeiko America for Bulgaria Children's Museums
(URL 147)

Figure 36: Photo View of Muzeiko America For Bulgaria Children's Museum Which Shows Recognizability

Reggio Emilia approach underlines the use of common architectural language together with an identical feature which in turn forms the character of the building. When observing the drawings, photos and webpages of the museum, it was discovered that;

- All building concept reflects the topographic region of Bulgaria and designed to symbolize the mountainous area of Bulgaria. The design, selected colours and materials were selected as an identical feature of museum building.

- A metaphoric tree was built from glass, plastic and steel and passes through the 3 levels of the building, symbolizing time, past, present, and future.

Social Space

Muzeiko America for Bulgaria Children's Museums
(URL 148)
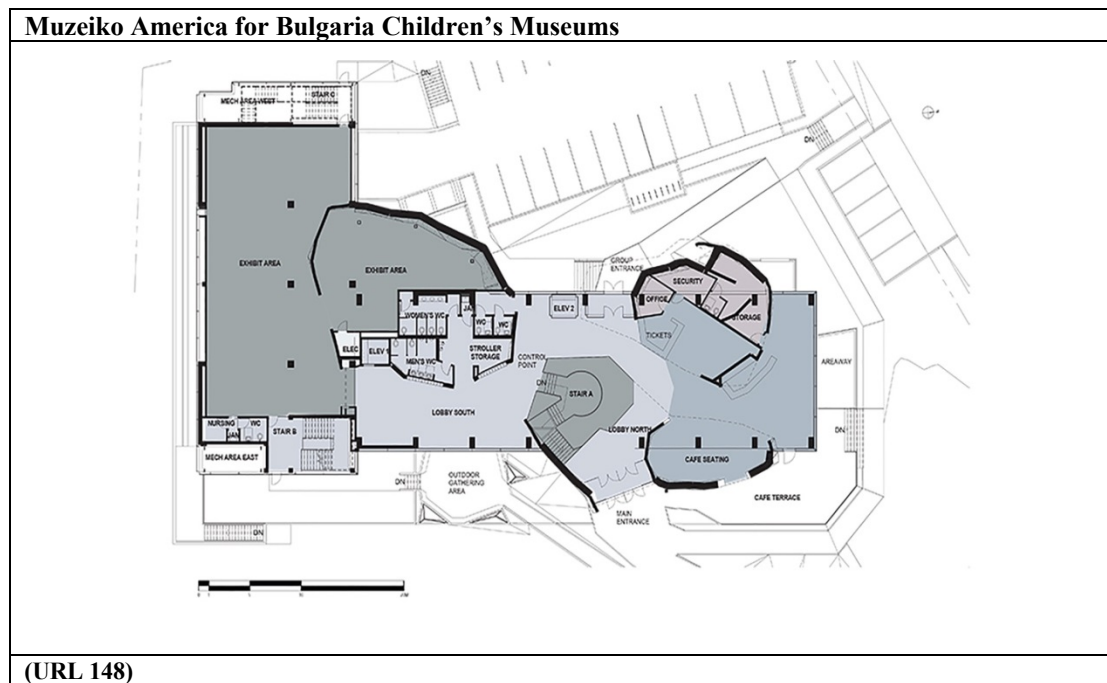
Figure 37: Plan View Of Muzeiko America For Bulgaria Children's Museum Which Shows Social Place

- No specific area was designed for gathering place but side functions like a spacious lobby and café provides the social space for the museum.

Anthropometric Design

Table 47: Photo view of Muzeiko America for Bulgaria Children's Museum Which Shows Anthropometric Design

Muzeiko America for Bulgaria Children's Museums
(URL 149)　　　　　　　　　　(URL 150)

Dr Montessori, while designing the Montessori method, speaks the importance of environment for children and she talks about the anthropometric measures of pupils. While observing the photos, webpage, and architectural drawings of the museum, it was observed that;

- All playing area was designed with the body measurements of the recommended age group.

- Exhibition area was arranged to be suitable for the eyel evel of the age interval.

Muzeiko America for Bulgaria Children's Museums

(URL 151)

Figure 38: Photo View Of Muzeiko America For Bulgaria Children's Museum
Which Shows Outdoor Learning Space

As seen in the above table, indoor and outdoor environment is integrated. The entire roof, dubbed the Skyloft, is also accessible; half of it is covered in native sedum and bushes, and there is an outdoor amphitheatre, a climbing wall, and a weather station. The rest is taken up by solar panels. These environmentally friendly modifications to Bulgaria's first LEED Gold building also create chances for educational interpretation throughout the displays. (URL 152)

- **Evaluation of Muzeiko**

Table 48: Evaluation of Muzeiko America for Bulgaria Children's Museums by the Decided Parameters

	Location: Bulgaria **Architect**: Lee H. Skolnick Architecture + Design Partnership **Content:** Travel in time and space
Recognizability	✔
Social space	✔
Anthropometry	✔
Outdoor Learning Space	✔

- **Interpretation of Muzeiko**

Muzeiko, Bulgaria's first and only children's scientific centre, is in Sofia, the country's capital. The America for Bulgaria Foundation created it and continues to support it. Muzeiko first opened its doors in October of 2015.Muzeiko has 100,000 visits each year from all around the country and from throughout the world. The Muzeiko learning team has created science and art programs for children aged 4 to 12, as well as other educational materials. (URL 153). The building speaks metaphorically. All parameters, social space, recognizability, anthropometry, outdoor learning space was fulfilled successfully by the design. All the design builds up a strong relationship on time, past, present, future visually, it helps forming a relationship on minds of children which in turns helps learning of children easily.

3.2.10 Papalote, Museo Planet Play

In Mexico City's Bosques de Chapultepec, the museum Papalote Museo del Nio is located. Through interactive science, technology, and art expositions for children, the museum focuses on learning, communication, and teamwork. (URL 154) In Mexico City's Bosques de Chapultepec, the museum Papalote Museo del Nio is located. Via

immersive science, technology, and art expositions for children, the museum focuses on literacy, communication, and teamwork. Ricardo Legorreta, an architect, designed this museum in 1993. He used geometric figures and traditional Mexican tiles in his design. The structure was designed for children to communicate with, experiment with, and touch. Children created the ceiling and walls. As its slogan suggests, this museum has over 288 interactive exhibits divided into five areas where children can touch, play, and learn. Ecology, the human body, technology, and music are among the topics that children learn about. 1st Exhibitions about various aspects of human development can be found in each field.

Table 49: Photos and Section of Papalote Children's Museum

Building photo	Section from dome	Photo from interior	Photo from exterior
(URL 155)	**(URL 156)**	**(URL 157)**	**(URL 158)**

Recognizability

Table 50: Photos of Papalote Children's Museum Which Shows Recognizability

Papalote Children's Museums	
(URL 159)	**(URL 160)**

Reggio Emilia approach mentioned the importance of recognizability in spaces designed for children and defines that there should be a common architectural language spoken by interior design and an identical feature which becomes the characteristic of that place.

While observing the photos, architectural drawings and webpage of the museum;

- Simple geometric forms which were combined to be easily understandable for children.

- Traditional glazed tiles recovering an ancient Mexican tradition.

- A Dome which is called Banamex Digital DOME is a spherical volume which is an identical feature of the design.

Were found which gave the identical character to the building.

Social Space

Papalote Children's Museums
(URL 161)
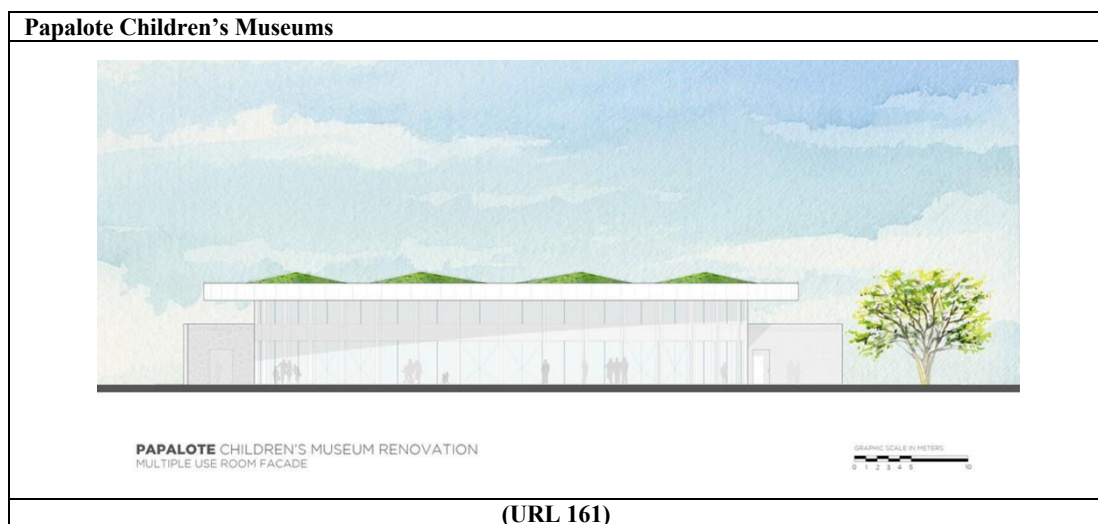
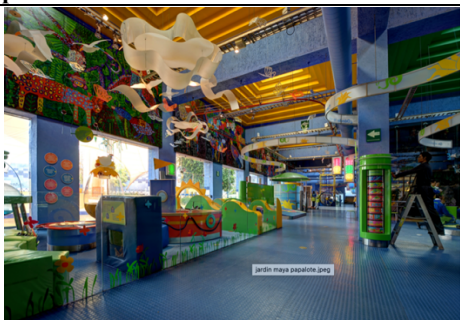Figure 39: Photo View Of Papalote Children's Museum Which Shows Social Space (Multiple Use Room)

Dr Montessori emphasizes the importance of social learning in-between children, so it was offered to create an environment that children can share their knowledge with each other.

When Papalote Museum's photos and architectural drawings were observed;

-A multipurpose room which brings together different people for visiting the museum for different purposes exist, which can be accepted as a social space.

Anthropometric Design

Table 51: Photo View of Papalote Children's Museum Which Shows Anthropometric Design

Papalote Children's Museums
(URL 162)   (URL 163)

In Montessori method, all environment which covers, shelves, doors, toilets, furniture were designed by the anthropometric data taken from the pupil**s.** So, the design of environment according to body measures is an important feature of the method.

While investigating the photos and architectural drawings of the museum, it was found that;

-Play areas for children are designed with the anthropometric dimensions of the recommended age group.

Outdoor Learning Space

Table 52: Photo View of Papalote Children's Museum Which Shows Outdoor Learning Space

Papalote Children's Museums
(URL 164)   (URL 165)

Dr Montessori emphasizes the importance of outdoor learning experience for children.While exploring the photos and architectural drawings of the Museum, it was found that,

- Jardin Maya is a distinctive feature of an outdoor learning experience for child users to experience maya civilisations.

- There exists a water feature to combine the indoor/outdoor experience to let children to experience new things with nature.

- **Evaluation of Papalote Museo Planet Play**

Table 53: Evaluation of Papalote Children's Museum by the Decided Parameters

	Location: Mexico Architect:Ricardo Legorreta Content: STEAM
Recognizability	✔
Social Space	✔
Anthropometry	✔
Outdoor Learning Space	✔

- **Interpretation of Papalote Museo Planet Play**

The dome and traditional Mexican tiles which covers the elevations are the identical features of the building. There is a place called main hall which is a gathering place of different age groups. All playing areas, permanent exhibition places were seemed to be designed with the body measures of recommended age groups. There exists an outdoor design called 'Jardin Maya', to give chance for the visitors to experience nature.

3.3 Chapter Conclusion

As explained in the previous chapters, firstly, the parameters of 'recognizability, anthropometric design, social space, and Indoor /Outdoor learning space were selected from the most widely used educational approaches in the world, Montessori, and Reggio Emilia, as explained during the 2nd chapter. Then, these parameters used as templates to analyse the selected 10 children's museums that were members of ACM (table 5) and were selected based on the principle of different educational concepts 'Boston children's museum, Chicago children's museum, Incheon Children's Museum children's museum of Art, Houston children's Museum, Indianapolis Children's Museum, Knock-knock children's museum, Muzeiko America for Bulgaria children's museum, Papa Lote, Museo planet play' buildings were analysed. As a result of the analysis made in this dissertation, it has been observed that the most important concepts among the parameters selected in this study that were observed are 'recognizability and anthropometric design' while designing interiors for the children's museums.

Starting from Piaget's cognitive theory, and considering the age limitation of the thesis, 2-11 years old, it was observed that, a message was tried to be given to children

through the building design and it should be concrete. Likewise, since one of the most principal elements required for learning is 'attention', all design should be done according to anthropometric design principles to eliminate any distracting factor. Most of the time, children's museums are volunteer acts for creating public places for a variety of use and the basic purpose of children's museum is to make learning easy. It is observed from the previous literatures that the easiest way for children to learn is, learning from others, in other words learn via social interaction. That is observed as a finding of study is, creating social places are another crucial factor to enhance learning. Finally, as C Day, C., & Midbjer, A. (2007). mentioned in 2007, living in nature is a crucial factor as soul-nutrient.

Chapter 4

CONCLUSION AND FURTHER RECOMMENDATIONS

'Learning means developing new ways of reacting by modifying old ones. The environment is ever changing and as it changes man finds it necessary to make new adaptations or changes in himself as well as in his environment. Indeed, man is himself continually changing because of physiological processes which are taking place, and these changes in internal conditions demand new adjustments.'(Garrison,1929).

The study tried to contribute learning of children of a rapidly growing population of world by the interdisciplinary study of interior architecture and learning. As a proven way of learning in between the selected age groups of 2-11, the study takes its environmental parameters from two most famous preschool approaches of Reggio Emilia Approach and Montessori Method.

In the second chapter the previous scientific studies were revised in order to prove that childhood is a post-concept created after industrial revolution by giving the 12000-year population graphic and the short history of childhood. Those were mentioned to emphasize the importance of doing interdisciplinary studies to contribute learning for all children and changing museum concepts were discussed. In the same chapter, evolution of museums from artifact based traditional concept to today's children's museums with hands on learning philosophy was highlighted. Children and their developmental stages were delved to relate learning with interior space. In the last part of the chapter, Reggio Emilia Approach together with Montessori method as a proven pedagogical method were examined in detail and their environmental directives were

taken. The chosen criteria to analyse the selected children's museums are 'recognizability, anthropometric design, social space and Outdoor learning space'.

In Chapter 3, 10 different children's museums with the principle of different contents which were 'Boston Children's Museum, Chicago Children's Museum, Incheon Children's Science Museum, Children's Museum of ART, Brooklyn Children's Museum, Houston Children's Museum, Indianapolis Children's Museum, Knock-knock Children's Museum, Muzeiko America for Bulgaria Children's Museum, Papalote Museo Planet Play' were selected. On the other hand, environmental parameters from two preschool approaches of Montessori and Reggio Emilia were selected with the principle of adaptability to informal Education. Then the selected cases were analysed with these principles.

With the findings of research, this study provides a thinking on the role of interior design on learning outcome.

. Although formal and informal education is different in terms of content and in terms of curriculum, some circumstances provided for environment affects learning in both contexts. After evaluating the analysis of selected 10 museums, it was observed that, 5 of the museums which are Muzeuiko America for Bulgaria, Papalote Planetary Play, Houston Children's Museum, Boston Children's Museum and Chicago Children's Museum, fulfilled the environmental design parameters perfectly.

Another point which was importantly found was Anthropometric Design Parameter and Recognizability Parameter were the most important environmental design parameters that was used while analysing the cases.

Finally, it was observed that, the parameters of 'Social Space' and 'Outdoor Learning Space' did not take the importance as other parameters.

This study can contribute to further interests by re-defining the criteria of informal learning environments from formal school approaches decided environmental design parameters. While the climate of education has changed in parallel with the changing technology in this century, as John Dewey said (1986), it is necessary to experience, to learn, and therefore, while designing spaces for children as children's museums, is the next step and could be the subject of further study to discuss how children can experience life better by using today's technology, and therefore learn more easily. How the parameters discussed can be applied to future spaces by the designers.

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