Studying the Effect of Color on Children in Learning Environment: Classrooms

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ABSTRACT

Children are an essential part of society, and it must know how to deal with them. Also, provide them with complete comfort where children are considered the age group that can be affected by color more than others. The selected age group for children is from 5-to 12 because before that it is a baby, and after that, it is the beginning of adolescence. The objective of this thesis is how to reach a good learning environment that will support students to achieve an academically appropriate atmosphere in the classroom through color and some physical environment factors, which are checklist existing for the classroom, activity room, handicraft, sports area and external playground, and some criteria such as types of technology, furniture, lighting, visual elements, types of arrangement, the height of the space and color. This study's evaluation was based on the selection of 10 elementary innovation schools according to the criteria made to evaluate the cases, and the analysis of what had been collected from previous studies, to reach the main objective. To handle this thesis qualitative research method was adopted by reviewing previous studies, books, and websites. Furthermore, it is rich in such information. For example, the result of this thesis showed the effect of color as a cold color; it is better than warm color inside the classroom because it has a positive effect on concentration and growing up academic performance. In addition, the external spaces should have been included in the school's ground due to its rich environment in authentic experiences, and some articles called it an external learning environment.

Keywords: Concentration, Children, Learning Environment, Academic Performance, Color

ÖZ

Çocuklar toplumun önemli bir parçasıdır ve onlarla nasıl başa çıkılacağı bilinmelidir. Çocukların renkten diğer yaş gruplarına kıyasla daha fazla etkilenebileceği kabul edildiğinden, onlara gerekli rahatlık sağlanmalıdır. Bu tez çalışmasında çocuklar için seçilen yaş grubu 5-12 yaş arasıdır, çünkü ondan öncesi bebeklik, sonrası ise ergenliğin başlangıcıdır. Bu tezin amacı, öğrencilerin sınıfta akademik olarak uygun bir atmosfer elde etmelerini destekleyen iyi bir öğrenme ortamına nasıl ulaşılabileceğini ortaya koymaktır. Sınıf, etkinlik odası, el sanatları, spor alanı ve dış oyun alanı için bir kontrol listesi oluşturularak, renk ve bazı fiziksel çevre faktörleri aracılığıyla, teknoloji türleri, mobilya, aydınlatma, görsel öğeler, düzenleme türleri, mekanın yüksekliği ve renk gibi bazı kriterlerle birlikte öğrenme ortamı araştırılmaktadır. Değerlendirilen bu çalışmada, ana amaca ulaşmak için yenilikçi (inovatif) 10 ilköğretim okulu seçilmiş ve değerlendirmek üzere oluşturulan kriterlere ve önceki çalışmalardan toplananların analizine göre sonuçlar ortaya konmuştur. Bu tezi ele almak için birçok bilgi açısından zengin olması nedeniyle önceki çalışmalar, kitaplar ve web siteleri incelenerek nitel araştırma yöntemi benimsenmiştir. Bu tezin sonucunda, önemli bir veri olarak soğuk renklerin bir renk olarak etkisini sınıf içinde sıcak renkten daha iyi gösterdiğini, çünkü konsantrasyonun ve akademik performansın artmasında olumlu bir etkisi olduğunu göstermiştir. Bunun yanı sıra, gerçek deneyimlerdeki zengin ortamı nedeniyle okullarda dış mekanlar da yer almalıdır ve bazı makalelere dış öğrenme ortamı denmiştir.

Anahtar Kelimeler: Renk, Çocuklar, Öğrenme Ortamı, Akademik Performans, Konsantrasyon

DEDICATION

I dedicate this work at the beginning to everyone who supported me and worked hard to stand by my side at that time, to my father and mother, who were the main supporters financially and morally to reach this point. I thank my mother for every prayer she prayed for me in her prayers, to my sister, Dr. Haya, and her fiancé, Eng. Ahmed And my younger brother, Dr. Muhammad, who helped and supported me in the difficult times I faced while writing the thesis, and who relieved the pressure on me many times. I would also like to dedicate this work to my friends and everyone who prayed for me in his prayers and was hoping for success from God to accomplish this work.

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LIST OF ABBREVIATIONS

CCT	Correlated Color Temperature
HPSV	High Pressure Sodium Vapour
IWB	Interaction White Board
K	Kelvin
LED	Light Emitting Diode

Chapter 1

INTRODUCTION

1.1 Back Ground of the Study

Designing building interior and external façade is essential in the term Aesthetic; it is vital for us designers and includes any age categories from baby to the elderly, whether male or female. Color is a tool to give the façade a suitable aesthetic that can also affect our bodies from a psychological point of view. According to (Alnasser, 2013), Color is essential in interior design because it can attract the eye and provides individuals with a sensual visual experience (Alnasser, 2013). Colors are used on most products, if not all, in our daily life; when someone is looking for anything, it can be recognized by its Color. Also, the structures are recognized by their colors most of the time. Furthermore, children can differentiate things by Color.

Colors can be used as a particular tool or material inside buildings to create a suitable environment, but each color's effects must be mentioned to realize their psychological effect. The effect of color is something beyond our control as it is psychological. Therefore, using color in interior design should be based on knowledge of color perception and its impact on the human brain. This study will point out children's responses in the age category of five to twelve for both genders in their living environment in elementary school.

Children are the most influential when it comes to color in this period of their lives. According to (Mazlum, 2019), Childhood is regarded as the era when the ability to learn is the greatest in all learning techniques; during this active learning period in Childhood, the process of learning colors and assigning sensations to colors may be observed (Mazlum, 2019). Due to their Childhood, they begin to discover materials around them at the age of three and can consider the differences at the age of five. According to Mazlum(2019), Children aged 5 to 6 years old can determine links, make decisions between concepts and colors, and assign significance to colors unconsciously (Mazlum, (2019), where they begin to receive information from the environment that surrounds them. Therefore, the circumstances that people pass through during their Childhood and the factors that help them to be helpful in their society can be improved by using color. Furthermore, it can lead to an increase in the interaction precisely in the learning environment, which is the place where children spend most of their time. So, attention should be drawn to the effect of colors on them in a particular way to improve their learning approach.

1.2 Problem Statement

Children are influenced significantly because they are among the category that the environment can easily influence them, whether the effect is negative or positive. (KALAYCI, 2018) argues that people encounter the world as a colorful environment from the minute they are born. Color is recognized in everything we see in our daily lives and even our dreams (KALAYCI, 2018). Color is one of the essential aspects influencing how children express themselves in a given environment. Various studies have found that the color surrounding us significantly impacts our mood and conduct in our daily lives. Children can be influenced by color physiologically or psychologically, two factors worth noting because they play a significant role in the

future of these generations. Also, attention should be drawn to the elements that can impact children through the presence of rooms or other places in the teaching environment. (KALAYCI, 2018) Colors are one of the essential factors in determining how individuals feel, both physically and psychologically. Different colors symbolize different moods. As a result, the color selection for a specific region must be such that it satisfies the needs of the group that will utilize that area (KALAYCI, 2018), which also must have specific colors, such as additional rooms in which these children's activities take place such as rooms for handicraft or outside environment.

Many children have problems with their skills (academic performance and concentration) in the classroom or learning environment due to the wrong choice of color in those spaces. However, there is limited research on how colors affect children's mental development. Because many children have a problem with their performance in education in some aspects, Many schools choose the wrong color or ignore their design in classrooms because they do not have enough knowledge about the effect of these colors on the children, such as psychologically, physiologically, academic performance and concentration in teaching, that negatively affect children.

1.3 Research Questions

Owing to the fact that color is a very important factor that has to have more attention within the concept of the design, the main question of this study will be:

1. How do create a suitable environment for children that affect positively on their achievements in their learning environment?

And sub-questions that support this question:

2. Which color that children like and what effect on their concentration in their learning environment?

3. Does the color also can be caused to affect children's academic performance?

1.4 Aim & Objective of Study

This study must have a significant point for children and how to get benefit from this research. So, this study aims to reach a better environment in the learning environment through color as a direct tool to affect children and how it will affect their performance, psychological, physiological, academic performance, and concentration. Moreover, it is required to utilize a lot of articles, books, and reviews as a literature review, with some tools to obtain the desired goal. Which then can gather a good literature review for this thesis.

1.5 Research Methodology

This study will be based on a qualitative method. It is suitable for this research for some reasons. From this kind of method, this study can observe the information from the cases in the study that it needs to collect the data and explore more deeply than others. In addition, it is rich in various information. Also, utilize literature such as a book, articles, and websites. To achieve the result this study is looking for, analyze the data into a graph and evaluate the cases that will select and fill the information in tables or frameworks.

1.6 Limitation

Color is considered a vast topic. So, this thesis will not be able to intensely discuss all of the perspectives linked with colors, such as climate and its relationship with colors, culture relation with color, and the topography of colors. The main focus will be on colors in spaces of schools such as classrooms, handicrafts, activity areas, sports areas, and external playgrounds, and some criteria will be considered in the scope of this thesis as well, such as technology, furniture, lighting, visual elements, type of arrangements, high of the space and the main focus in these criteria will be

on color. In addition, the group of colors that will be focused on in this thesis will be primary colors which are red, blue, and yellow, and secondary colors which are orange, green, and purple. This thesis will focus on children of both genders from five to twelve years old, without choosing a specific group of children to see the impact of color on them. The cases of this thesis will be ten elementary schools that followed innovation and competition, which means the schools will not be standard schools, which may help the educational environment to be more suitable. These cases were chosen by those who provided the criteria mentioned before to reach a better environment inside the class through the criteria to improve their skills and look for their academic performance, psychological and physiological impact, and concentration in the learning environment.

1.7 Structure of Thesis

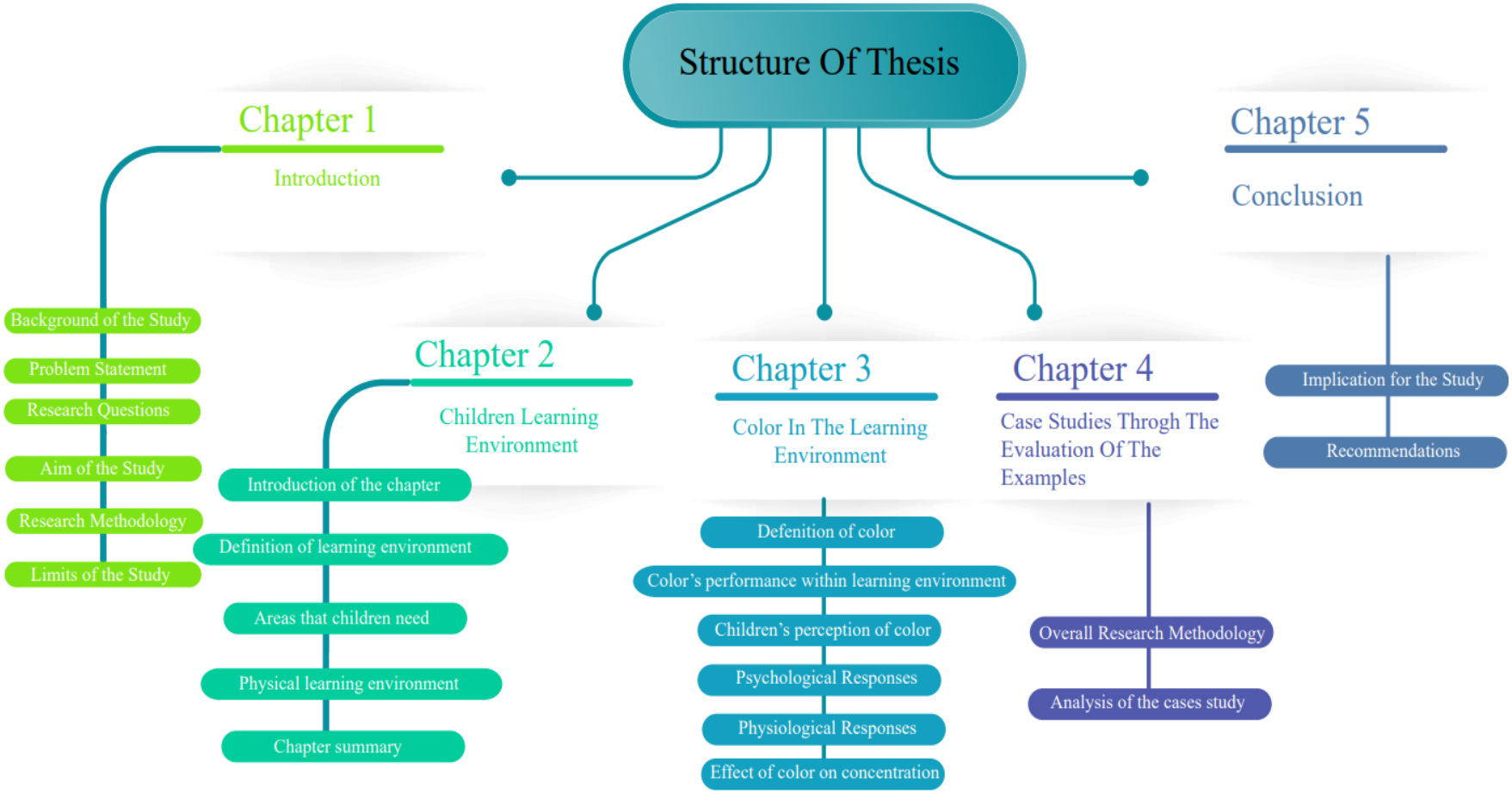


Figure 1.1: Structure of Thesis

Chapter 2

CHILDREN LEARNING ENVIRONMENT AND THEIR PERFORMANCE WITHIN CLASSROOMS

2.1 Introduction of the Chapter

This chapter will point out the physical environment in the classroom. The first debate is about the meaning of the learning environment; this chapter will talk about technology and its importance in the classroom—moreover, furniture and how it should be in terms of the dimensions that provide comfort for children. Next, the quiet that should exist in classrooms for children will mention, then moving to light and its importance in the classroom and how it affects children. Next, painting and visual elements will be addressed and how it supports the study method, which leads to the development of the scientific level. After that, the spatial arrangement will be mentioned in addition to some elements that can affect children through a spatial arrangement, such as the distance between the students and the teacher. An aesthetic component is a color and how color affects children, and then it will also point out the areas that could support their achievements for academic performance and concentration in the learning environment. Furthermore, mention the external playground for playing in addition to the presence of rooms for handicrafts and the importance of their presence in schools as an essential element that works to enhance skills in children. Then it will be noted about other influences that can help to improve the education process, such as the height of room ceilings, the colors in the classrooms, and how they are affected (Figure 2.1).

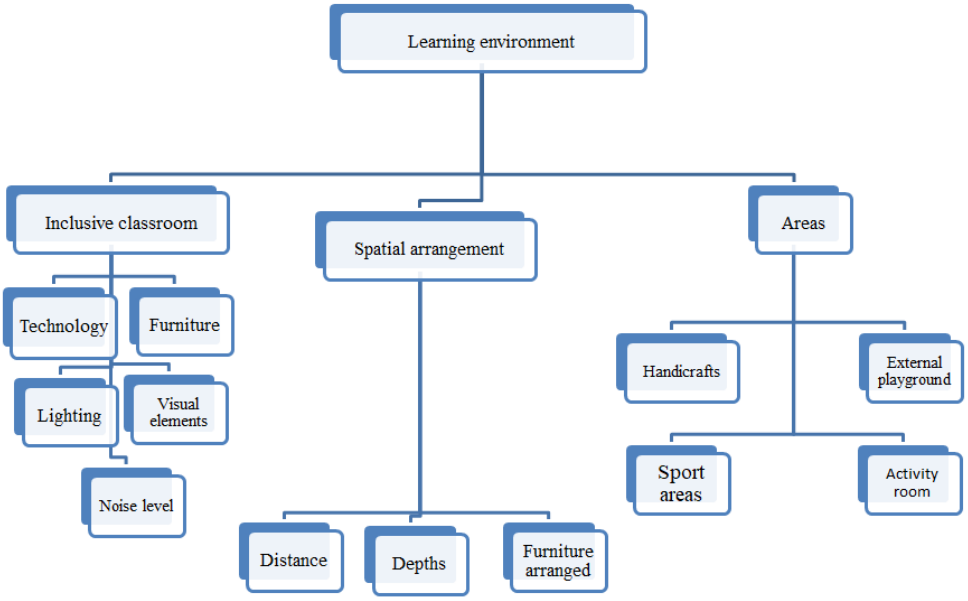


Figure 2.1: Criteria of Learning Environment

2.2 Definition of Learning Environment

A learning environment can be defined as it is a supportive place where all children can grow. Classrooms, virtual environments, play places, activity spaces, and external areas are all included. Learning environments are well-managed and organized spaces. They provide developmentally appropriate schedules, educational programs, and chances for choice, play, discovery, and experimentation inside and out (Lage, 2000).

To reach a suitable environment for both children and teachers to allow them to support their education and their performance. The classroom has to have some features. The first thing that has to get attention is the style or a method that should exist in classrooms to make sure to allow the children to get maximum value from the benefit from the teachers and grow up their education. The teaching method has a strong point that can affect children's performance in their education if there is no suitable method between the teachers and the children that will make a classroom so

dull and less effective for the children and have a terrible effect on them (Lage, 2000).

Recent studies suggest that a misalignment between a teacher's teaching style and a student's learning style might result in the student learning less and less engaged in the subject matter (Lage, 2000). This finding indicates that educational administrators should attempt to obtain a successful match between the teacher's teaching approach and the student's learning styles or that concerned teachers should use a portfolio of teaching styles to appeal to various student learning types (Lage, 2000). Of course, these things mainly affect children in different ways. Furthermore, many factors can affect children's performance.

Also, it can be defined as a Learning Management System, a Course Management System, a Virtual Learning Environment, or even a Knowledge Management System that can be used to describe the learning environment (Moore, 2011). The learning environment was defined from another perspective as a place where there should be some characteristics, such as rich learning activities to help students think deeply about the contents of the educational environment.

The presence of collaborative work for the ability to help students learn among each other under the supervision of teachers, in addition to the presence of experience By teachers to motivate students to take responsibility and put them in realistic conditions, such characteristics exist to provide several types of thinking that help students develop skills and general attitudes that work to solve problems that students face in the classroom or their lives. In addition, the most important thing is

acquiring new concepts and merging them with old concepts, which in turn provide an effective way of thinking in their fields (Grabinger, 1995).

2.2.1 The Inclusive Classroom

The inclusive classroom has been defined as an educational classroom that must contain several strategies that support students to reach correct conclusions as the classroom can organize healthy students and others with differences in learning. In addition, it must provide academic and social needs and communication skills, which are strategies that should exist in a classroom. Moreover, such strategies are central measures of the learning process in the inclusive classroom (Nilholm, 2010).

For this part, first question will come to your mind is what should classroom contain that will make any effect for who will use it?

In an inclusive classroom is vital to have furniture and technologies that enable young students to take adequate rest, to be able to focus, and to have the right amount of giving to develop the minds of children in such an important place as it has mentioned before as characteristics.

Once there is a traditional or basic board, as some say (the blackboard) and some furniture that the teacher and students can use to create an element of comfort for both. These elements have the ability in their simplicity to provide an atmosphere suitable for the study environment, which enables the teacher to give any lecture to benefit the students. When someone comes into a classroom with merely a blackboard and probably some sound amplification, the presumption is clear: the teacher can teach whatever ideas and supply whatever information students need with the lecture, chalkboard, and discussion (Conway, 1993). The importance of

furniture in maintaining a proper sitting posture. Children, more than adults, benefit from furniture that encourages appropriate posture since sitting habits are acquired early. (Panagiotopoulou, 2004).

Figure 2.2: Inclusive Classroom (URL1)

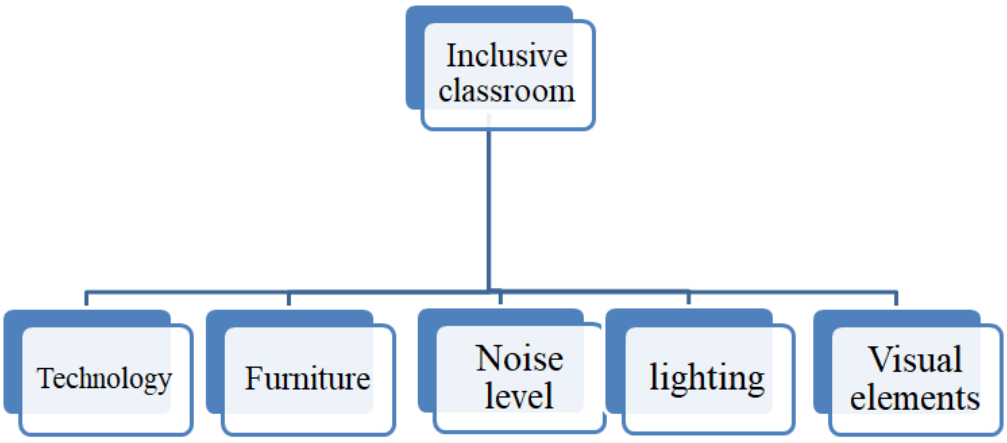


Figure 2.3: Inclusive classroom Criteria

From the point of view of technology, for instance, interactive whiteboards (IWD)" An IWB is a large touch-sensitive display board onto which the computer image

was projected, the image can be controlled by touching the surface of the board with a pen or finger. It is possible to write off a draw on the surface, print the image off, or save it electronically" (Morgan, 2010). It can say that there is no need for very advanced technology to attract the attention of the student, although its presence can provide several avenues for the teacher's comfort. As each teacher has a different teaching method that enables him to attract students' attention to information that must be known by the student and also for learners, there are different ways to gain knowledge. That (IWB) is commonly utilized to support a more instructions type of teaching as would be encouraged by the socio-cultural principles espoused by most teachers or the new foundation phase now being implemented. (Morgan, 2010).

It was also noted that the issue of advanced technology is not the basis of education because the teacher is the most automatic and most valuable tool in evaluating and educating the student and giving them the benefit. The fact that technology allows for these many ways of communication does not imply that the 'live and real-time' teacher is not the driving force in the classroom. The teacher decides course content and technique and is the most spontaneous and vital instrument in the learner assessment process (Conway, 1993). With the ability to provide knowledge in several formats, access to a wide range of information sources, and maximum resilience for communication between teacher, student, and information. In general, classrooms should be built to facilitate participatory teaching and to learn to obtain the maximum knowledge capacity. (Panagiotopoulou, 2004).

The essential element that comforts students is the furniture because if the body gains a comfortable position, it can focus on other things better (Panagiotopoulou, 2004). For example, the furniture dimensions used by students in particular,

regardless of gender. If these dimensions are not suitable for the student, it will affect the student's well-being level in the classroom, in addition to the negative impact on the sitting position, significantly when reading or writing, which will negatively affect the student's performance in the classroom. One study mentioned that the findings show a disconnect between the student's physical proportions and the classroom equipment that is accessible to them. The seats are too high and deep for the students, and the desks are too high. This circumstance has a destructive impact on the children's sitting posture, especially while reading or writing. (Panagiotopoulou, 2004). The classroom should contain high flexibility of setting to allow students to be satisfied.

Furthermore, another study points out another factor in the classroom: noise level. Children must be dealt with in a manner that may be slightly different from adults, as it is possible to influence them in the simplest ways, and among these things is the quietness in the classroom. Adults can gain knowledge or even hear each other even if there is some noise in the classroom. Although children are smaller and noisier than adults, a classroom space must be provided for children free from noise to hear each other and gain the necessary information. As a result, they need a quiet atmosphere in the classroom because they face difficulty hearing the talk in pure form and acquiring information in the event of noise or auditory discomfort. Children are not just more minor and louder than adults; they are also immature and inefficient listeners who are still establishing their speech perception skills until they reach adolescence. Children have more difficulty processing speech in noisy and reverberant rooms than adults. As a result, when designing classrooms for children relying on acoustics that are "good enough" for adults is insufficient. Instead, it is preferable to construct classrooms with children's specific needs in

mind. Children require minimal noise and reverberation in order to hear and grasp everything uttered across the room. (Nelson, 2003). Sound in the classroom: Why children need quiet (Nelson, 2003).

The other important element inside the classrooms is the lighting. In the era of development, the presence of lighting is in many types and forms. While school hours start in the early morning hours, there must be lighting in the classrooms, as some studies have indicated to some types. According to (Hansen, 2017), dynamic lighting refers to intelligent, automated systems in which one or more factors, such as light intensity, corresponding color temperature, or distribution, change over time. Lighting is also included, which comprises scenarios with predetermined light characteristics. The phrase daylight refers to natural light, such as sunshine and skylight, whereas incandescent, fluorescent, LED, HPSV, and other types of illumination are referred to as artificial or electrical lighting. According to (Comenius, 1967), the impact of two specified light conditions on reading performance - accuracy, speed, and expressiveness - was investigated using standardized examinations. The study revealed that reading improved more under the emphasis setting (6000 K, 1000 lx) than under the usual (3500 K, 500 lx).

Furthermore, another dynamic light experiment used field and laboratory tests to assess the impact of three distinct settings with varying CCT and intensity levels on student performance. The results revealed that students produced fewer mistakes of omission under the Concentrate lighting scenario (5800 K, 1060 lx) than under the Standard setting (4000 K, 300 lx) (Comenius, 1967). In addition, the effect of dynamic LED light. One laboratory experiment and two field experiments were conducted. The light was different in terms of CCT and intensity. According to the

findings of the field trials, the children did better in the experimental Focus setting (6500 K, 1000 lx) than in the Standard (3000–4000 K, 300 lx) (Hansen, 2017).

Visual elements are essential in the classroom to attract students' attention and maintain an ideal school study environment, which also helps improve students' skills. It can also help with learning difficulties for some students in the classroom (Bush, 2007). Moreover, the importance of previous information was proved in many studies, and it is much needed in the eyes of many. Words should not learn without visual forms that support them. Drawings as a type of visual element were also referred to their importance and the extent of their help in improving the teaching process. The idea of the drawings is to provide the intended with visual support for their fear of not receiving oral information alone (Comenius, 1967). Many researchers contributed to the Pictures and graphics after they observed smoothly received information supported by graphics and visual forms. In addition, they concluded that visuals could help provide the receiving of information and enhance the process of education (Bush, 2007). After a large number of researchers studied the subject of pictures and graphics, which stimulate learning, they found that pictures have great importance in learning and retaining vocabulary and can motivate students to improve education (Kellogg, 1971). It was also noted that the cognitive theory, explaining how students remember information through pictures, improved children's performance and their memory rate, in addition to acquiring grammatical structures more than just learning information (Kellogg, 1971). It can also point out that thinking deeply sometimes makes it difficult to imagine the lessons that can be conducted through visual explanations, while images gain an additional point through research that proves the acquisition of information is stronger through images (Bush, 2007).

2.2.2 Spatial Arrangement within Classrooms

The spatial arrangement within the classes is essential in meeting the needs of both the gender student and the teacher in their spaces. The spatial arrangement can also help the teacher arrange the class by giving the lecture or lesson with a specific idea so that the students benefit from it as much as possible. In addition, in this study, attention was drawn to some problems such as the size of the classroom, the space occupied by the furniture in the classrooms, and the method of arranging the seats in order to find the factor of equality among students in terms of benefiting from the information that given in the classroom and how to deal with it.

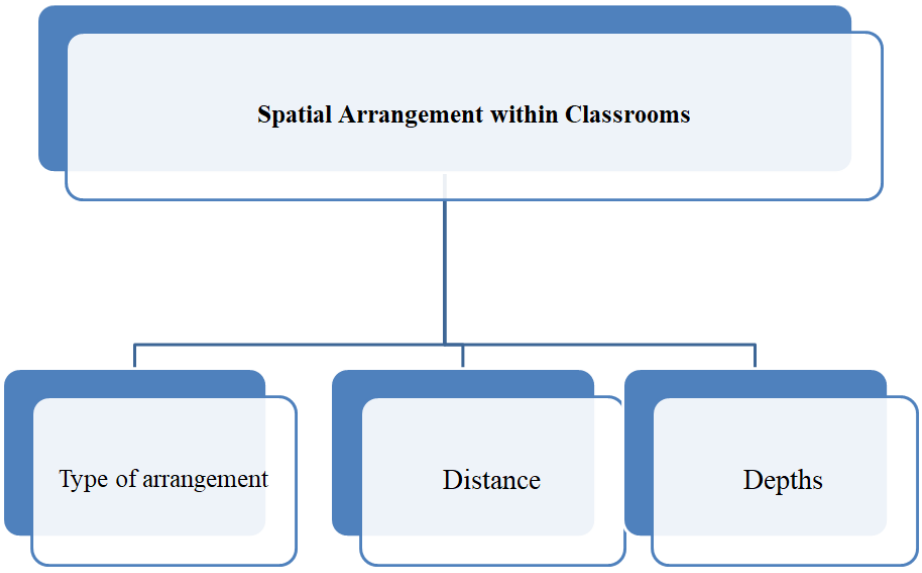


Figure 2.4: Spatial Arrangement within Classroom

The spatial arrangement has several reasons, such as the size of the classroom and the type of furniture used (Ankney, 1974). (Cardellino, 2017) has argued that the position of seating in the classroom of students can affect how much they can see and hear from the teacher (Cardellino, 2017). In a study, the optimal sitting in a classroom was discussed. It was found that the students who used to sit in the front

seats were more attentive and actively engaged in participation than the students in the back seats (Weinstein, 1979). It can also depend on the teacher's desire for how the class is arranged because each teacher has their teaching method.

On the other hand, spatial arrangements can affect the interactions that occur between students and the teacher within their classroom spaces. Also, attention can draw to a certain number of row arrangements and mention some of the benefits of each arrangement. For example, if the class is arranged in terms of seats and the platform (the teacher) opposite each other, such an arrangement increases the possibility of having a lecture to teach a topic or present a specific idea by the teacher to the students. For instance, arranging the students' seats in a circle increases the opportunity for group discussion or interaction between students if there is a specific activity (ANKNEY, 1974). Therefore, they are two types of seating arrangements.

The traditional method: It is a podium for the teacher, and the students' desks are in the form of rectangular rows in front of it.

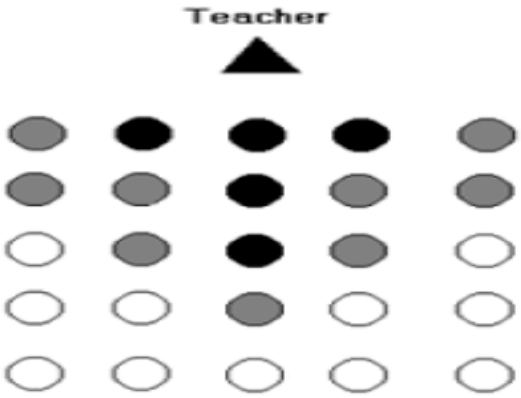


Figure 2.5: Traditional Method (URL2)

Semi-circle shape: It is a semi-circular arrangement for children's seats.

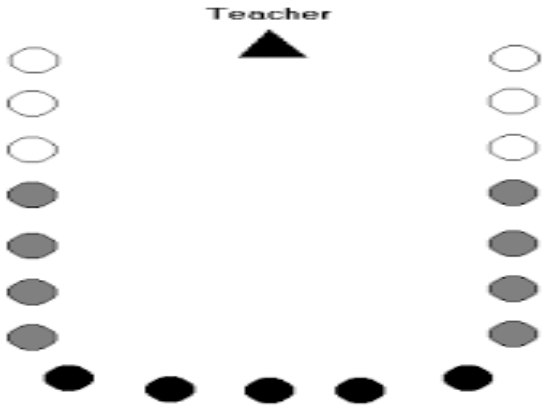


Figure 2.6: Semi-Circle Method (URL3)

There must be a reason for everything that exists, which is to serve humanity in the first place, to facilitate a specific topic that was raised as a problem (ANKNEY, 1974). According to Sommer, he found that the spatial arrangement affected the participation and interaction between students through the introduction of the distance factor, through which the influence on students is affected in terms of the students who sit opposite the teacher that they participate more than other students in behind of the class. As for the other arrangement, the semi-circle, the participation is almost equal between the students in the class. Moreover, known color can also affect depth if it is dark or light, which will be mentioned in the next chapter (Sommer, 1969).

An investigation was made between classroom space and the self-concept of learners. The researcher found that distance is an essential element that could enhance the skills of children in participation in the classroom (Kling, 1971). So, in his field experience, the researcher referred to two classrooms, one of which is beautiful, which is a room painted in bright colors and modern furniture arranged beautifully. As for the ugly room, it had dark paint and untidy furniture. The results were that students who gave an exam in ugly rooms from his point of view completed their

exams in a shorter time. In addition to that, their reactions tended to avoid the room quickly, fatigue, feel restless, and irritability. These were the opposite of the actual responses in the beautiful room (Mintz, 1956). Furthermore, depths in the classroom affect the spatial arrangement by determining the number of classroom seats. Moreover, they also point out that the children in the last seats are more affected (Cardellino, 2018). Finally, classroom spatial arrangement can affect the relationship between student and teacher offices in their interaction (Simmons, 2015).

2.3 Areas that Children Need in their Learning Environment

When children are born, they begin to sense the surrounding environment, and the environment that surrounds them also can affect their behavior and performance in their life. Therefore, the environment is vital in influencing children and developing their way of life. Loebach said, "Children are affected more deeply by the environment than any other age group" (Loebach, 2005). Another study mentioned that children like to play and have fun most of the time and could prefer it to study, and playing is the best way to communicate between children and the world around them. Play can also aid in the learning process, enhancing learning opportunities by discovering elements inside or outside (nature) of the classroom. So, outer space is meant for children when it supports the teaching process and improves it for the better (Acar, 2014). Furthermore, to see the deferent between indoor and outdoor spaces. Several aspects, such as size, dimensions, visible landmarks, and the nature of the building, can be found to distinguish between them.

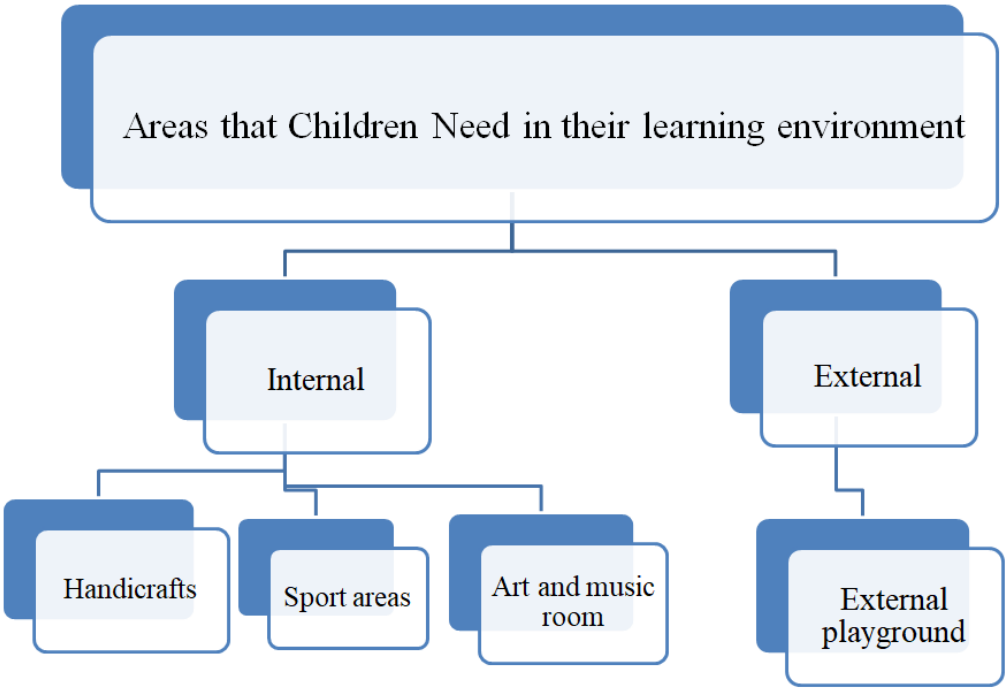


Figure 2.7: Areas that Children Need

This study indicates the extent of the difference between indoor and outdoor spaces. In the beginning, it was indicated that the spaces could be either indoors or outdoors (Kray, 2013).

Internal spaces can be defined as places with small borders and must have specific three dimensions, allowing children to move between different levels (floors) within their three dimensions. The viewing angles inside the buildings and the interior spaces are limited by obstacles such as doors and windows, which constitute the three dimensions of those spaces. While the external spaces were defined based on the aspects that were previously mentioned as the opposite of the interior spaces and that it is not bound by triangular borders but rather its wide-ranging bilateral borders and enjoy a long vertical horizon that can be exploited in addition to the viewing angles that are unlimited and it described as flexible in addition mountains, horizon

and the sun are the elements that improve the movement of children outside which make it more flexible (Kray, 2013).

To draw attention to the outdoor spaces of children, play areas should be designed with non-harmful equipment, because the best way to teach is through practice, not theory (Acar, 2013). It can be summarized what was said in this area into two points:

1. The presence of activities, games and explorations in the teaching curriculam will enable children to gain experience and unload negative energy.
2. Children's use of outer space for play purposes. This method can provide information to children and acquire it unconsciously, in addition to gaining experience about the environment (Acar, 2014).

Also, the activity can be in both of them, either indoor or outdoor. In the beginning, the activity area must be defined. It is part of the learning environment described by specific materials and physical limits. The environment is divided into areas to reduce chaos because there is a spatial arrangement and to motivate children to learn. The activity areas isolated from the classroom should be chosen based on the teacher's teaching style and the student's needs. Attention should be drawn to sensory stimulation, which means the presence of colors in areas designated for activities and classrooms, and cognitive stimulation, which is the teacher's use of the educational environment to stimulate and support children to work in areas that promote intellectual growth (Sanoff, 1988). For example, Smith mentioned in his study that the existence of an external playground was proposed to develop the activities for children, as many consider it to be an external educational environment, and it is also considered a term that indicates child development and early education (Smith, 2016). In another instance, Handicrafts are among the necessities of teaching. This

study proved the necessity of handicrafts in education to make the teaching process easy. It is necessary to use both hands of the student to enhance student's writing and some activities that help them in their studies (Sederevičiūtė-Pačiauskienė, 2019).

2.4 Physical Learning Environments Design and it's Spatial Requirements for Children

Some of the elements that must be provided in the classroom, lead to providing comfort for students, such as the height room ceiling, color, and pollution. For example, it has been proven that the height of the space can affect the psyche of children (Read, 1999). Moreover, the colors inside the classrooms. Other factors that harm children, such as the pollution of the nearby air and the pollution of the water that is used, have proven that leads to a decline in academic performance if there exists (Wang, 2009). (Rosado, 2007). Such aspects are crucial to discuss since they are present in the physical environment, which is a part of the learning environment in which students spend most of their time.

2.4.1 Effect of the Physical learning Environment on Children

The physical learning environment can affect children's development process from the things they face. The physical environment with its characteristics: furniture used, user age, color, and dimensions of interior spaces can affect children in several ways (Evans, 2006). Attention should be drawn to the environmental characteristics that help in the child's development, which can affect them in many aspects. The collective exposure to adjacent hazards in the physical environment can be a critical issue that may influence the adverse developmental effects on children, which will be mentioned later (Evans, 2006).

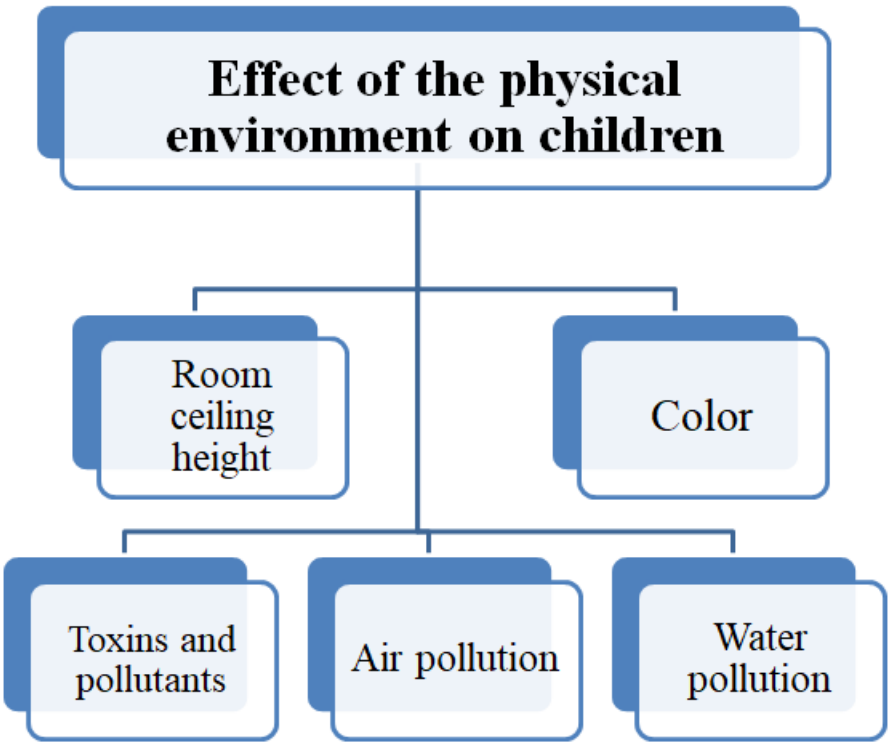


Figure 2.8: Effect of the Physical Environment on Children

Some of the elements in the physical environment that can affect children;

- **Room Ceiling Height**

There is great importance revolving around the height of the classroom ceiling, as there are possibilities to affect children in terms of physical movement. A study has shown that low ceilings motivate children to play more quietly while those ceilings that are more than 2.5 meters high encourage more activity. Therefore, attention must be paid to the purpose of the room, whether it is for lessons or activities, while also paying attention to respecting the standards of children to ensure a sense of safety (Read, 1999).

- **Color**

A study discovered that brighter light combined with color can increase the most intimate communication between individuals in the interior space because color is a very important factor even in internal or external spaces. Gifford suggested the use of

warm tones such as red and followed it in areas that need to motivate children such as the sports area and the use of cold colors in areas that need to control children such as the classroom. The researcher also pointed out that girls and boys differ in their preference for colors, as girls preferred the most dramatic and diverse degrees of color, such as red and its followed colors, and also if the white color engaged any of them (Gifford, 1988).

- **Toxins and pollutant**

Toxins and pollutants that may be present on the ground or in a nearby place are considered as one of the aspects of the physical environment, which may be carrying toxins according to the locations of schools or educational institutes. Some studies have shown that lead greatly affects children in terms of sensory perception and cognitive performance, and this affects their learning and reduces their performance of participation in the classroom or their homework (Ferguson, 2013).

The topic of this chapter includes the physical environment, but this part of the study deviated a little from the main topic and wanted to draw attention to the suffering of some schools because of their locations or the reason for the presence of old factories from which lead leaked in the land adjacent to the place of teaching.

- **Air pollution**

With air pollution, nitrogen dioxide gas spreads. This type of toxic air affects children in terms of their perceptual senses and reduces their performance. It was also found that children who were exposed to high levels of nitrogen dioxide had lower scores on memory assessment tests (Wang, 2009).

- **Water pollution**

As for water pollution, should stay away from places where arsenic is concentrated. A study found that children aged between six and eight years performed poorly compared to children those who have a low concentration of arsenic (Rosado, 2007).

2.4.2 Factors That Improve Education

The physical learning environment is a term that should be paid attention to meet the needs of children and others in the classroom. This term refers to the class's personal climate and organizational structure (Weinstein, 1979). Over time, teachers have increased awareness of other dimensions that can affect the educational environment. The term open learning environment was introduced to become a new variable in how the classroom space is used to achieve additional conditions that could positively affect children (Weinstein, 1979). Attention can be drawn to the definition of each personal climate, which can be defined as some of the needs of the individual, such as comfort, integration, and the ability to control the classroom. In contrast, the school climate was defined as some needs such as comfort, integration, control, Interaction, sharing, and affection, and each student seeks their climate among these needs (Feitler, 1970). In addition, this study demonstrated the existence of the relationship between the personal climate and the school climate, that each student has requirements and needs that must be present, and that most of these needs can be reached through the spatial arrangements within the classroom that provide all the desired needs of the children (Feitler, 1970).

Over and above, open education refers to the state of the physical environment and not in its literal sense. Open education is many changes or different teaching methods that, in turn, reflect the belief that children can learn better when they discover an educational environment rich in materials and effectiveness. This may enhance

children's ability to make decisions, and then they can interact in an informal (more comfortable) way with the teacher and break some restrictions between each other as well (Walberg, 1972). In terms of spatial arrangement, which is also essential as a requirement in class to present the appropriate environment and is an important part of the physical environment, a previous study pointed out the students' preference to sit in the front of the room that able them to concentrate in class, and also the students who tend to sit near their parents had a great need for criticism others, furthermore students who set at the back of the room or near window demonstrated lower academic performance and tended to be unable to pass a semester (Weinstein, 1979).

A study proved that additional rooms preferred by children, other than classrooms, contain rooms for handicrafts, drawing, and outdoor spaces due to their ability to enhance children's intellectual and practical development to improve academic performance. They did not prefer the presence of additional rooms for books and more study rooms other than the classroom (Rosenthal, 1973). Otherwise, the school climate is considered one of the most important aspects of motivating students to learn, and it can create an effective learning environment in the classroom where a study has focused on giving the school climate much attention as an essential component for improving education. This climate represents the rules and expectations that stimulate people's sense of social and physical safety, leading to exemplary achievements (Thapa, 2013).

2.5 Chapter Summary

This study talked about the learning environment, its importance, and the extent to which its elements affect children. One of the most important elements is the physical environment; it includes many aspects mentioned previously, such as

technology, furniture, noise level, lighting, and visual elements, and how each of these elements affects children in several aspects, as mentioned previously. After that, attention was paid to one of the essential elements that enter into the formation of the learning environment, which is the spatial arrangement which was talked about its importance and the elements that help support it to be one of the essential elements of the learning environment such as the types of arrangement, distance and depth in the classroom and how each affects each other for the children. Then it was pointed out the places children need inside schools to support their academic performance and reach the desired goal, which is a rich learning environment. In addition to referring to the expected impact of the physical environment on children, some elements were discussed, such as the height of the classroom ceiling, colors, gender, and toxins, if any of them exist in the physical environment, and how they could impair academic performance in the classroom.

Chapter 3

COLOR IN THE LEARNING ENVIRONMENTS

3.1 Definition of the Color

At the beginning of the third chapter, some essential elements such as color, color theory, primary and secondary colors, hue, and saturation must be mentioned before the expanded explanation of the effect of color on some perspectives. Color can be defined as the visual quality that is determined, a reason the elements look beautiful, as it gives different appearances to the eye. The hue is one of the essential color supplements, as it is known to change color to lighter or darker degrees to achieve what is called saturation. In contrast, saturation is defined as reaching the desired color degree to show the element to be beautified with an attractive appearance (Pulliam, 2012). Finally, color theory can be defined as some of the rules designers use to communicate their ideas through colors that give the aesthetic and functional character appropriate to the interior places with the study of each color and its effect (Krantz, 1975).

Thus, the color wheel should also be understood. This means a circle that emphasizes the relationship between each color (Figure: 3.1). There are three primary colors from which the rest are extracted. Red, blue and yellow, the primary colors of the color wheel, can also be called primary colors. In addition, secondary colors can be combined with any two primary colors, such as red and yellow, to make orange. The

rest of the colors are extracted by increasing the white color to lighten the degree of color or black to appear darker (Morton, 1995).

Moreover, by mentioning color and the wheel of colors, there are colors called warm colors and, in contrast, cold colors. Each of those has a specific effect that differs from the other. For example, the colors associated with red and yellow are described as warm because they indicate a feeling of warmth and are symbols of the sun or fire. At the same time, blue and green refer to nature and water, which evoke a wonderful feeling (Amarin, 2020).

It can be possible to mention the color theory for its high usefulness in facilitating the ability to communicate between designers and other groups of humanity, such as children, youth, and the elderly. In addition, the color theory attempts to provide all the critical data, such as color defects, and how to adapt to each of them within this theory (Krantz, 1975).

Color theory and color perception must be known to understand color responses in all forms. At the outset, it should be noted how the human eye receives color. As soon as the rays of natural or artificial light reach an object, it reflects the colored light and thus receives it by the human eye, and the response occurs in all its forms (Amarin, 2020).

Figure 3.1: Color Wheel (URL4)

The physical environment was mentioned in the previous chapter, this study aims to know about the effect of color in the classroom, but it is necessary to show the contents of the classroom to be somewhat detailed about what is essential before entering the most critical chapter in this study, The information in this chapter revolves around the effects of color in the school classroom and its effect on children.

Color affects students in many aspects, the most important of which are behavior, performance, and concentration in the classroom. In addition to the fact that color affects students in different ways than adults, children have different responses from physiological and psychological points of view. So, color is an essential element within interior spaces. Furthermore, there are different responses of children to the color, whether it is a cold or warm color, which will be mentioned later (Gaines,

2011). These responses can be sorted in the form of color preferences regarding emotion and academic performance (Gaines, 2011).

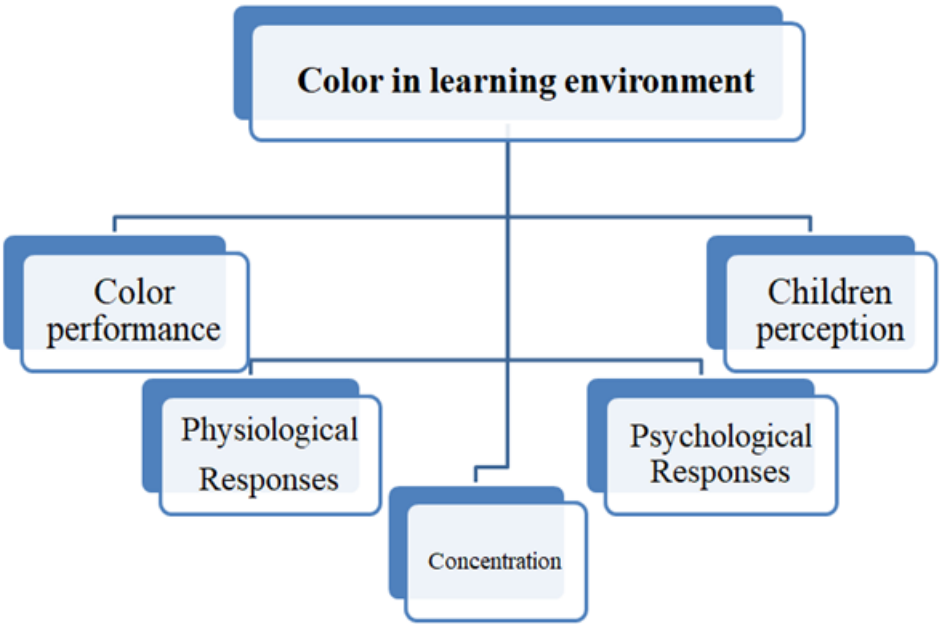


Figure: 3.2: Color in the Learning Environment

3.2 Color's Performance within Learning Environment

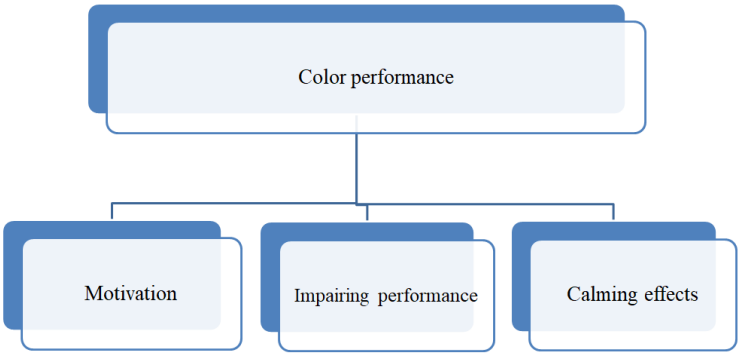


Figure3.3: Impacts Included in Color Performance

A study has shown that colors and their wavelength can have physiological or psychological effects on children. This depends on color preferences and their strong relationship to academic performance in the classroom. The wavelength of any color

is a feature that can affect children or others through it; also, it is pointed out that the colors those fall under the name cold colors are blue and green (Figure: 3.4), indicating a feeling of less depth in the room, while the warm colors that are red, yellow (Figure: 3.4) have been proven to give a sense of more depth than the actual presence (Boyatzis, 1994).

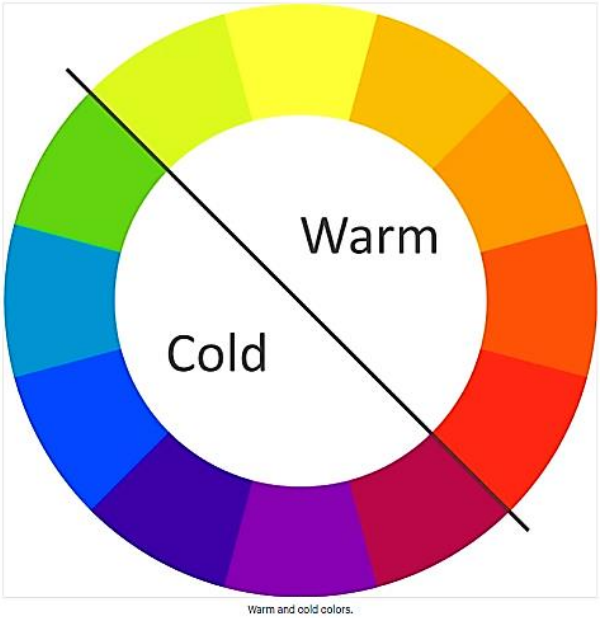


Figure 3.4: Cold & Warm Color (URL5)

Another study mentioned the rapport between color and mood, as the study indicates that mood is directly related to performance. Furthermore, in this study, red and yellow colors in classrooms were associated with motivation, while blue and green colors were associated with calming effects. As well as that, the study found that color also affected tasks in the classroom. For example, red walls impair children's performance in knowledge-intensive tasks (Lewinski, 2015). Another study indicated the physiological and psychological effect of colors, a test was conducted on students using red, green, and black colors, and the results proved that exposure to red color led to weakens academic performance. Even if the participants were unaware of the

exposure or if the words on the head of the paper were in red (Elliot, 2007). There are many studies about exposing children to color and seeing their reactions. (Table: 3.1).

Table 3.1: The Impact on Performance

Color	Impacts	
Type	Negative	Positive
Red & yellow	Red: Impairing academic performance. Yellow: Distraction if exist a lot	Red & Yellow: Associated with motivation
Blue & Green	……	Blue & Green: Associated with calming effects.
Note	Warm colors give a feeling of greater depth, Cold colors give the opposite feeling.	

3.3 Children's Perception of Colors

Most things are perceived, and stimuli are also received through color significantly. When looking at the stop sign, the entry signal, or others like this, it is color alone that can distinguish the intended or the mean from the sign. The signal emitted by color is the standard method for physical or digital warnings (Jeong, 2020). A study on the preferred colors for children proved as follows that children aged between 60-72 months or the equivalent of 5-6 years tend to prefer the colors that tend lighter shades (such as red, blue, orange, and yellow) and that This group of colors indicates happiness and comfort, while the children did not prefer the colors that tend to the dark category and that symbolize sadness and anger for children such as (black, brown and gray tone) (Jeong, 2020). One of the results of that study proved that children aged between 10-11 years, meaning they are in the fourth grade, those

children symbolized safety and security in green color, and rarely were the signs indicating safety in red color (Iftadi, 2018) (Figure: 3.5).

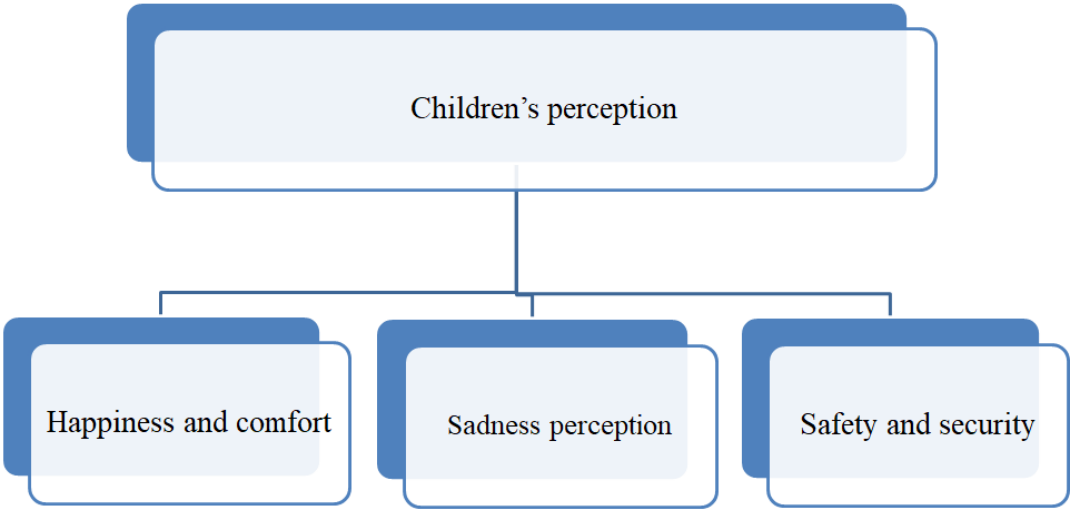


Figure 3.5: Impacts Included in Children Perception

Other results of this study proved children's color preferences, which were that children preferred blue, red, and green colors while black, white, and children less preferred orange colors. The children unanimously agreed on their preference for bright colors in their concept of the beauty of colors (Iftadi, 2018). In this study that proved several results about the preference for colors and their effect on children, a test was conducted on children between the ages of 60-78 months or the equivalent of 5-6.5 years, and they were a mixture of 30 males and 30 females. The test was about nine colors, including bright and dark colors, where most of the children's reactions were positive, such as happiness. Positive responses revolved around bright colors such as blue and red, while negative feelings were in response to dark colors such as brown, which is a darker shade of orange, gray, which is a tone of mixing white and black, and black as it mentioned previously, in addition of that, preferences increased to bright colors with age going up. It can also refer to the reactions to color

specifically for girls and boys, each separately, that girls prefer bright colors, while boys prefer darker colors more (Boyatzis, 1994) (Table: 3.2).

Table 3.2: Types of Feeling for Children

Color	Impact	
Note	**Girls prefer bright colors, while boys are the opposite.**	
Type	Negative	Positive
Yellow	Impairing the attention if it exist in large amount	Work on support chest function, attract the attention if presence in small amount
Red	Rarely has red been a symbol of peace, fighting and blood.	It was preferred by most children, indicating happiness and comfort and love.
Blue	Refers to loneliness for children with specific problems.	Indicating happiness and comfort, also denotes relaxation, calm and peace.
Orange	.....	Indicating happiness and comfort also soothing to the body and slow down the blood circulation.
Black	Most children did not prefer it because it indicates sadness and anger.	.....
Brown	Most children did not prefer it because it indicates sadness and anger.	.....
Grey	Most children did not prefer it because it indicates sadness and anger.	.....
Green	.....	It is a sign of safety and security for most children.
purple	.....	Rest, peace, relaxation and laugh.

Otherwise, another study talked about the effect of colors on children, how children receive colors, and their emotional impact on them. It proved that the emotions tended more toward light colors associated with positive emotions, such as blue and yellow. On the other hand, the study indicated a minority preference for dark colors, such as gray and black, which indicated negative emotions (Kaya, 2004). In addition,

color preference can be arranged according to an experiment conducted around the following colors blue and red. Most children tend to the color blue because, for them, it symbolizes relaxation, calm, and peace in terms of its positive effect. However, as for its negative effect, it symbolizes loneliness for children that have a specific problem. Furthermore, in terms of its positive effect, the red color symbolizes love, fighting, and blood from the opposing side. In addition, purple symbolizes relaxation and is associated with laughter and a good atmosphere (Kaya, 2004) Table3.3.

Table3.3: Color Related with

Color	Impact	
Kind of impact	Positive	Negative
Blue	Symbolizes relaxation, calm and peace	Symbolizes loneliness for children's that have specific problem
Red	Symbolizes love	Symbolizes fighting and blood
Purple	Symbolized relaxation, associated with laughter	……..

It is also possible to mention the effect of color on children according to the wavelength of each color and the possibility of preference for it over other colors. This study pointed out that younger children prefer colors with a long wavelength, such as red and yellow, considered warm colors, as mentioned previously. In contrast, colors with short wavelengths, such as blue and green, were less preferred, and this was the opinion of both males and females in the test (Gyu, 2014). Furthermore, each length has various consequences on humans, whether or not we

are concerned. In addition to an essential component, luminosity, color has a favorable influence if the brightness level is appropriate for the individual. (N.A. Jalil, 2012)).

Children aged five years were mentioned, and how the brain adapts to color is essential to point out in this study. It was mentioned that the color responses in the body are temporary, as the brain's job is always to try to achieve balance. Sometimes the color creates a state of imbalance and biological response in the body. However, the brain will accept the change and mediate the response, leading to the cancellation of the color effects after some time (Safferman, 2015). From what can be concluded here, conditions can influence children's responses, and simple inconsistencies can be found that make it difficult to predict the effects accurately. Moreover, the results of this study indicated that warm colors with red and yellow increase the number of play and activity behaviors, which indicates that they are stimuli to play, while blue increases the duration of these behaviors (Safferman, 2015) (table:3.4).

Another study on the effect of colors proved that yellow is known for its brightness, but it is a color that works on eye strain and facilitates breathing. Like the red color, it increases the heart rate, which leads to an increase in pressure, and it increases muscle tension. On the other hand, the blue color, the opposite color of red, reduces the heart rate, slows breathing, and increases the stimulation of the sense of smell and hearing (Gaines, 2011). While the green color has a high effect on improving speech skills, it is considered the opposite of yellow because it does not strain the eye. Moreover, this study also proved that the orange color slows down blood circulation; thus, they are considered a strong sedative (Gaines, 2011) (table3.4).

Table 3.4: Impact Color on Body

Color	Impact
Yellow	Works on eye strain and facilitates breathing.
Red	Increases heart rate, increase the pressure and increases muscle tension
Blue	Reduces the heart rate, slows breathing.
Green	Improving speech skills.
Orange	Slows down blood circulation, considered a strong sedative.
Note	Warm color increase the number of play and activity behaviors stimuli to play. While cold increases the duration of these behaviors.

3.4 Psychological Responses

A strong rapport can be created between the body and soul through color. The psychology of color says that people can be treated using color, and human health can be improved through the physiological and psychological effects of color on the human body (Dorriy, 2019). A color is a powerful tool that affects children significantly. Through the human senses receive color effects, color can affect bodies in different ways meaning that color, in general, has two effects, warm feelings (joy or pleasure) and cold feelings (sadness) (Dorriy, 2019). It can be emphasized that color is an effective tool that can make a person happy or sad through its effect on the person.

Otherwise, a study proved that color could affect human moods in addition to their emotion, intelligence, and the development of their personalities. An Italian teacher proved that children begin to understand what is happening around them through sense, and knowledge of color lies in its feel and then understanding its effects on children and others (Xiaoxian, 2021). Moreover, color affects the human senses; the

most important sense is sight. By sight, children can perceive color and other nearby elements, the most important of which is color. To confirm that color is also an essential element that must be paid attention to, the results of this study demonstrated that children during the breastfeeding period could distinguish pure colors such as white, red, and yellow. Thus, it can be said that color has a strong relationship with their feelings and intelligence, as indicated previously, reflecting feelings such as happiness or sadness (Xiaoxian, 2021).

Color can affect the educational process also in terms of remembering the information presented in the classroom. From a psychological point of view, it is proven that color can affect the behaviors and attitudes of students in the classroom. These behaviors also can affect how to go to the desired goal of the information provided (Kumi, 2012). A study proved that the presence of a blue background for the information to be presented gives children the ability to remember the information presented, while the presence of a high-bright color such as yellow reduces the extent of remembering the information that was presented (Kumi, 2012). Thus, it can be concluded that color can affect children in the extent to which they remember the information in the school curriculum, so must be taken into account the color of the background on which the information is displayed (Table: 3.5).

To get more about the effect of color on attention and academic performance in the classroom. A study focused on the extent to which the color red affects attention in the classroom as the results of this study demonstrated that the color red encourages children to avoid focusing because it creates restrictions on brain commands on the subject of attention and distracts the listener, which also works to gradually reduce attention, in addition, to impair academic performance. Another result proved that the

gray tone has the same effect as the red color on children, as they stimulate avoidance of focus and concentration, which reduces the individual's ability to remember information (Maier, 2008). Therefore, it can be said that the ambiance in the interior spaces affects the behavior of users through color and evokes their emotional states through their perceptual senses. Moreover, color has positive and other negative characteristics. Also, it should be noted that the saturation of the color tone also has an effect (KALAYCI, 2018) (Table: 3.5).

Table 3.5: Psychological Impacts of Color.

Color	Impact
Blue	Support children remember the information that was explained in the classroom.
Yellow	It reduces the amount of information remembered.
Red	It distracts students because these colors create restrictions on the brain's commands on the subject of attention.

3.5 Physiological Responses

Physiological effects such as increased or decreased heart rate, eye strain, and brain development are as significant as other effects associated with a color and should be mentioned. This study discussed the physiological effects on children of different ages, not exceeding 13 years, in another way before puberty proved that the red color accelerates the heartbeat, which leads to an increase in the rate of blood circulation and thus increases the activity of the sense of smell. At the same time, the blue color works to reverse the color of Red from the point of view of the heartbeat and lowers the body temperature, and cools the appetite (Gaines, 2011). It can be concluded here that the red and blue colors are opposite from the physiological point of view of the children's bodies. It also indicated that the yellow color stimulates the work of the

chest and lungs and is a very suitable color for children with asthma. In addition, most children interact with it positively because it stimulates the work of the lungs, and the preference for this color was among children at the age of 7. However, this color may irritate The eye in the event of its presence in large quantities in front of the students. It was also mentioned that the green color, as mentioned previously, stimulates the activation of speech skills, and this color was preferred more by females (Gaines, 2011)). In another study, it has been pointed out that the green color calms the body and reduces stress (Knez, 2001). While brown, gray tone and black stimulate negative emotions in females, unlike males (Gaines, 2011).

Although some previous studies have proven the effect of some colors, such as red, on distracting attention, and the percentage of mistakes is significant if it is present, in a study that proved the opposite, the red color reduces mistakes committed. The study also proved that the gray tone has a negative effect: the tendency to drowsiness and reduced concentration. There is a contradiction between some of the results found in some studies about color and its effect (Kwallek, 1990). This field is so large that it is challenging to cover all the gaps in it through one study because there are negative and positive effects for each color and each wavelength. Attention should also be paid to the color scales, such as brightness, glossiness, density, and saturation, to know the effects on children and their psychology.

Table 3.6: Physiological Impact of Color

Color	Physiological Impact
Red	Accelerates the heartbeat, distracting attention, a lot of mistake if it is present
Blue	Lowers the body temperature and cooling down the appetite
Yellow	Stimulates the work of the chest and lungs, suitable for children with asthma, may irritate eye in the event of its presence in large quantities.
Green	Stimulates the activation of speech skills, calms the body and reduces stress.

3.6 Effect of Color on Concentration

With the effects of color mentioned previously in this study, it must not be forgotten that the effect of color on concentration is also essential and can affect children's performance in tasks such as mental rotation (von Castell, 2018). Concentration is an essential element in classrooms or other physical environments. However, there are important issues about the effect of colors on children, the most important of which is attention in the classroom because the benefit lies in providing all the elements at the levels that satisfy students and make them interested and attracted to what is given in the lesson displayed.

On the other hand, another study proved that there is a positive point in favor of cold colors about the ability of color to affect children’s concentration, which means that colors that exist under the name of cold colors help children in the tasks of attention and remembering information for children, as it is possible through the presence of cold colors in the classrooms. That is helping to improve the educational environment spaces to provide the most outstanding amount of benefit. In addition,

such colors provide correlations between the neurophysiological and psychological scales (Llinares, 2021). Thus, some gaps can be noticed in finding solutions to provide the best physical environment for students of both genders. Moreover, Grangaard argues that in his study, classrooms with white walls may have poor grades for students, which indicates that this color distracts students from making their academic performance unsatisfactory. However, it is a current problem in many schools (Grangaard, 1995). As a result of the above, walls with one cold color are better for students than white walls (Figure: 3.6).

Figure 3.6: The White Walls in a Classroom (URL6)

In addition to the results of the previous study, this study indicates that the presence of cold colors, such as light blue, on the walls of the inner classroom is better than the presence of warm colors. Also, it has been proven that cold colors motivate students more than the opposite colors. In addition, the children looked positively at the walls, which had cool colors such as light blue (Yildirim, 2015). According to Llinares, his study indicated the quality and efficiency of cold colors when they affect children. At the same time, a difficult task contains many details and requires

more concentration (Llinares, 2021). Another study talked about the effect of cold and warm colors in school environments, which is a topic that deserves to be mentioned for its great importance. It was pointed out that environments with blue-colored walls motivate and support children to solve complex tasks requiring a higher concentration to understand the task and the ability to deal with and solve it, unlike the environments with red-colored walls (Stone, 2003). Furthermore, what can be concluded here is that the concentration required in classrooms is more available in blue environments or environments with cool colors than in others.

3.7 Chapter Summary

Firstly, this chapter looked at the effect of color on students in some respects, such as behavior and the ability to focus, given that color affects all age groups. However, it significantly affects children, as the reference was made to the types of colors. There are cold and warm ones. Each has a different effect, including the color circle, which is the basis of colors and is also considered a smooth softness that enables designers to deal with any other human party via using appropriate colors that support performance and focus in the lectures. The wavelength of most colors and how it affects children and its strong relationship to academic performance, in addition to the effects of color and how children receive it in their spaces to create the appropriate atmosphere for them, also were mentioned in this chapter, adding that most of the ages covered in this study were mentioned, which are from 5-12 years for each male And females. Furthermore, attention was drawn to knowing the psychological and physiological impact of these age groups, which is the extent to which most colors affect children’s bodies. Finally, this chapter highlighted colors that help focus on children in classrooms.

Chapter 4

CASE STUDIES THROUGH THE EVALUATION OF THE EXAMPLES

4.1 Overall Research Methodology

This thesis aims to reach a better learning environment through color and physical factors, which are also the questions of the thesis that support the aim. The main question is how to create a suitable environment for children that positively affects their achievements in the classroom through color. Furthermore, two sub-questions; firstly, which color do children like and what affects their concentration in the class? Secondly, does the color affects the children's academic performance?

Regarding limitations, color is considered a vast topic. So, this thesis will not be able to profoundly discuss all of the perspectives linked with colors, such as climate and its relationship with colors, culture relation with color, and the topography of colors. The main focus will be on colors in spaces of schools such as classrooms, handicrafts, activity areas, sports areas, and external playgrounds, and some criteria will be considered in the scope of this thesis as well, such as technology, furniture, lighting, visual elements, type of arrangements, high of the space and the main focus in these criteria will be on color.

This thesis will focus on children of both genders from five to twelve years old, without choosing a specific group of children to see the impact of color on them. The

cases of this thesis will be ten elementary schools that followed innovation and competition future of schools, which means the schools will not be standard schools, which may help the educational environment to be more suitable. These cases were chosen by those who provided the criteria mentioned before to reach a better environment inside the class through the criteria to improve their skills and look for their academic performance, psychological and physiological impact, and concentration in the learning environment. The source of these ten schools was the website Arch daily, one of the most popular websites for its professional model and cases. The ten schools were selected by entering Arch daily and based on the criteria to evaluate cases. The researcher checked if it was possible to criticize these examples published on the website, furthermore, through the checklist of some spaces that exist or do not in each example, such as classroom, activity room, handicraft, sports area, and external playground. Also, in the same checklist, some criteria were checked out, such as types of technology, furniture, lighting, visual elements, types of arrangement, the height of the space, and color. In the end, the ten elementary schools selected were analyzed through a table.

Some criteria could not be included in the checklist in the description of each case in the fourth chapter, such as noise level, toxins and pollutants, air pollution, and water pollution, because these criteria need to be present in the school location to be asked about or monitored by the researcher.

Moreover, due to the current conditions of the spread of the Covid-19 epidemic, it was not easy to reach the school sites. Therefore, the method used in this thesis is based on a qualitative method for its ability to allow the researcher to collect the data that it need from articles, book, and websites. Moreover, to be able to look at some

visual elements and evaluate them as much as possible and have a good literature review. This thesis is based on the framework (Table 4.1 :) to analyze the cases by checklist if those factors exist or not by two circles green means yes, red means no, then a brief description for each one before the text description. The table has been developed to analyze the selected cases separately. The table includes the available data in the text description for each school, with its location, an external picture, and a checklist for the physical elements inside each school. Moreover, a simplified explanation of each field is provided with an image to facilitate understanding and for the ability to summarize the situation in a simple way for the reader, that make comments to evaluate the cases that have been collected through the criteria that exist in this thesis.

Table 4.1: Evaluation Table through Criteria

Information	Name of school						
	Drawings		Location		External facade		
	Criteria						
NO YES	Classroom ☐	Handicraft ☐	External playground ☐	Furniture ☐	Visual Elements ☐	Color ☐	
Description							
Photographs							
NO YES	Activity Room ☐	Sport Areas ☐	Technology ☐	Lighting ☐	Type of arrangement ☐	Height room ceiling ☐	
Description							
Photographs							

4.2 Analysis of the Cases Study

The cases were collected from random elementary schools globally worldwide, looking for the elements that this thesis wants to criticize, looking at the decoration and services included in each of these schools. This will allow this thesis to make a table to critique each of these schools:

1. Waynflete Lower School

2. Woodland Elementary School

3. Sangam Elementary School

4. Barcelona Elementary School

5. Duranes Elementary School

6. Panther Lake Elementary School

7. Gloria Marshall Elementary School

8. Wilkes Elementary School

9. Lakeland Elementary School

10. Taleny School.

4.2.1 Waynflete Lower School

All the figures of the first case referred to URL7. The first case in this thesis is Waynflete Lower Elementary School, located in Portland's Western Promenade Historic District; the new 3150m2 Lower School was designed to reflect the scale and rhythm of neighboring residences. The project merges the school's 121-year history with its future by incorporating its original building, Founders Hall, with a new innovative, Passive House certified school building (figure4.1). Simons Architects is the responsibility of design for this school.

Figure 4.1: Location of Waynflete School **(**URL7**).**

Furthermore, as they mentioned, this school concludes three floors (lower floor, 1st floor, and 2nd floor). The parts define as one of the main parts. Deeply include administration, shared learning spaces, common spaces, and classrooms (Figure 4.2).

Figure 4.2: Areas Conclude **(**URL7**).**

Checklist spaces

- **Classroom**

As mentioned above, this school has classrooms, and they divide these classes for each category of children separately. In addition, each group has its own gathering space, cubbies, and bathrooms, with its distinctive sense of place and relationship to

the shared community spaces, to create opportunities for small group and individual experiences that are age-appropriate and encourage the children to develop greater confidence and self-expression.

Windows that go to the floor that the children can play inside of it also can be noticed as a playing place and mentioned as a point in areas part in the second chapter; playing places enhance the learning environment and motivate the children to get the information quickly (Acar, 2014). (Figure: 4.3)

Figure 4.3: Classrooms(URL7).

- **Activity room**

As described in the second chapter of this thesis, the activity room allowed the children to undertake some activities to make a good relationship with each other (Figure:4.4).

Figure 4.4: Handicraft Room (URL7).

- **Handicraft**

Handicraft is also important; this school includes space for this activity, which enhances the atmosphere and allows youngsters to improve their abilities by utilizing both hands (Figure:4.4).

- **Sport areas**

Dunn mentioned in his study that the sports area is one of the important places that should be in school to motivate children in their academic performance (Dunn, 2012). However, this school does not use this kind of place which will not let them benefit from this place and may impact them negatively.

- **External playground**

For the external playground, this school has a good external place that lets children develop their education, as mentioned in Smith's study, many researchers consider this place as an external educational environment because it indicates child development and early education (Smith, 2016).

Checklist criteria

- **Technology**

A type of technology was used in this school in order to facilitate the teacher and students to receive or send information because it was mentioned that it is not very important as much as it is an aid to facilitate the education process as indicated in the second chapter (Morgan, 2010), (Conway, 1993). (Figure: 4.5)

Figure 4.5: Types of Technology (URL7)

- **Furniture**

Several types of furniture were used in the interior spaces of this school, including the study chairs for students, which were comfortable for students to look at, and they did not use height or deep seats, which has been proven to negatively affect children in the reading and writing processes (Panagiotopoulou, 2004). (Figure: 4.6)

Figure 4.6: Types of Furniture (URL7)

- **Lighting**

A comfortable kind of lighting for students was used, which is white lights (6500 KL), instead of yellow lights (3500 KL) because it distracts and disturbs students, which is an important element in the internal learning environment for its ability to facilitate the teaching process and not to be distracted students, (Hansen, (2017), (Comenius, 1967). (Figure: 4.7)

Figure 4.7 Types of Lighting (URL7)

- **Visual elements**

The visual elements used in the classrooms were paintings hung on the walls in different colors and others that are used to facilitate the explanation process through means of facilitating the presentation of information by data show, which is a necessary factor for its ability to reduce the explanation and provide a clearer understanding of the information to be presented, Second chapter (Bush, 2007), (Kellogg G. S., 1971). (Figure 4.8)

Figure 4.8: Types of Visual Elements (URL7)

- **Type of arrangement**

They used three types of arrangement: traditional arrangement and arrangement of the semicircle, additional one more flexible that allows children to make a good rapport with each other (ANKNEY, 1974) as mentioned in the second chapter. (Figure: 4.9)

Figure 4.9: Types of Arrangement (URL7)

- **Height of the space**

As seen in the photograph in the visual description, some rooms have a high height, and the cause of this high is to increase the number of activities, and it should be in the areas that need, according to (Read, 1999) in the second chapter.

- **Color**

The white color was used extensively in this school, which contradicts what was found in previous studies, where (Grangaard, 1995) indicated that the white color on the walls leads to a distraction, negatively affecting children's concentration when they read any book or solve any task. Also, it leads to a decline in their academic performance, in addition to the fact that white is one of the least preferred colors for children (Iftadi, 2018), whereas (Llinares, 2021) indicated that the colors of the walls or the colors inside the rooms should be from cold colors to make the learning environment better for concentration and attention.

Figure 4.10: Color Exist in Space (URL7)

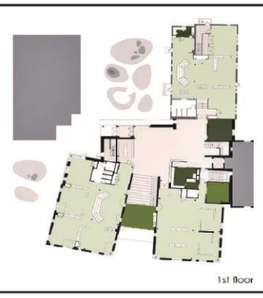
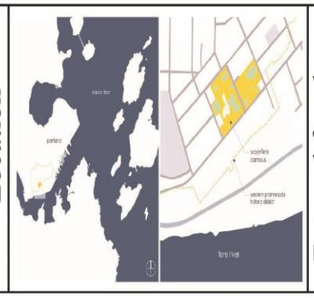
The blue color was used in the outdoor playground, and this is a good choice of color because Safferman (2015) indicated in his study that the blue color is helpful for children in the playing space since it affects psychologically on children by extending the duration of play, which leads to children enjoying their time With each other.

Green was used as a good color for children, as Gaines (2011) indicated that this color stimulates children's speech skills, which leads to support children and improves self-confidence between each other.

Figure 4.11: Color Exist in Space (URL7)

The colors yellow and blue were used, and as previous studies indicated that the blue color works to support focus in children and remember the information that they had previously obtained in the lessons, in addition to the calm effect that they have and the amount of color was moderate because if it were found in a large amount, the reaction of the children would be precisely the opposite (Lewinski, 2015), (Jeong, 2020), (Kaya, 2004) and (Gaines, 2011).

Table 4.2: Table for First Case

Information											
	Waynflete Lower School										
	Drawings	 lower level	 1st floor	 2nd floor		Location		External facade			
	Criteria										
NO YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color					
Description	• Approximately 15 rooms • Specific class for each group • Divided in each floor	• One room for handicraft • Multifunctional table • Safety equipment	• External learning environment • Huge space • A lot of tools	• Flexible form • Table with some seat • Designed properly	• Paintings hanging • Using data show						
Photographs				 	 	 					
NO YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space					
Description	• One room for activity • Safety equipment	None	• Data show	• white light • Comfort type • Attractively distributed	• Traditional arrangement • Arrange in a semicircle • Extra Flexible Arrangement	None					
Photographs			 	 							

4.2.2 Woodland Elementary School

All the figures of the second case referred to URL8. The second case for this thesis is Woodland School, located in MILFORD, United States, which has an area of 12,300m2 and is an elementary school for both genders. In addition, it supports the methodology of group teaching and works to provide an individual climate for students and a school climate that contains most of the student's needs. Also, it supports space for 985 students (Figure 4.12 :).

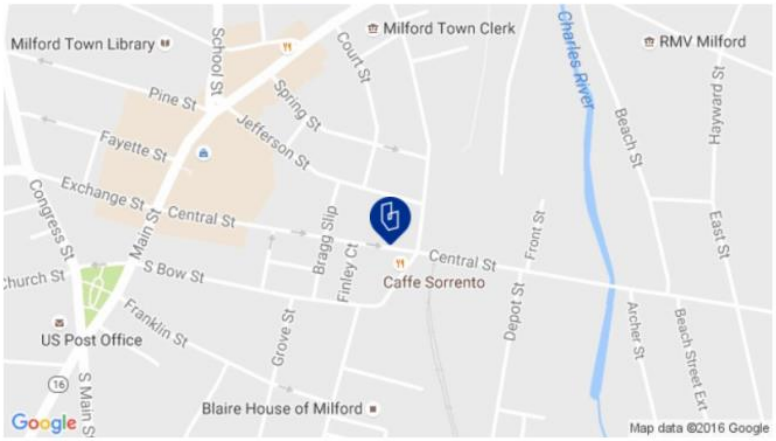


Figure 4.12: Location of Woodland Elementary School (URL8)

The school contains three floors as it is found in the section, the first floor contains an extensive library and additional rooms, the second floor contains classrooms and a theater, and the third floor contains classrooms. The new school is organized around grade-level learning. Each grade occupies one floor in the academic wing, grouped into three smaller clusters of six classrooms with a learning commons just outside the classrooms. (Figure 4.13:).

Figure 4.13: Areas Conclude (URL8)

Other pictures to be more understandable (Figure 4.14:)

Figure 4.14: External Façade for the School (URL8)

Checklist spaces

- **Classroom**

The school contains several classrooms on each floor designed in a very flexible way so that the teacher can move between the indoor environments easily. The classrooms have several forms to make the subject of teaching seem easier to the

student. In addition to the open teaching space that also provides an easy base of information, Learning in outer space confirms the importance of such spaces in schools (Figure 4.15:).

Figure 4.15: Classrooms (URL8**)**

- **Activity room**

The school contains many activity rooms, including dining rooms, music rooms, art rooms, cafeteria, and theater. Where these additional spaces are considered among the important elements that must be provided in the school to reach a high level of meeting the student's needs (Sanoff, 1988), this favors the school by the students because students prefer to play, move, and places in which they find their talents more than the study spaces inside the school. Which leads to meeting the individual climate needs of each student (Figure 4.16:).

Figure 4.16: Activity Room (URL8)

- **Handicrafts**

This school does not have a handicraft room; it is so important to exist this kind of space in the school for its importance to improve the skills of children in writing and some activities that help them in their studies (Sederevičiūtė-Pačiauskienė, 2019).

- **Sport areas**

This school contains a large sports area, which enables children to play and have fun with each other, which leads to students getting to know each other more at playtime and strengthening the relationship between them, and motivating them to work as a team in other tasks within the classroom which also will enhance self-confidence (Dunn, 2012). In addition to the possibility of students searching for more difficult tasks because they had accomplished mathematical tasks that could have been difficult concerning their mental, physical and intellectual abilities (Figure 4.17).

Figure 4.17: Sports Area (URL8)

- **External playground**

This school contains an external playground that can call an external study area. Such spaces are important because they can enhance the feeling of study in children when

they analyze the elements of nature. As mentioned previously, it is a large area of nature for education (Smith, 2016). In addition to the main objective of which is for children to go out and discover nature and learn from it since children by their psychological, they prefer nature to discover things around them (Figure 4.18) and (Figure: 4.19).

Figure 4.18: External Play Ground (URL8)

Figure 4.19: External Play Ground (URL8)

Checklist criteria

- **Technology**

Advanced technology has been used in this school in several ways, which are considered as means to facilitate the process of education, as data show has been used in classrooms, types of suspended lighting, and screens located in the theater.

It is not necessary to have such technologies because the main organizer in the classroom is the teacher, but such equipment facilitates teaching procedures and facilitates the teacher's job within the school (Panagiotopoulou, 2004), (Figure 4.20).

Figure 4.20: Types of Technology (URL8)

- **Furniture**

Some kind of Comfortable furniture has been used by the observation that the children are sitting comfortably and that it does not have dimensions that are not suitable for students. Many types of furniture were used, including the basic shape of the seats, which have a flexible shape, and several semi-sponge sofas, which takes a streamlined position for the back of the student and helps to provide a more suitable seating position for students (Figure 4.21).

Figure 4.21: Types of Furniture (URL8)

- **Lighting**

White lighting is used in most spaces; it has been proven it provides comfort to the eye while it is concentrating in the classroom more than any other kind of lighting. In addition, it is benefiting from the daylight from nature by making large windows within the modern design of this school, which is a more flexible type that allows a large amount of lighting to enter instead of Industrial lighting (Comenius, 1967) (Figure 4.22).

Figure 4.22: Types of Lighting (URL8)

- **Visual elements**

Visual samples were used inside the theater to facilitate the explanation and facilitate the process of receiving information for students. As this feature facilitates the role of the teacher and the student to be able to preserve the information in the student's mind and not forget it, it was not noticed that teachers used this feature in the classroom, and they have approved the basic method of teaching which is explained by words only (Figure 4.23).

Figure 4.23: Types of Visual Elements (URL8)

- **Type of arrangement**

Several types of spatial arrangement were used in this school, some of which were of the traditional arrangement type that teachers used in most classrooms. However, in some rooms, a simple modification was used to appear more flexible by providing a seat that can gather some students to enhance teamwork, and adding some types such as semi sofas; some rooms had a large seat in the shape of a semi-circle as mentioned in the second chapter, which works on the presence of equal participation of all students (Comenius, 1967).

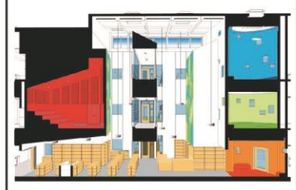
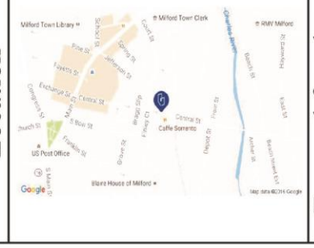
- **Height of the space**

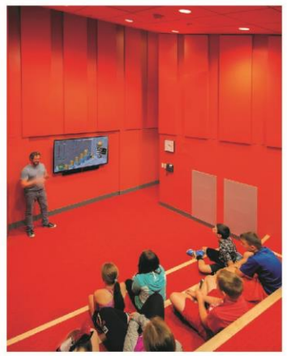
As it is observed in the photographs, it seems that some rooms had a height of more than 2.5 meters, and these rooms were activity rooms, sports areas, dining rooms, and theaters. At the same time, the rooms that were less high than approximately 2.5 meters were classrooms for the ability to control the activity of students because it has been proven that when the room height is more than 2.5 meters, it increases the activity of the students, which is supposed to be only in the activity rooms.

- **Color**

Green was used on some of the rooms' floors and walls, and it was proven that this color improves speaking skills, which leads to enhancing self-confidence (Lewinski, 2015). In addition, the color purple was used in the classroom, and it is a color that has been proven to be a sedative for children. The presence of white was observed in the sports area, as it was proven that it is an unfavorable color for children and can negatively affect their academic performance. The blue color was used in the external playground, which leads to an increase in playing time, and this works to strengthen the relationship between children to stimulate teamwork between them. The color of some classroom furniture was orange, and this color is considered one of the strongest sedatives for children for the ability to control students within the classroom spaces. Yellow was used in one of the classrooms, which is a popular color for children, but it was used extensively in the classroom, and this distracts the children's concentration. The red color was present in one of the classrooms and the school theater, and this led to a decline in academic performance, distraction, and high-pressure blood because of the negative impact of this color on children, making them aggressive with each other. Blue spaces were used, such as the floors and walls of some classrooms, and this leads to providing an appropriate atmosphere for children to support their academic performance through the ability to remember the information given in such classes and its high ability to attract students' attention to provide a high-quality teaching space.

Table 4.3: Table for Second Case

Information						
	Drawings				Location	
	External facade					

Criteria					
NO YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color
Description	• Several classes • Divided in each floor • One open education space	NONE	• Big external education environment	• Comfortable furniture • Basic shape • Flexible shape • Semi-sponge sofa	• Suspended-visual • Show by technology	
Photographs		NONE				
NO YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space
Description	• Several rooms • Dining room • Music & Art room • Kitchen • Cafeteria • Other: Library Figure: 4.19	• Larg sports area	• Advanced technology • Data show • Suspended lighting • Screens	• White lighting • Day-light	• Large seat • Traditional arrangement • Flexible seats • Semi The sponge sofa	• More than 2.5
Photographs						

4.2.3 Sangam Elementary School

All the figures of the third case refer to URL9. The third case in this thesis is Sangam Elementary School. This school is located in the urban fabric of Bhilwara, Rajasthan, India. The project covers an area of 2612 m2The design is focused on establishing an entity for students, where the built space and environment together become a successful tool for learning. The goal of this school was inspired by the opening education, as mentioned in the second chapter, and that it works to allow the children to discover the surrounding environment and themselves, urges them to play and jump that helps them communicate with nature (Figure 4.24:).

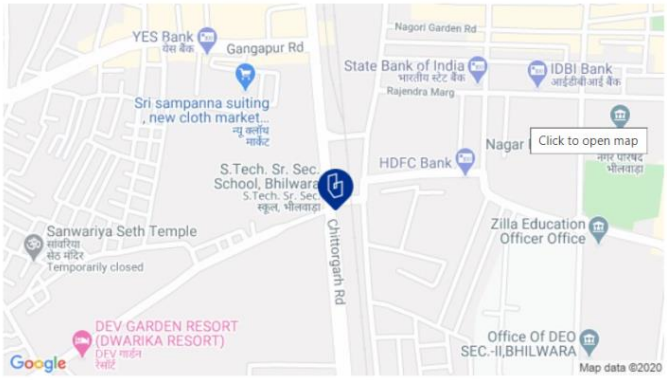


Figure 4.24: Location of Sangam Elementary School (URL9)

This school has three floors (ground, first, and second). In addition to that, the roof area has also been used to provide a good external playground that will allow children to discover nature and keep a good relationship between them and nature (Figure 4.25 :).

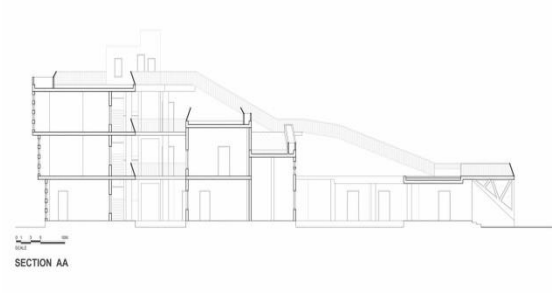


Figure 4.25: Areas Conclude (URL9)

Checklist spaces

- **Classroom**

This school has seventeen classrooms, “seven of them on the ground floor, another seven on the first floor, and the rest of them on the second floor”. They took a good space for each of them to make the process of teaching very easy for teachers and students, which will allow teachers to move smoothly with their students. In addition, keeping the classes near the windows to keep good eye contact with nature. In addition to finding some characteristics that each student needs, such as social needs and communication skills (Figure 4.26).

Figure 4.26: Classrooms (URL9)

- **Activity room**

There is an activity room in this school that serves all students located on the second floor, arranged in such a way as to provide teamwork to harmonize the students with

each other, which leads to attracting the students' attention and making the subject be given easy by fun between the students and the teacher, where the arrangement of the room in the school was made in the form of rings of Group seating to motivate students to help each other, also to provide a harmonious environment and a comfortable atmosphere within this type of room (Figure 4.27).

They used some other areas that may also be serving children, such as the music room, store, and open-air theatre. Some children may be interested in music or want to learn some principles of it, and this kind of room will serve them to grow these hobbies

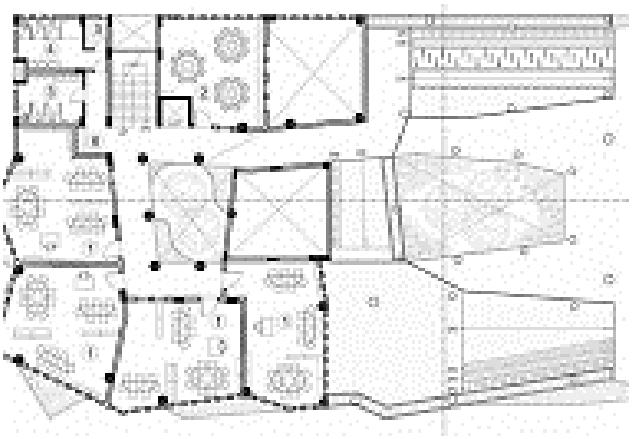


Figure 4.27: Activity Room (URL9)

- **Handicrafts**

In this school, there is a handicraft room with a good space that has been provided for all students. This type of room is essential for presence in the school (Sederevičiūtė-Pačiauskienė, 2019) because it carries a strong value of the benefit for students to provide a great playing atmosphere for them, in addition to improving the students' skills such as writing because of the use both hands in such spaces through

The way of playing with clay, drawing, developing body language to enhance their self-confidence among their peers from the students and the teacher (Figure 4.28)

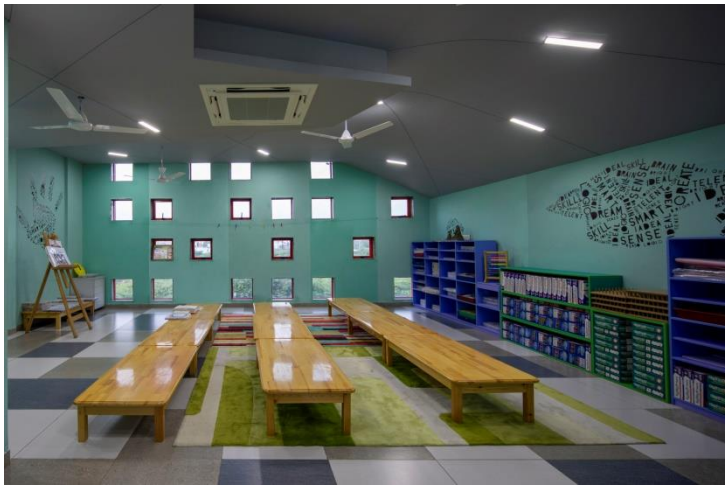


Figure 4.28: Handicraft Room (URL9)

- **Sport areas**

In this school there is outdoor sports area of the building, they used play equipment provided for children in this school was used on the roof of the building appropriately and flexibly that makes the children have fun and enhances the relationship between each other, in addition to making good use of the surface area (Figure: 4.29).

Figure 4.29: Sports Area (URL9)

- **External playground**

by providing an outdoor playground as well as in the open air because the design of this school is inspired by the open education method that provides a value of the high level of education in connection with nature and the air, which promotes the exploration of each individual's requirements and able them to looking for ways to enhance self-confidence. In addition, these types have been combined in the appropriate colors for each of them, which also increases the fun during play, returning to the nature of children that they are like chaos (Dunn, 2012) (Smith, 2016), (Figure 4.30).

Figure 4.30: External Play Ground (URL9)

Checklist Criteria

- **Technology**

Some types of technology have been used, such as central heating in the ceiling for most of the rooms in this school, which can make it easier to maintain the temperature inside the school on days when the outside atmosphere is not suitable for students and other, and some forms of modern lighting on the ceiling in addition to

data show, which can facilitate the teaching process. However, additional ceiling fans were used that may be present to reduce energy use, but they may also be unsafe for children (Figure 4.31).

Figure 4.31: Types of Technology (URL9)

- **Furniture**

Some types of furniture were used in this school; first, a semi-barrel with a sponge head was used to make the seat flexible, but there is no back for that chair, which indicates that it is unsafe for children. In addition to the use of plastic chairs in the activity room, plastic chairs were used in the classrooms in proportion to the back of the student. The seats were not deep or high but were suitable for the average height of the students, and they were of a suitable shape, which was flexible and designed safely, without protruding edges to preserve the safety of children. Wooden chairs were used in the handicraft room with relatively short dimensions, perhaps to enable the students to sit on the ground and change the traditional sitting position maybe to appear more flexible, in addition to the fact that the furniture in this room was safe and had no edges that could hurt the students (Figure: 4.32).

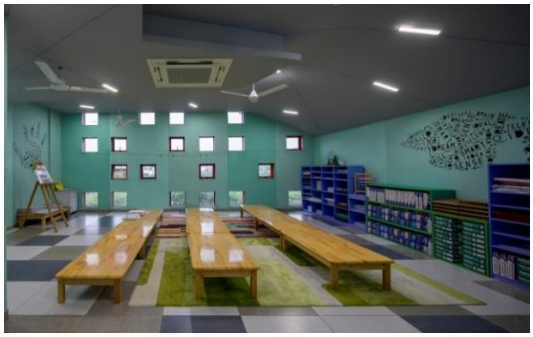


Figure 4.32: Types of Furniture (URL9)

- **Lighting**

The light of nature was greatly benefited because the shape of the building was inspired by the triangular cheese sliver with tiny holes, which led to the provision of a large amount of natural lighting in the school, in addition to some yellow lighting (3500 K L) in some rooms, which proved to be unsuitable for children due to its negative impact on their concentration and academic performance. Moreover, white lighting (6000 K L) was used in other rooms, which has been proven to be better than yellow lighting for its positive effect (Comenius, 1967), (Figure 4.33).

Figure 4.33: Types of Lighting (URL9)

- **Visual elements**

Some visuals, some of them to illustrate the information and others give aesthetics in classrooms, for the ability of this type of visual elements to enhance and facilitate the process of understanding for the student and teaching for the teacher so that the

student does not take more time to understand issues or receive information (Bush, 2007), (Figure 4.34).

Figure 4.34: Types of Visual Elements (URL9)

- **Type of arrangement**

The semi-circle shape was used in some classrooms and the music room, which leads to providing an appropriate study atmosphere for children because such an arrangement works to support children to keep their participation and concentration almost equal, and there is nothing to distract their attention because the distance between them and the teacher is Close, as it mentioned previously on the topic of distance in the second chapter, semi-floor seats were used and accommodated several students, such this type was present in the handicraft room. Some other classrooms had a different arrangement and were relatively flexible tables containing a certain number of seats, which allows such an arrangement to make a good relationship between children where students are divided into groups under the supervision of the teacher to encourage teamwork as well (Ankney, 1974), (Kling, 1971), (Figure: 4.35).

Figure 4.35: Types of Arrangement (URL9)

- **Height of the Space**

By eye observation, this school has a high ceiling in most of the rooms; if it exists in an activity room, it is good for the student. On the other hand, if it is in the classroom, it is not good for the negative impact on children's control.

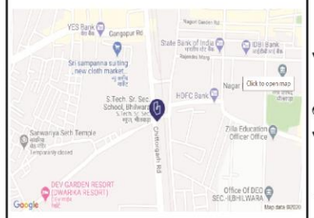
- **Color**

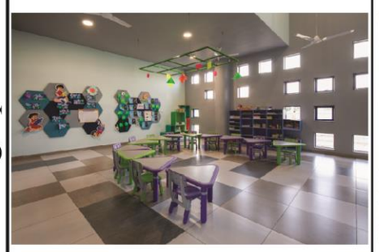
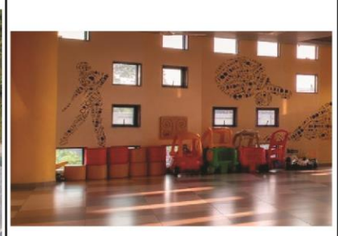
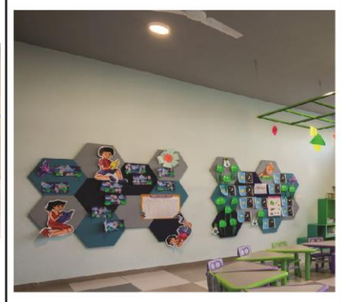
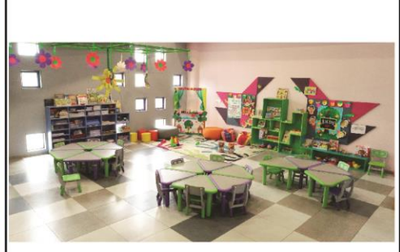
The colors yellow and red were used extensively in the outdoor playground, which led to a significant increase in activity because it has been proven that these two colors are associated with excessive activity, which leads to children's enjoyment and increased activity during play, in addition to the fact that yellow is a color associated with positive emotion. The blue color was used on one of the long play equipment, which has been proven to increase children's playing periods, making them enjoy greatly without their awareness, in addition to increasing interaction between them. The orange color was used in the activity rooms, which works to provide a calm atmosphere in those spaces, and is unpopular in such these rooms. The colors purple and green were used in the classroom. The color orange is one of the strongest sedatives for children, which makes the teacher able to control the students in the class. The green color is one of the motivators for students to develop their speech skills. The color of light green was used, as it is one of the cool colors, which has

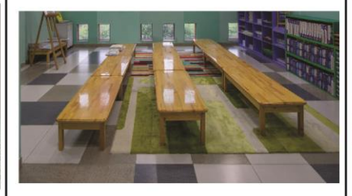
been proven to be good and better than warm colors, because it improves academic performance and concentration, which supports students. In addition to that, the blue color was used in the same room, which works to support children's memory and help Keeping the information in mind (Figure 4.36).

Figure 4.36: Color Exist in Spaces (URL9)

Table 4.4: Table for Third Case

Information		
	Sangam Elementary School	
Drawings		Location:  External facade: 
	Criteria	

NO / YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color
Description	• Seventeen classroom • Seven in first floor • Seven in ground floor • Rest of them in second floor	• One room with a good space • Can playing with clay, drawing	• The roof of the building • Outdoor playground • Inspired by the open education	• Some types • Wooden chairs • Plastic chairs • Semi-barrel with a sponge head	• Some visual • Illustrate the information • Others give aesthetics	
Photographs						

NO / YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space
Description	• One room in second floor • Structured as rings of Group seating • Other: Music room, store and open air theatre (Figure: 4.30)	NONE	• Several types • Data show • Central heating • Modern lighting	• Daylight • Yellow lighting • White lighting	• Semi-circle shape • Flexible tables • Floor table	• More than 2.5meters
Photographs		NONE				

4.2.4 Barcelona Elementary School

All the figures for the fourth case refer to URL10. Design of the school Barcelona refers to Architects Baker. This school has a good area, which is 1160 $m^2$and contains one floor with a small roof. The school's design is inspired by the school system in Albuquerque, and is the first project that received a gold certificate; the school is located in Barcelona, USA (Figur 4.37).

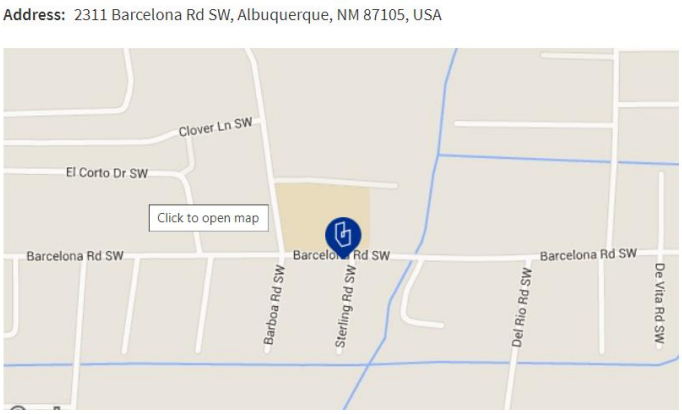


Figure 4.37: Location of Barcelona Elementary School (URL10)

The school contains several facilities, including classrooms, an activity room, a music room, and special facilities for children and school staff (Figure 4.38).

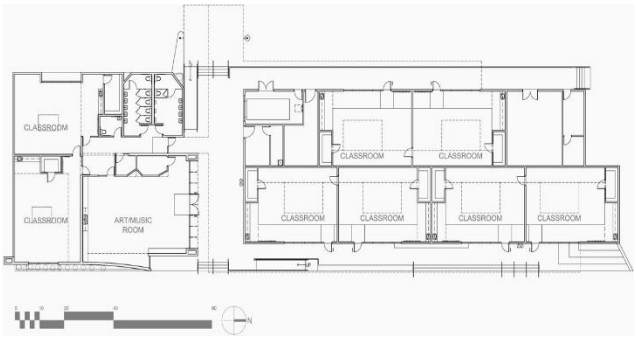


Figure 4.38: Areas Conclude (URL10)

For external façade to be more understandable (Figure 4.39).

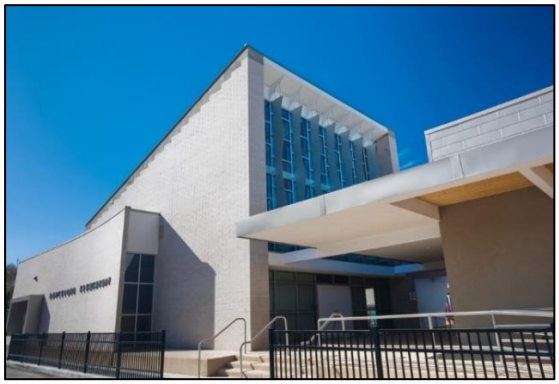


Figure 4.39: External Façade for the School (URL10)

Checklist Spaces

- **Classroom**

This school contains eight classrooms, which indicates that the school provides seats for approximately 180 seats for males and fssssss. The school is small in size because it is only one floor, bearing in mind that the total area of the school with all its facilities is only 1160 m^2, which indicates a small number of Students inside the school (Figure 4.40).

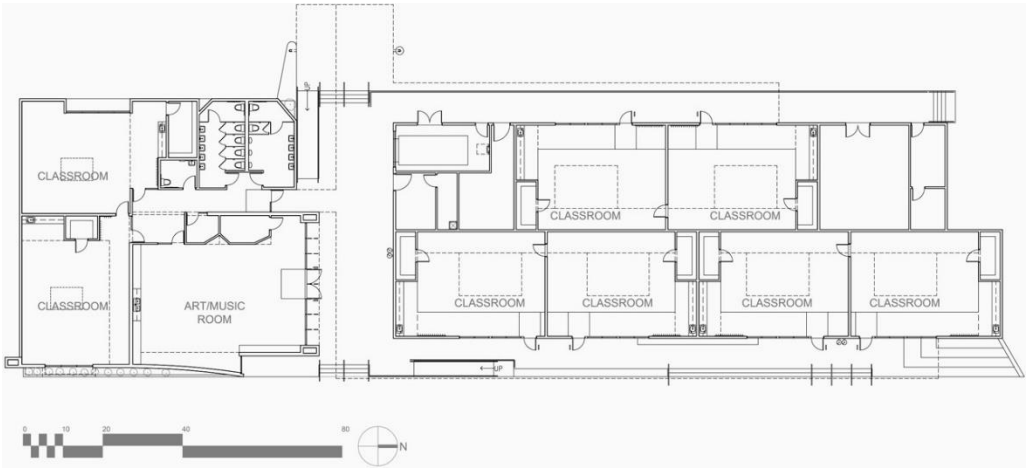


Figure 4.40: Classrooms (URL10)

- **Activity room**

There is one activity room in the school of a relatively large space with a large glass facade to maintain direct contact with nature, which enables children to have fun and play with it and take specific lessons by entertainment way through the presence of specific activities for each teacher that are employed to support the skills of children and the absence of boring atmosphere that will be if children spend all time in the classroom (Figure 4.41).

Figure 4.41: Activity Room (URL10)

- **Handicraft**

There is no room for handicrafts in this school, and this is a weak point for the school because of the high value of the handicrafts room for serving students, which is a space to support children and develop their writing and mental skills, as mentioned in the second chapter (Sederevičiūtė-Pačiauskienė, 2019).

- **Sport areas**

The school does not have a sports area, which is another weak point for this school because such a type of room motivates the students to pass tasks within these spaces through play, which leads to enhancing self-confidence and supporting skills, in addition to searching for more difficult tasks this will enable the students to solve the

problems they face in the classroom, such as questions or tasks assigned to them by the teacher, such as homework or classwork (Dunn, 2012).

- **External playground**

By the plan of the school, it pointed out of a big external playground that will give a huge amount of benefit to students (Smith, 2016) because this kind of area able the children to play with each other, which will create a good rapport between them, in addition, develop their learning as some articles mentioned, it is an external learning environment that could enhance their education through playing and keep a direct connection with nature (Figure 4.42).

Figure 4.42: External Play Ground (URL10)

Checklist Criteria

- **Technology**

None of the technology is visible in the pictures shown for this school, neither in the classroom nor even in the outdoor spaces. It is possible that the school system reverts to the traditional system with complete dependence on the teacher inside the educational spaces and others inside and outside the school.

- **Furniture**

One type of traditional-shaped children's seat was used, which is steel seats with a rounded back to suit the position of the students. It is comfortable because it does not contain any dimensions that are not suitable for the size of children. In the classrooms, there are tables designed to allow a number of students to sit with each other, which leads to the promotion of the spirit of teamwork among the students (Figure 4.43).

Figure 4.43: Types of Furniture (URL10)

- **Lighting**

Yellow lighting was used in most of the spaces of this school, which was in the form of spotlights on the ceiling or suspended lighting in rooms with high ceilings. As was mentioned on the topic of lighting in the second chapter (Comenius, 1967), this color of lighting is not suitable for children because it works on eye strain, in addition to the decline in students' academic performance due to the negative psychological impact of yellow lighting in classrooms on children. In addition, wide facades of glass were used in the activities room and some classrooms (Figure 4.44).

Figure 4.44: Types of Lighting (URL10)

- **Visual elements**

Some visuals hung on the walls in this school were used inside the classrooms to facilitate the teaching process for the teacher because of the high value of these visual elements in making the student able to analyze the information faster than it just exists as written information (Comenius, 1967), (Figure 4.45).

Figure 4.45: Types of Visual Elements (URL10)

- **Type of arrangement**

The traditional arrangement was used in this school, which is the presence of children's seats almost square in front of the teacher, and this does not give all students equal participation because such an arrangement, the students who sit at the

back of the class are far from the teacher, which leads to making the subject of teaching Boring for them because it has been proven that the students at the front of the class are the ones who participate more than other students. Another arrangement used in the classrooms is a table that allows several students to sit with each other. This arrangement is better to be in activity rooms or rooms where there are group tasks to support the relationship between students (Cardellino, (2017), (Kling, 1971), (Figure 4.46).

Figure 4.46: Types of Arrangement (URL10)

- **Height of the Space**

  Through the pictures shown for this school by eye observation, the height of the existing rooms was more than 2.5meters based on the dimensions of the items in the rooms because there is no dimensional plan showing the height of the rooms. This indicates that students' activity is supported in the activity rooms. However, if there is this height in the classrooms, it will negatively affect the students because it has been proven that rooms with ceilings that are more than 2.5 meters high stimulate students and increase physical activity, which will affect the teacher's ability to control students (Figure 4.47).

Figure 4.47: Height of the Space (URL10)

- **Color**

The red color was used on the classroom doors from the outside, and based on what was mentioned in previous studies in chapter three; the red color increases activity. It is considered a stimulating color, but it negatively affects academic performance if it is in the classroom.

Orange and green were used in the classroom spaces, and it was proven that these colors are comfortable for children, as orange is one of the strongest sedatives for children, and green is a comfortable color for the eye and works to stimulate speech skills.

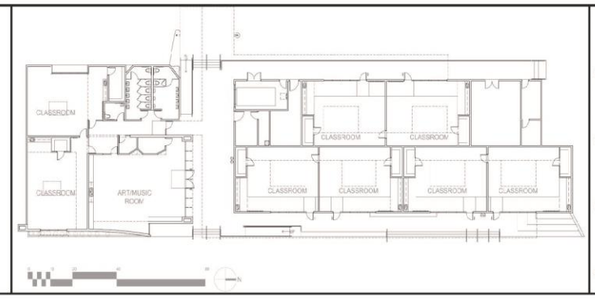
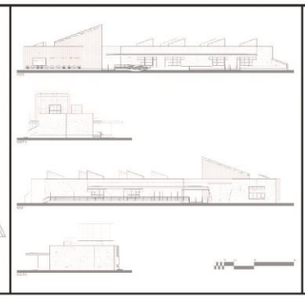
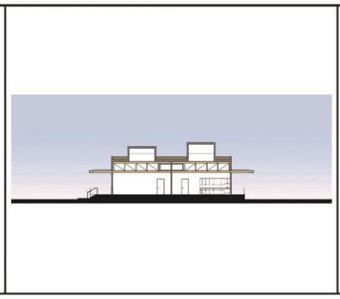
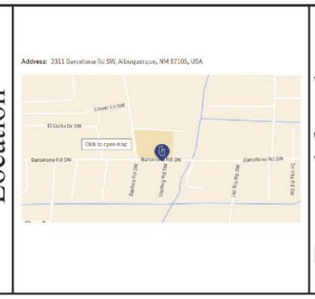
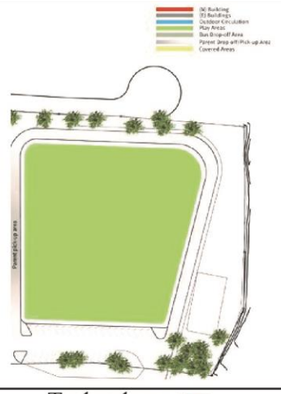
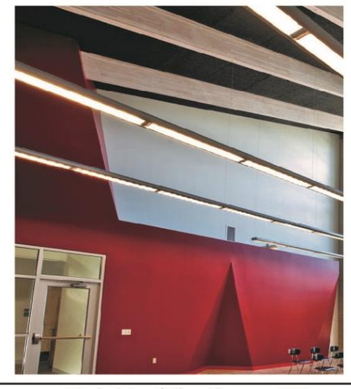
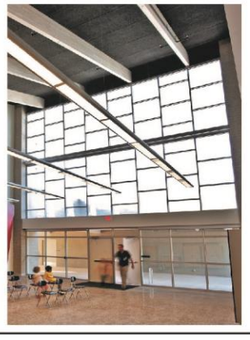
The red color was used in one of the facades of the activity room, as the presence of such a color is appropriate in this room because it increases blood pressure, which leads to increased activity and reaching the desired goal (Figure 4.48).

The blue color was used in a creative way, by using a blue glass color in some classrooms, which leads to an increase in calm in the study places and supports the

students to be able to remember the information and not forget it, as was previously proven in chapter three.

Figure 4.48: Color Exist in Spaces (URL10)

Table 4.5: Table for Fourth Case

Information								
	Barcelona Elementary School							
Drawings				Location		External facade		
	Criteria							
NO YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color		
Description	• Eight classrooms • Seats for approximately 180 student	NONE	• Big external playground • External learning environment	• Traditional-shaped • Tables to gather a number of students • Steel seats	• Some visuals • Hung on the walls			
Photographs		NONE						
NO YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space		
Description	• One activity room • Large space	NONE	NONE	• Yellow lighting • Spotlights • Suspended lighting	• Tables to gather a number of students • Traditional arrangement • Square table	• More than 2.5meters		
Photographs		NONE	NONE					

4.2.5 Duranes Elementary School

All the figures for the fifth case refer to URL11. Design of the school Duranes Elementary School refers to Architects Baker. This school has a good area, which is 930 m2 and has one ground floor containing all the rooms. As mentioned on its site, it is limited space for a school of elementary. This school is located in Albuquerque, NM, USA (Figure 4.49).

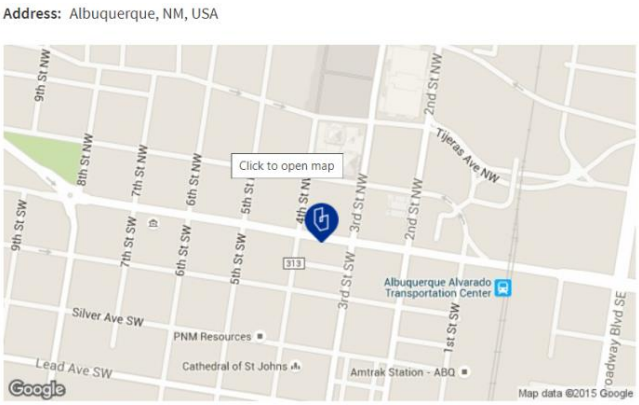


Figure 4.49: Location of Duranes Elementary School (URL11)

This school has one floor just, and all of the spaces are limited to 930 m^2, which makes it a small elementary school (Figure 4.50).

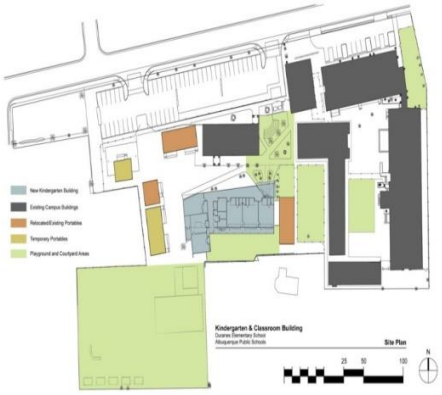


Figure 4.50: Areas Conclude (URL11)

This picture maybe will make the school more understandable (Figure 4.51).

Figure 4.51: External Façade of School (URL11)

Checklist Spaces

- **Classroom**

This school has five large classrooms, allowing the school to accommodate approximately 100 male and female students. Each classroom is supported with a bathroom and a small indoor kitchen to meet the needs of the students and help provide the personal atmosphere possible for each student. Class spaces were chosen to be next to each other and separated from other event rooms to unify a collaborative atmosphere for study. In addition, two classrooms were established for early development (Figure 4.52).

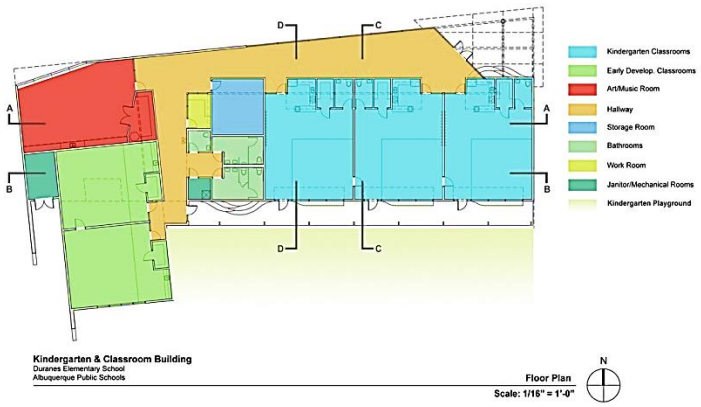


Figure 4.52: Classrooms (URL11)

- **Activity Room**

In this school, there is a large-sized and somewhat flexible activity room with a high ceiling and a facade of glass. The room allows children to play and have fun and perform the activities they prefer or that are assigned to them by the teacher to spend a certain time within these spaces (Figure 4.53).

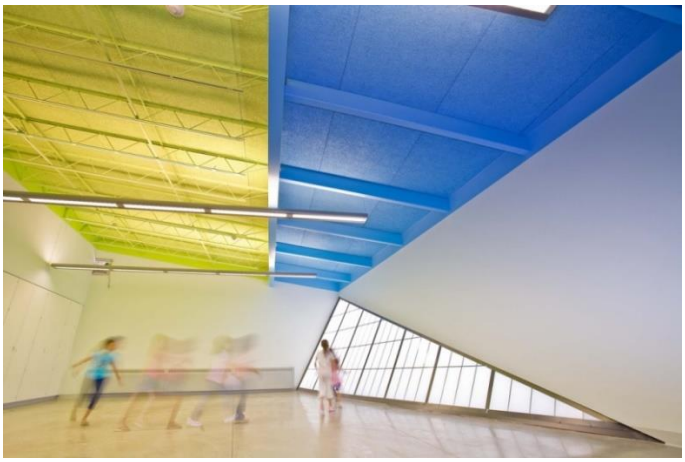


Figure: 4.53: Activity Room (URL11)

- **Handicraft**

According to the existing plan for this school, there is no room for handicrafts. Still, it has been proven that elementary school must provide students with such spaces (Sederevičiūtė-Pačiauskienė, 2019) because of its importance in strengthening and supporting the student's hand skills that may help them in writing, playing, and developing their mental skills, because children as mentioned Previously, they preferred to explore the surrounding environments and learn in ways other than the traditional method of study in the classroom.

- **Sport Areas**

The school has no sports area, which is a weakness point for it since such a room stimulates students to complete activities inside these spaces in a different way which

is playing. That will increase their self-confidence and supportive abilities, as well as the hunt for more challenging tasks. As a result, students will be able to more easily address difficulties in the classroom, such as questions or assignments set to them by the teacher, such as homework or classwork (Dunn, 2012).

- **External Playground**

According to the school's plan, several external playgrounds located in some spaces in the plan will provide plenty of benefits to students because this type of area allows the children to play with each other, which will build a good relationship between them, in addition to developing their learning. As previously mentioned (Smith, 2016), it is an external learning environment that could enhance their education through playing and maintain a direct connection with nature during the early development of children (Figure 4.54).

Figure 4.54: External Play Ground (URL11)

Checklist Criteria

- **Technology**

There is no kind of technology that exists in this elementary school, and it has been proven that it’s not vital to prove a technology in the school(Conway, 1993). Still, it

is good to make the learning process easier than the traditional way the school uses. Thus it is good if it is provided to enhance the learning environment for students to get a great amount of knowledge.

- **Furniture**

Some types of furniture were used in this school's interior rooms, a whiteboard and some small cupboards that make up the small kitchen in each classroom. Some shelves were provided to serve the students in the classroom, in addition to the use of two types of student seats, which were adjustable chairs with wheels, which enable the student to control the sitting position through a manual handle with a back and a sponge seat, which provides students with the comfort of sitting to be able to support their attention In the lesson, as demonstrated in the second chapter, wooden chairs with cambered backs and some tables that allow group seating also used (Figure 4.55).

Figure 4.55: Types of Furniture (URL11)

- **Lighting**

Yellow lighting was used in the external courtyards of the school, such as the main entrance and the internal and external corridors leading to the classrooms. The recommended lighting for children was used in the activity room and classrooms which is white lighting (6000 KL), which has been proven to support the student’s

academic performance (Hansen, (2017)) because it does not work on eye strain and distraction, such as yellow lighting (3500 KL). In addition to making good use of natural lighting through ventilation openings and skylights (Figure 4.56).

Figure 4.56: Types of Lighting (URL11)

- **Visual Elements**

There are no visual elements that exist in the school, which is a weakness for such a school. As mentioned in the second chapter, how much important the visual factors to be in the classroom to facilitate the thinking of children for any task they solve in class, also to make the teaching process easier fothe r teacher to support their academic performance and rest their minds as much as can (Kellogg G. S., 1971). the

- **Type of Arrangement**

A single spatial arrangement has been adopted in the classrooms, which is a number of wooden tables arranged in the form of a beehive that allows a group of students to sit together to unify the spirit of teamwork among students, which enables the teacher to divide students according to their mental abilities to be able to help each other, where they can Shifting the tables to form a semi-circle shape or any other shape appropriate to the topic to be given in the lesson (Ankney, 1974), (Figure 4.57).

Figure 4.57: Types of Arrangement (URL11)

- **Height of the Space**

A height of more than 2.5 meters was provided in the yard in front of the main entrance to the school, which increases the physical activity of children in playing and having fun. The ceiling of the activity room was not high, which led to restrictions on children's physical activity. However, in such places, a ceiling higher than 2.5 meters must be provided to affect the children psychologically. On the contrary, a ceiling higher than 2.5 was provided in the classroom, which negatively impacts children and leads to difficulty in controlling their activities, which sometimes leads to their dispersal (Figure 4.58).

Figure 4.58: Height of the Space (URL11)

- **Color**

The red color was used on the classroom doors, and as mentioned previously, the red color stimulates activity and increases blood pressure for children, which may negatively affect children (Figure 4.59).

The blue and green color has been provided in the activity room, which can unpleasantly affect the children. These two colors have been proven to calm children and have a calming effect. In addition, raising the hormone of happiness and comfort has many advantages but should be used in Classrooms for the ability to control children's activities (Figure 4.59).

The green color was used in the classrooms, which provided comfort and calm for children during the lesson, in addition to developing their speech skills from a psychological point of view. This color is preferred for children in general (Figure: 4.59).

The color orange was used in the classrooms, and this provides a positive point in front of the red doors, as the orange creates a calm atmosphere inside the rooms, which helps students to focus and not be distracted during the lecture (Figure 4.59).

There was a small corner in the rooms that had yellow in the classrooms. It was proven that the yellow color is psychologically beneficial for children and activates the work of the lungs, and it is a favorite color for most children. In addition, the presence of this color in a small percentage compared to the size of the room helps to attract the attention of children.

The light blue color was used in the internal corridors of the school, which gives a sense of comfort to the children during the movement between the school facilities, which enhances their inner peace (Figure 4.59).

Figure 4.59: Color Exist in Spaces (URL11)

Table 4.6: Table for Fifth Case

Information		
	Duranes Elementary School	
Drawings		
Location		
External facade		

NO / YES	Criteria					
	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color
Description	• Five large classrooms • Approximately 100 student • With a bathroom and a small indoor kitchen	NONE	• Several external playgrounds • External learning environment	• Some cupboards • Small kitchen • White board • Flexible chairs • Wooden chairs • Some shelves	NONE	
Photographs		NONE			NONE	
NO / YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space
Description	• Large-size • Flexible activity room	NONE		• White lighting • Natural lighting • Yellow lighting	• Flexible arranged • Form of a beehive	• More than 2.5 meters • Less than 2.5 meters
Photographs		NONE	NONE			

4.2.6 Panther Lake Elementary School

All the figures for the sixth case refer to URL12. The design for Panther Lake Elementary School focuses on bringing together the school's learning and common areas to enrich the student's educational experiences. As a result, the various learning centers remain open to one another even though they appear to be separated by their different colors and structural elements. Also, it has 4180 m^2, which means it has a big space that provides many facilities. The school is located in Kent, WA 98031, United States, refers to architect DLR Group (Figure 4.60).

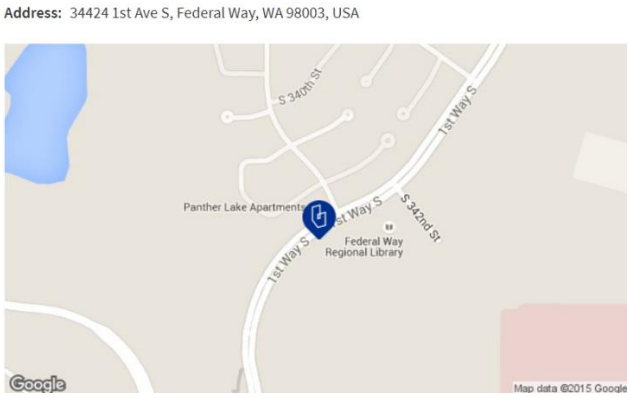


Figure 4.60: Location of Panther Lake Elementary School (URL12)

The classroom, each dedicated to structured learning activities, varies in width and length depending on the learning activities that will take place inside them. Rooms were divided flexibly to allow for greater adaptability over time (Figure 4.61).

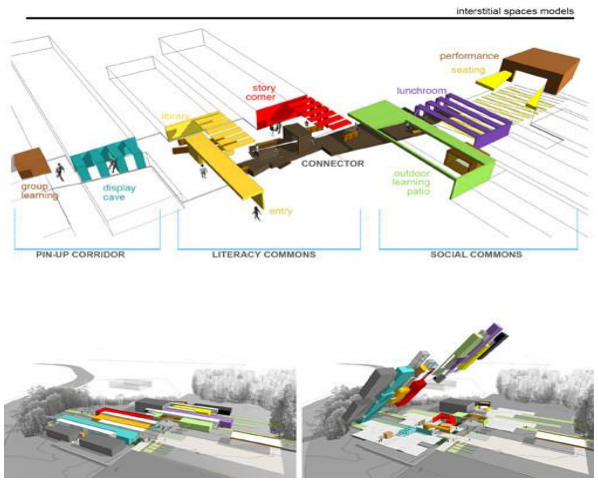


Figure 4.61: Areas Conclude (URL12)

To make the explanation more understandable for the reader, a picture of the external facade (Figure 4.62).

Figure 4.62: External Façade of School (URL12)

Checklist Spaces

- **Classroom**

Fifteen classrooms were provided in the total area of the school with different dimensions and arranged parallel to each other to give a harmonious shape to the school's surroundings. In addition, such a school allows providing approximately 300 seats for students. In addition to the number of rooms that have been provided,

four technical laboratories have been equipped to help students in some subjects that need such rooms, including computers or chemistry classes (Figure 4.63).

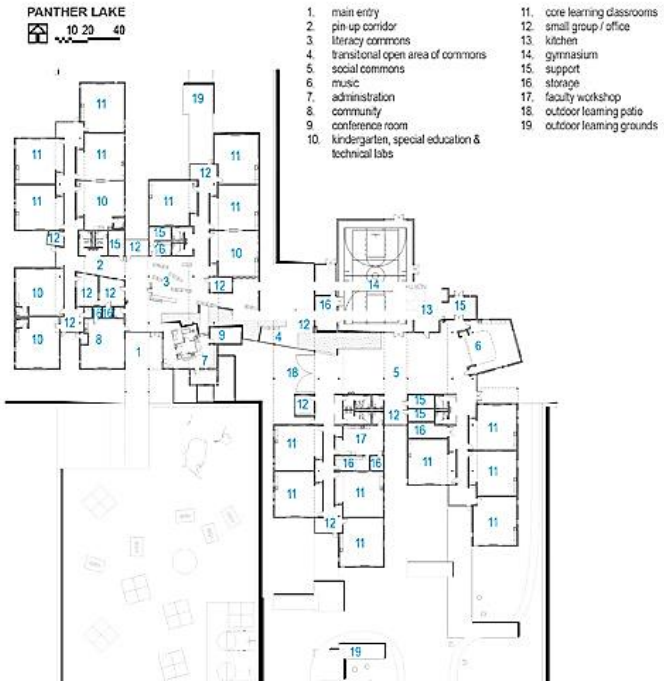


Figure 4.63: Classrooms (URL12)

- **Activity Room**

Referring to the attached plan in the description of the school above, it was mentioned that there is one faculty workshop within the design of the school, which allows students of all grades the ability to go to it and use it as an activity room, because this type of room is designed in a flexible way that allows students to conduct many activities, which will lead to strengthening the relationship between students, which leads to the development of self-confidence. Furthermore, it has a music room, kitchen ,and conference room (Figure 4.63).

- **Handicraft**

There is no mentioned to present a handicraft room in the description or pictures attached with the school that may not allow children to spend a specific time in such spaces. This may affect them negatively because this type of room let children use both hands to develop their skills in writing or body language may be as mentioned in the second chapter that talked about how important to exist such spaces in school for children (Sederevičiūtė-Pačiauskienė, 2019).

- **Sport Areas**

The gymnasium has been used in this school, which let this space to provide a flexible place for playing that will provide various types of sports, for instance, running and rope play. That will allow students to choose what they are interested in and enhance their discovery skills for each one. As mentioned in the second chapter, these spaces develop discovery skills for students because children are more curious to dig into the environment surrounding them (Dunn, 2012), (Figure 4.64).

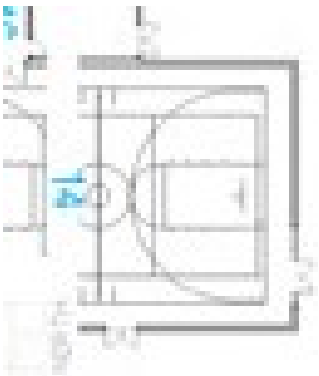


Figure 4.64: Sports Area (URL12)

- **External Playground**

The school owns two patios, one of which is an external room for learning, and the other is an outdoor courtyard for learning through fun. As mentioned in the second

chapter (Smith, 2016), the external playground is considered one of the educational environments for children due to the amount of benefit found in it. They added to not feeling bored by taking all the lessons in one place, which is the classrooms in which children spend most of their time, as these places help to spend a fun time full of information, which also stimulates the relationship between children (Figure 4.65).

Figure 4.65: External Play Ground (URL12)

Checklist Criteria

- **Technology**

There is nothing mentioned in the plan or pictures that this school has any technology inside or outside, it is not vital to provide technology in the school's (Morgan, 2010) equipment, but it is good to able to facilitate the process of teaching and receiving the information in the classroom.

- **Furniture**

One type of furniture has been adopted in this school, which is flexible tables that can be moved and contain several seats to provide participatory work between children and to make them benefit from the mental abilities of each of them, which

leads to strengthening their identities and providing early development for some children.

- **Lighting**

Two types of lighting were adopted in this school as observed in the plan. White lights was used, which proved to be suitable for children and work to support academic performance by resting the eye and not distracting the student when they are in the room (Hansen, 2017), in addition to making good use of natural lighting as mentioned previously in the description of the school, it had adopted the presence of a lot of transparent panels to provide a large amount of daylight and direct contact with nature (Figure 4.66).

Figure 4.66: Types of Lighting (URL12)

- **Visual Elements**

There are no visual components in the school, indicating a weakness. As noted in the second chapter, the importance of visual components in the classroom is to aid children's thinking for any work they solve in class, as well as to make the teaching process easier for teachers to support their academic achievement and relax their minds as much as possible (Bush, 2007).

- **Type of Arrangement**

As mentioned previously in the furniture point, one flexible spatial arrangement was used that allows the user to comfortably move the student by including a certain number of chairs around each table, and an individual table was dispensed with for each student. It is possible for the ability to have more control over the arrangement of the class to be able to give different types of lectures, such as the explanation of information by the teacher only or the presence of participatory work for students. It can be arranged in a semi-circle or traditional shape (Cardellino, 2017), (Ankney, 1974), (Figure 4.67).

Figure 4.67: Types of Arrangement (URL12)

- **Height of the Space**

The school relied on a relatively high ceiling system in many rooms, as shown in the visual description of the school, higher than 2.5 meters. This increases physical activity psychologically for children. If these heights are used in the activity or sports, the reactions of the children will be positive on them because the movement of the students is supposed to be stimulated in such places. On the other hand, if these heights are used in the classrooms, the reactions will be inappropriate for the

children because this will affect the teacher's ability to control the activities of the children (Figure 4.68).

Figure 4.68: Height of the Space (URL12)

- **Color**

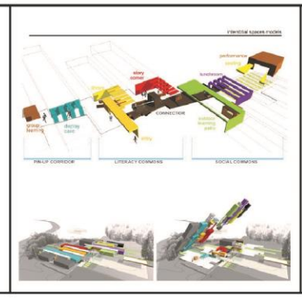
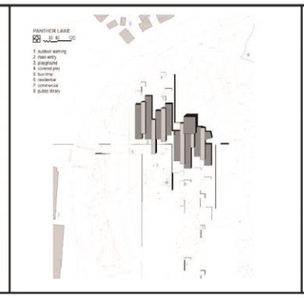
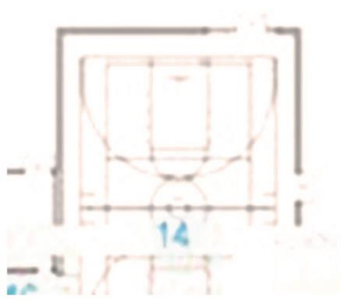
Red The redor was used in the outdoor yard, and it was proven that this color has a positive psychological effect in these places, which is an increase in blood pressure, which leads to increased activity and enjoyment of playing, because children prefer fun and acquiring information through playing more than traditional methods.

White color was used in abundance in this school in the corridors and some rooms, as the presence of white color in the educational spaces reduces academic performance as its proved that white rooms are not suitable for children.

The orange was used on the main entrance to the school, which students frequent during the day. This color helps to make students feel comfortable and relieve stress because it has been proven that this color is one of the strongest sedatives for children and preferred by most of them for its good effect (Figure 4.69).

Figure 4.69: Colors Exist in Spaces (URL12)

Table 4.7: Table for Sixth Case

Information									
	Panther Lake Elementary School								
Drawings				NONE	Location		External facade		
	Criteria								
NO / YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color			
Description	• Fifteen classrooms • Harmonious shape • Approximately 300 seats	NONE	• Two patios • External room • Outdoor courtyard	• One type • Flexible tables	NONE				
Photographs		NONE			NONE				
NO / YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space			
Description	• One faculty workshop • Conference room • Activity room • Music room • Kitchen	• Gymnasium • Rope play • Type of playing • Running	NONE	• Two types • White lights • Natural lighting	• Flexible arrangement • Comfortably move	• High ceiling system • Higher than 2.5 meters			
Photographs	NONE		NONE						

4.2.7 Gloria Marshall Elementary School

All the figures for the seventh case refer to URL13. The seventh case of this thesis is Gloria Marshall Elementary School. The school is located on a large area of 9800 m^2, which enables the presence of many rooms and activities for children other than the classroom. The design of the school goes back to the architect SHW Group. One of the goals of this school is to save energy, make good use of the energy of nature, and teach generations how to conserve energy for a more sustainable future. The school is located in Spring Texas, USA (Figure 4.70).

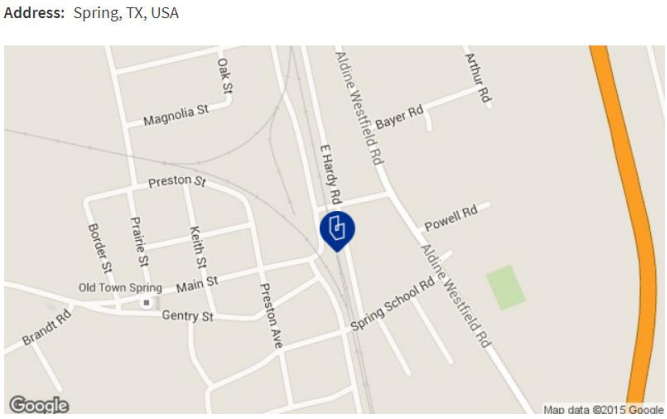


Figure 4.70: Location of Gloria Marshall Elementary School (URL13)

The school has a rectangular exterior shape on two floors facing north and south, in addition to the fact that every classroom has good daylight inspired by the pixel of trees (Figure 4.71).

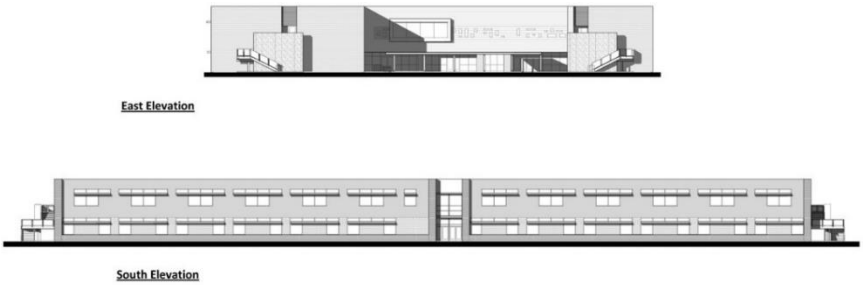


Figure 4.71: Elevation of Gloria School (URL13)

One external façade will be the school more understandable (Figure 4.72):

Figure 4.72: External Façade (URL13)

Checklist Spaces

- **Classroom**

Six large spaces were used in the school on its sides to maintain direct contact with nature; six to eight classrooms were provided in each suite, where the school provided approximately 43 classrooms, 15 of them on the first floor and the rest in the second one, with a total of approximately 860 students, such an arrangement allows for the separation of age groups separately to provide a harmonious school atmosphere (Figure 4.73).

Figure 4.73: Classrooms (URL13)

- **Activity Room**

Many activities have been provided in this school, including music rooms, computer lab, library, gymnasium, kitchen, and dining rooms located in one first floor. This allows students the freedom to choose what they are interested in and spend a pleasant free time in the many places available within the boarding school, which enhances the abilities of discovery and intellectual development of students because how much it has been proven that children are very curious (Acar, 2014) and prefer to discover the environments that surround them, which leads to the development of their mental abilities (Figure 4.74).

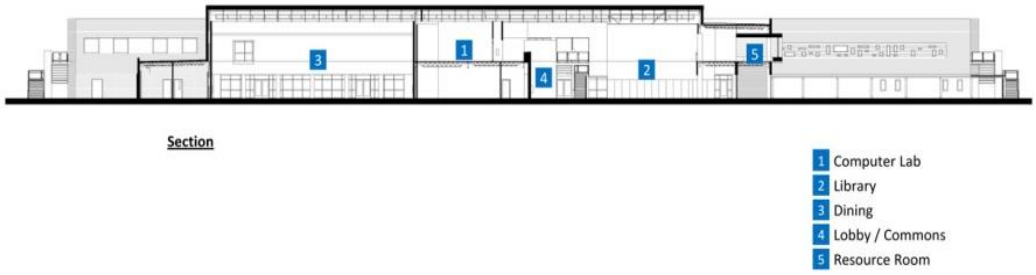


Figure 4.74: Activity Rooms (URL13)

- **Handicraft**

There is nothing mentioned about handicraft room in the plan or visual description of the school, which mean that there is no handicraft that maybe will impact negatively on children because it has been proven that this type of school is very important to be there due to its importance to develop the hand skills for writing and do some activity by both hands (Sederevičiūtė-Pačiauskienė, 2019).

- **Sport Areas**

A good space was provided for the school's sports area. This is a good point for the design of the school and the use of the available space to provide for the welfare of

the students, which helps the students to go through many experiences and support them to overcome bigger tasks in education and stimulate the relationship between the children and make them enjoy spending time with each other. This was also proven in the second chapter, which talked about the importance of having such spaces in the school for their ability to support the motor and mental abilities of children (Dunn, 2012). (Figure 4.75).

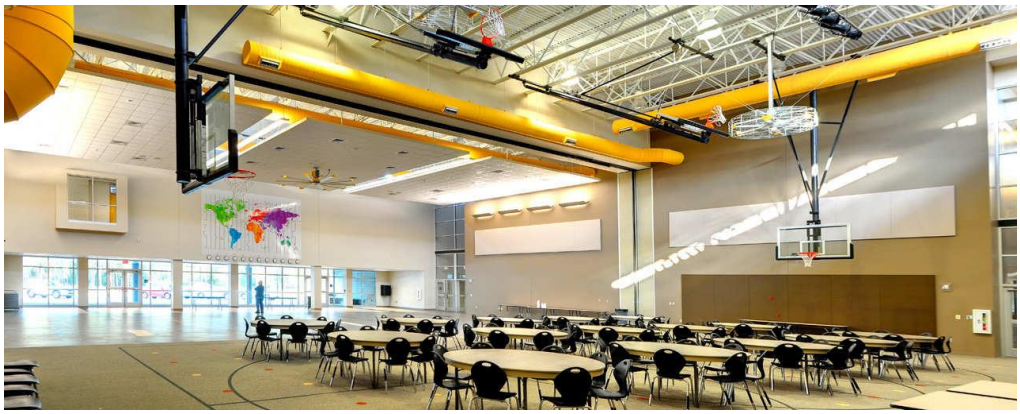


Figure 4.75: Sports Area (URL13)

- **External Playground**

This school is supported by an external space that provides many experiences as mentioned in the text description of the school. There is a large environmentally friendly pond and a water basin, which can teach children integrated concepts about mathematics and science with the ability to apply real experiences, allowing students to learn through fun and Gain a lot of information because it has been proven that such spaces are information-rich external centers and have been described as external learning environments (Smith, 2016). In addition to an external playground for playing to enhance the relationship between peers, create a friendly team spirit among students, and develop their abilities (Figure 4.76).

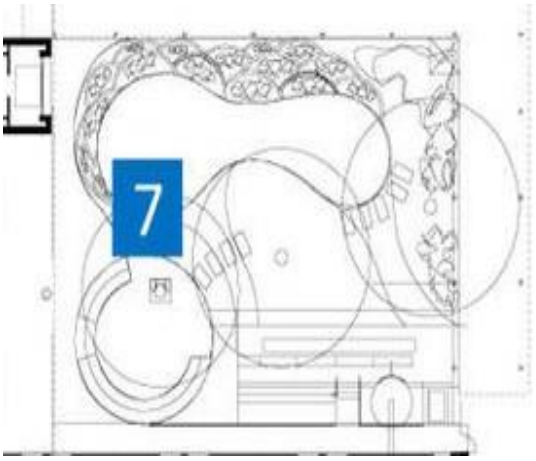


Figure 4.76: External Play Ground (URL13)

Checklist Criteria

- **Technology**

Some types of technology were provided to serve the children and the teaching staff in this school. A sensor system was used to turn on and off the lights based on the levels of external lighting, in addition to the school having a thermal power well to control the school's thermal system. Furthermore, extensive use of the Internet as an educational tool and the use of Surveillance cameras to keep children safe. All of these elements facilitate the education process to develop children's early thinking and the ability to direct them to the right path for the school's goal, which promotes energy conservation and how to take advantage of the surrounding environment around us for the presence of comfort and better education. Based on reference (Morgan, 2010) and an explanation for the importance of technology (Figure 4.77).

Figure 4.77: Types of Technology (URL13)

- **Furniture**

Stairs have been provided in several forms to ascend to the second floor, some of which are traditional with an iron pipe for the safety of children, and some are in the form of a slide to increase the level of welfare for students as well. A flexible circular staircase was also provided for ascending and descending. In addition, a semi-circle-shaped wooden huge seat was used in one of the rooms with a large glass facade. Flexible collective wooden tables were used in the library with several chairs (Figure 4.78).

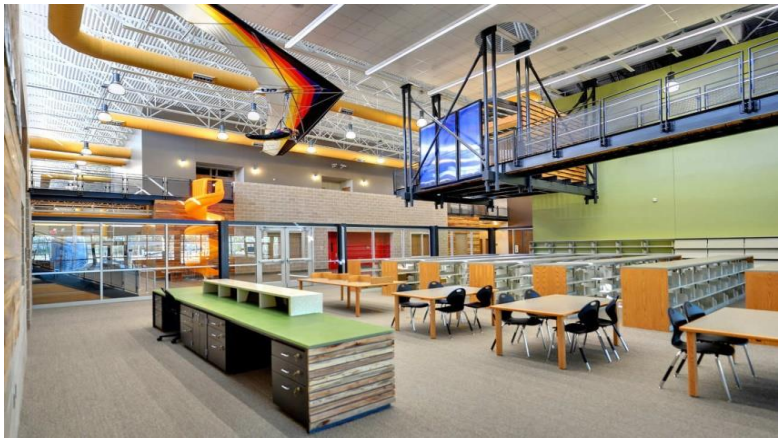


Figure 4.78: Types of Furniture (URL13)

- **Lighting**

Some forms of lighting have been provided, including yellow, which is abundant on the first floor in lobby spaces and internal corridors, which has been proven to work

on eye strain for children because such lighting, which carries a power of (3500kL), is not suitable for children because of its ability to affect the Academic performance negatively. Still, it gives an aesthetic character in indoor spaces (Comenius, 1967), (Hansen, 2017).

In addition, white lighting was used on the second floor to a large extent in the internal corridors, classrooms, and the library as well, which gives a positive effect of comfort and lack of eye strain and the ability to positively affect the academic performance of children through lighting that carries (6000kL), (Comenius, 1967), (Hansen, 2017). In addition to many glass facades that allow daylighting to enter and save energy at a high rate (Figure 4.79).

Figure 4.79: Types of Lighting (URL13)

- **Visual Elements**

Few of the visual elements were provided in the corridors to facilitate the process of explaining the measurement of the temperature outside and inside, with the design of a small model to explain the process of ground gravity. As for the classroom, none of the visual elements were used, and this made the students think more and made the process of receiving information difficult. Because it was also proven in the second chapter that the visual elements save the time spent by the teacher to facilitate the

teaching process for both the student and the teacher (Bush, 2007), (Kellogg G. S., 1971), (Figure 4.80).

Figure 4.80: Types of Visual Elements (URL13)

- **Type of Arrangement**

Many types of spatial arrangements were used in the school. A small amphitheater was provided in the outer courtyard, which supports the collective participation of students and the ability to enhance self-confidence among students and develop an individual identity. In addition to a large wooden bench in one of the rooms, such an arrangement makes the distance between the students and the teacher equal and enhances the spirit of participation among the students because of the close contact with the teacher (Sommer, 1969). A flexible arrangement was provided inside the library on the first floor, which is a group of square and circular tables for the ability to benefit from the mental abilities of each student and to promote teamwork to solve a topic or issue that they face. Most of the spatial arrangements in the school were a form that was closer to a semi-circle, as it was mentioned about that that this arrangement is suitable for students in many cases for the development of children's destiny (Ankney, 1974), (Figure 4.81).

Figure 4.81: Types of Arrangement (URL13)

- **Height of the Space**

A height of more than 2.5 meters was provided in the yard in front of the main entrance to the school and most of the rooms inside, which increases the physical activity of children in play and have fun. The library's ceiling was high, which led to restrictions on children's physical activity. However, as it was previously noted that in such places a ceiling higher than 2.5 meters must not provide to be able to limit the body activity for children. On the contrary, a ceiling approximately 2.5 was provide in the classroom, which leads to a positive impact on children and leads to easy in controlling their body activities (Read, 1999).

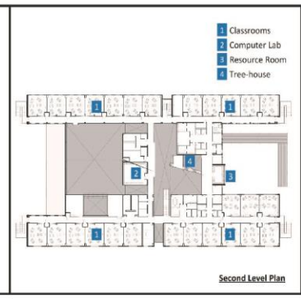
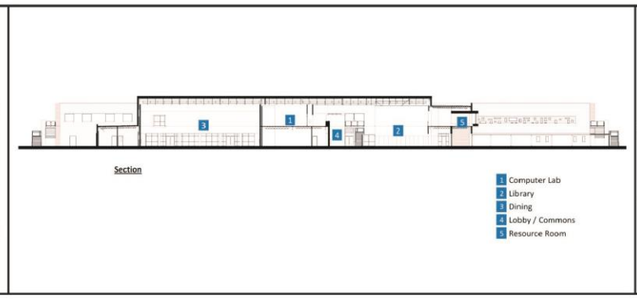
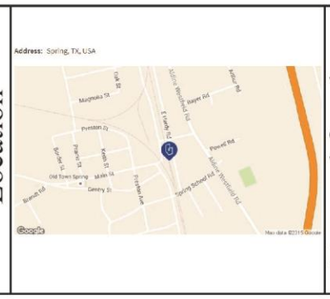
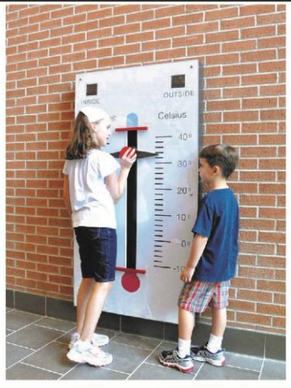
- **Color**

The yellow color was used on the thermal system tubes that circulate inside the entire school, as it has been proven that this color is linked to physical activity, happiness, and comfort, which means that the color has a strong positive effect on children as it enhances their comfort and works to remove stress and activates them wonderfully (Kaya, 2004), (Gyu “Phillip” Park, 2014). A large green facade was used in the library. It was proven that the green color is associated with comfort and works to develop speech skills and stimulates reading and this indicates that it is a good color in these places and works to reach the goal rooms from its presence, which is to

provide the student's comfort and improve speech skills, which leads to enhancing self-confidence. (Gaines, 2011). The black color was used in some of the chairs used in the school and the circular staircase located in one of the corners of the boarding school, as it was previously mentioned that the black color is not preferred by students, meaning that it has a negative impact on them (Jeong, 2020). Brown was used in the interior corridors, and it has been proven that brown is unsuitable for most children and increases feelings of sadness and anger, leading to a negative psychological impact on children (Jeong, 2020). The orange color was used on the slide and some spaces in the school, and this gives a feeling of comfort because it has been proven that this color is one of the strongest sedatives for children and is preferred by most of them (Gaines, 2011), (Figure 4.82).

Figure 4.82: Color Exist in Spaces (URL13)

Table 4.8: Table for Seventh Case

Information	Gloria Marshall Elementary School									
Drawings				Location		External facade			
	Criteria									
NO YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color				
Description	• Six large spaces • Approximately 43 classrooms • Six-eight in each suite • Approximately 860 students	NONE	• External space • Large environmentally pond • Real experiences	• Semi-circle-shaped wooden • Circular staircase • Wooden tables • Stair of a slide	• Few of the visual elements					
Photographs		NONE								
NO YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space				
Description	• Dining rooms • Music rooms • Computer lab • Library • Gymnasium • Kitchen	• Available space • A good space	• Internet as an educational tool • Surveillance cameras • Thermal power • Sensor system	• Yellow lighting • White lighting • Many glass facades	• Small amphitheater • Semi-circle • Large wooden bench • Flexible arrangement	• More than 2.5 • Approximately 2.5				
Photographs										

4.2.8 Wilkes Elementary School

All the figures of the eighth case refer to URL14. The eighth case for this thesis is Wilkes Elementary School, located in Portland, United States, which has an area of 6000 m^2. This school is distinguished by the strong interconnection between the interior and the exterior to maintain contact with nature, in addition to the fact that children are not restricted to one place to study only. Moreover, there are external pillars as a canopy for the outer courtyards. Design of school refers to Architect Mahlum. The building calls for sustainability and energy conservation (Figure 4.83).

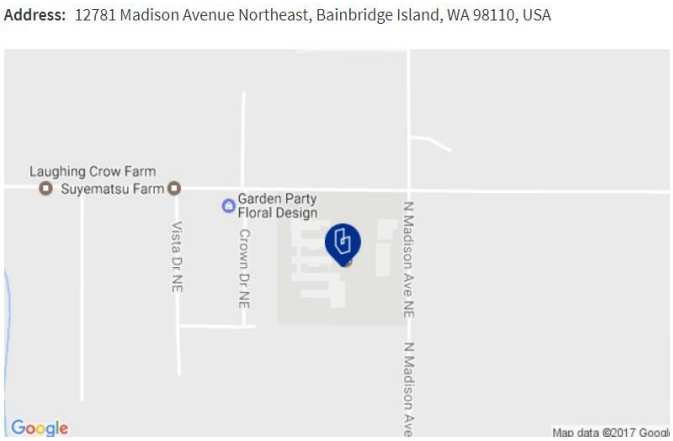


Figure 4.83: Location of Wilkes Elementary School (URL13)

The school contains two floors (ground floor and upper floor) and an external courtyard. It is located on 6000 m^2. The spaces were distributed very flexibly to maintain direct contact with nature. Furthermore, the school includes 450 students (Figure 4.84).

Figure 4.84: Areas Conclude in School

More pictures for the external façade will make it understandable (Figure 4.85)

Figure 4.85: External Façade

Checklist Spaces

- **Classroom**

According to the existing plan of the school, 23 classrooms were provided in the internal space within two floors, which allows for approximately 460 students. The classrooms were divided into suites in the inner courtyard, and each group consisted of 4-5 classrooms separately, allowing for calmness and giving a harmonious shape to the school, in addition to providing a good space for each classroom (Figure 4.86).

Figure 4.86: Classrooms

- **Activity Room**

The activity room in this school was focused on and provided a strong incentive to support the skills and provide an individual climate for each student inside the school. These rooms have been proven to be very important for their high value in assisting the education process (Sanoff, 1988). In addition to developing moving skills, developing individual identity, and enhancing self-confidence (Figure 4.87).

Figure 4.87: Activity Room

- **Handicraft**

A room was provided for handicrafts, and it was also proven that this room is valuable for children (Sederevičiūtė-Pačiauskienė, 2019) and it must be provided

because of its importance in providing participatory work and making children discover the environments around them, in addition to urging the development of writing abilities by using both hands in the tasks assigned to children from the teacher, such as planting seedlings or playing clay (Figure 4.88).

Figure 4.88: Handicraft Room

- **Sport Areas**

Based on the plan shown for the distribution of rooms presented in the visual explanation, an indoor gymnasium was provided, which confirms the importance of providing it (Dunn, 2012). Which indicates that such places encourage children to solve difficult problems by playing and skipping the tasks they face in this area, in addition to enhancing self-confidence, which makes children able to develop their academic performance (Figure 4.89).

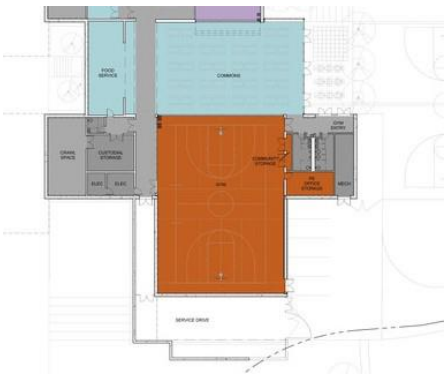


Figure 4.89: Spots Area

- **External Playground**

A large outdoor courtyard has been provided that includes many toys and safe equipment for children. It has also been proven that outdoor courtyards are important for children (Smith, 2016) as children prefer playing instead of studying. In addition, outdoor playgrounds are considered outdoor educational environments where children have a great time playing and strengthening their relationship, which leads to the provision of a large amount of information by playing (Figure 4.90).

Figure 4.90: External Play Ground

Checklist Criteria

- **Technology**

Many types of technology have been provided in this school, although it is not a major source of education (Conway, 1993). But it facilitates the learning process and provides comfort for the students and the teacher at the same time. Computer laboratories were provided, in addition to the use of the Internet as an educational tool, to motivate students to develop their thinking by searching for the interests of each student and providing them with their needs, which will lead to high academic performance through fun. In addition, using a live wastewater treatment system and a hybrid heating system to provide an appropriate temperature in the building.

- **Furniture**

Many types of furniture were used, and they were all in shapes and dimensions suitable for children (Panagiotopoulou, 2004). Sponge balls and plastic chairs were provided with comfortable dimensions compared to the position of the student sitting that showed, sponge floor seats in the activity rooms, in addition to the use of plastic chairs with concave backs to ensure The complete comfort of the children with tables suitable for the sizes of the children. Large sponge seats were used in the library between the shelves, which can serve the children in the case of sitting while searching for a specific book. By eye observation, the furniture used in the school was suitable for children and provided them with complete comfort not to be distracted and to maintain academic performance (Figure 4.91).

Figure 4.91: Types of Furniture

- **Lighting**

Three types of lighting were used in the school "yellow lighting, white lighting, and natural lighting." It has also been proven that yellow lighting is not suitable for students. On the contrary, white lighting is better for students because of its positive effect on supporting academic performance (Comenius, 1967). White lighting (6000 KL) was used in the handicraft, classrooms, and the library for its ability not to

distract the students and support their academic performance. On the other hand, yellow lighting (3500 KL) was used in the interior corridors of the building, which has been proven to weaken academic performance because it works on eye strain (Comenius, 1967), (Figure 4.92).

Figure 4.92: Types of Lighting

- **Visual Elements**

Visual elements are used in classrooms, activity rooms, and the library. It has been proven that these elements can facilitate the student's understanding process (Bush, 2007). These elements work to ease the understanding and reduce deep thinking that weakens the abilities of students. Hence, the presence of these elements works to understand problems quickly and the ability to solve them smoother than information Written only. This leads to supporting mental abilities and the ability to provide simple thinking to solve problems for students (Figure 4.93).

Figure 4.93: Types of Visual Elements

- **Type of Arrangement**

The effect of the spatial arrangement of the room on the extent of student attention and participation, it was shown that students at the front of the class are more involved than others who are sitting at the back (Weinstein, 1979). A flexible spatial arrangement was used in the handicraft and activity rooms, which can be arranged depending on the type of lesson present. The traditional arrangement was used, which proved to be unsuitable for children (Ankney, 1974), because the students who are affected in this arrangement are the ones who sit in the back. Arrangement of parallel lines of gathering tables with some shapes of carpets on the floor in the library was used to provide freedom of choice when reading or using the computer to ensure that the appropriate needs are provided for each individual needs in the school (Figure 4.94).

Figure 4.94: Types of Arrangement

- **Height of the space**

Most of the rooms shown in the visual description of the school had a height equivalent to 2.5 meters depending on observation by eyes, and this height is suitable for the ability to control the physical activities of children such as classrooms, libraries and quiet places. As for the activities room and the gymnasium, the height should be more than 2.5 in order to be able to influence psychologically in positive way, which is to support students' activity to motivate them to move more and release negative energies.

- **Color**

Green color has been used in handicrafts, which has been proven to be good for children, as it is associated with comfort and the ability to create a stimulating atmosphere for speech abilities and enhance self-confidence, in addition to providing a psychologically safe atmosphere (Iftadi, 2018), (Gaines, 2011). The blue color was provided, one of the best colors for children. It stimulates memory and gives a sense of comfort, and reduces blood pressure (Gaines, 2011). The orange color was used, one of the most powerful sedatives for children, and works to remove stress and indicates happiness for children (Jeong, 2020). Brown was used, which is an

unfavorable color for its psychologically negative impact on children, as it stimulates depression and indicates sadness for them (Boyatzis, 1994).

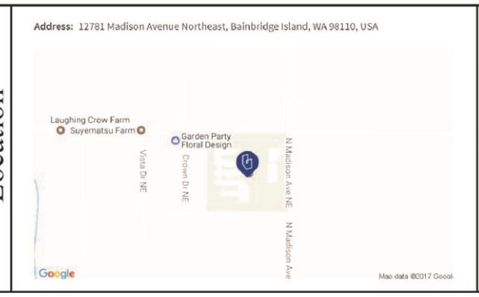
Brown was used in the interior corridors, which is considered an unfavorable color for its psychologically negative effect on children, as it stimulates depression and indicates sadness for them (Boyatzis, 1994).

The blue and red colors were used in the activity room, which is considered the opposite of each other. Still, in these rooms the red color must be provided because it has a high level of increase in blood pressure and motivating students to play and increase movement. However, it has negative aspects, such as aggression. Furthermore, the blue color was Also provided, which works to provide comfort and the ability to stimulate memory for any process that needs thinking, which helps children spend an enjoyable time in this room (Gaines, 2011), (Safferman, 2015).

The color red was used in classrooms, one of the strongest negative influences on weakening academic performance and distracting them (Elliot, 2007). Orange and purple were provided, which is of great importance in creating an atmosphere of comfort for students and supporting their sense of humor when it was proven that these colors are associated with happiness and laughter and reduce the internal tension of children to make them more comfortable (Kaya, 2004). In addition to the use of blue, green and yellow, these colors are associated with comfort and the ability to attract attention and stimulate speech abilities and create a suitable atmosphere to stimulate memory to help children not forget information. Yellow color was used in a small amount, which makes it a good psychological effect on children's concentration and stimulate their lung function (Gaines, 2011) (Figure 4.95).

Figure 4.95: Colors Exist in Spaces

Table 4.9: Table for Eighth Case

Information		
	Wilkes Elementary School	
Drawings	 Lower level  Upper level	Location  External facade 
	Criteria	

NO / YES	Classroom	Handicraft	External playground	Furniture	Visual Elements	Color
Description	• 23 classrooms • 4-5 classrooms separately • 460 students	• One handicraft room	• A large outdoor	• Large sponge seats • Plastic chairs • Sponge balls • Sponge floor seats • Tables suitable	• Activity rooms • L library • In classrooms	
Photographs						

NO / YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space
Description	• One activity room	• Indoor gymnasium	• Hybrid heating system • Wastewater treatment system • Internet • Computer laboratories	• Three types	• Flexible spatial arrangement • Arrangement of parallel lines • Traditional arrangement	• Equivalent to 2.5 meters
Photographs						

4.2.9 Lakeland Elementary School

All the figures of the ninth case refer to URL15. The ninth case of this thesis is Lakeland Elementary School, located in America on an area of 4,000 square meters. A flexible design was adopted in it, and many multi-use rooms were provided, which led to a design that greatly reduced the cost compared to the existing schools at that time. The school has an area of 4,000 square meters and was designed by the architect DLR Group (Figure 4.96).

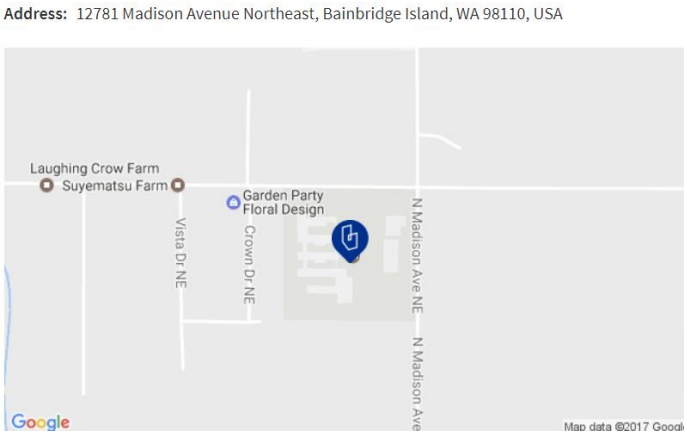


Figure 4.96: Location of Lakeland Elementary School

The school has one floor and offers approximately 22 classrooms, with a total number of 460 students. It has a library, a computer lab, a group showroom, and a shared kitchen (Figure 4.97).

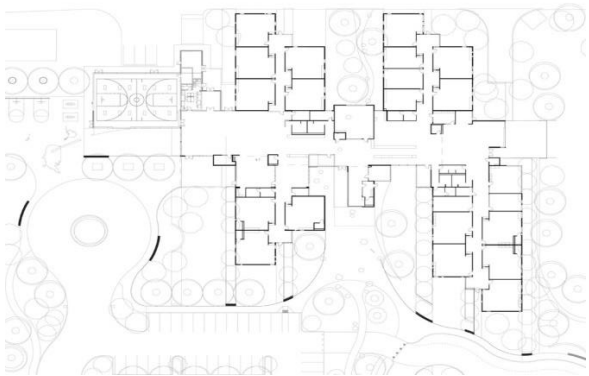


Figure 4.97: Areas Conclude

More pictures to be more understandable (Figure 4.98)

Figure 4.98: External Façade

Checklist Spaces

- **Classroom**

About 22 classrooms were provided in a harmonious arrangement on one floor, the floor was divided into four large squares, and 4-5 classrooms were provided in each square, as shown in the plan mentioned above, with a total number of 460 students (Figure 4.97).

- **Activity Room**

An activity room was provided in the school to demonstrate that such spaces are very important (Sanoff, 1988) for their ability to provide a group and participatory atmosphere for students and the ability to have children help each other in the activities available and benefit from of the mental capabilities of each of them (Figure 4.99).

Figure 4.99: Activity Room

- **Handicraft**

The school does not have a handicraft room. This is a weak point of the school for not providing that space for students, because it has been shown to be necessary (Sederevičiūtė-Pačiauskienė, 2019), because it encourages To enhance teamwork in addition to developing writing skills by using both hands, which leads to an increase in self-confidence.

- **Sport Areas**

An indoor gymnasium exists based on the design described for allocating rooms in the visual explanation, confirming the need to provide it (Dunn, 2012). This suggests that such environments help children tackle challenging issues by playing and solving the challenges they confront in this area, in addition to boosting self-confidence, which allows children to improve their academic performance (Figure 4.100).

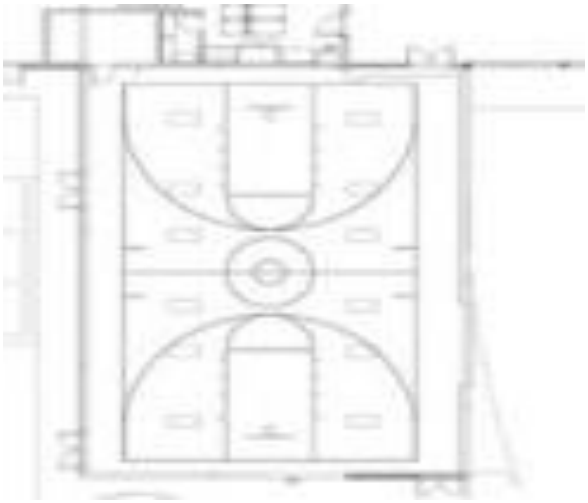


Figure 4.100: Sport Areas

- **External Playground**

There is a twice-large outdoor patio with several toys; some of the equipment is safe for children, and other rocks outside may hurt children. It has also been established that outdoor courtyards benefit children (Smith, 2016) as children will rather play than learn. Furthermore, outdoor playgrounds are regarded as outdoor educational spaces where children have a fantastic time playing and building their relationships, providing a large quantity of knowledge via playing (Figure 4.101).

Figure 4.101: External Play Ground

Checklist Criteria

- **Technology**

There are some types of technology provided in the school to facilitate the study process as mentioned in (Panagiotopoulou, 2004). This equipment is intended to facilitate the learning process, but it is not an essential component. A computer lab provided the Internet was used as a tool of education, a data show, and alarm systems to keep children safe, in addition to a thermal system to maintain a suitable temperature for children in the internal spaces (Figure 4.102).

Figure 4.102: Types of Technology

- **Furniture**

In the activity room, comfortable plastic chairs were provided for the student with a flexible arrangement of a set of rectangular tables. Wooden chairs were provided in the corridors and the lobby, with some sponge sofas in the waiting area. Strange types of furniture are provided in the library, including boards attached to bookshelves with sponge cushions for usable space, a small wooden amphitheater provided in the classrooms as a tool for assembling students, and steel chairs with sponge seats to provide complete comfort for children. Circle tables are provided that

accommodate a certain number of chairs in the classrooms with plastic ones (Figure 4.103).

Figure 4.103: Types of Furniture

- **Lighting**

The school had three forms of illumination. Natural lighting, yellow lighting, and white lighting it has also been shown that yellow lighting is not appropriate for pupils and that white lighting is preferable due to its good influence on academic performance (Comenius, 1967). White lighting (6000 KL) was employed in classrooms and other spaces since it does not distract children and helps them achieve academically. Yellow lighting (3500 KL) was employed in the building's inner hallways and the library, which has been shown to impair academic performance by reducing eye strain (Comenius, 1967).

- **Visual Elements**

There are no visual elements that exist in the school, which will point out a weak point for the school. As mentioned before in the second chapter, how important visual factors to be in the classroom to facilitate the thinking of children for any task

they solve it in class, also to make the teaching process easier for the teachers to support their academic performance and rest their mind as much as can.

- **Type of Arrangement**

Some spatial arrangements were adopted in this school, the half-circle arrangement was used in the activities room due to its importance ((Cardellino, 2017), (Weinstein, 1979) in the ability to provide equal participation for students and not let them feel bored. Flexible spatial arrangement in the library, which is built-in seats in the bookshelves, creates a harmonious atmosphere of calm and does not allow disturbance because each student is in a semi-separate place from the others. A small amphitheater was provided in the classrooms, but it was not suitable for children's comfort. In addition, steel chairs with sponge seats and wooden tables were provided in a random arrangement inside the classrooms with the possibility of seating a certain number of students to create a participatory atmosphere among students and strengthen their relationship with each other (Figure 4.104).

Figure 4.104: Types of Arrangement

- **Height of the space**

The heights of more than 2.5 meters were used in the activity room, which gives a positive point for the school because the goal of these heights is to increase the

physical activity of students to influence them psychologically in a positive way and increase their rate of physical activity. Some classrooms have a ceiling height of more than 2.5 meters, which leads to negative effects. In some others, the ceiling height is approximately 2.5 meters, which helps the teacher control the students' physical activity, prevent them from being distracted, and maintain their attention (Rosado, 2007), (Figure 4.105).

Figure 4.105: Height of the Space

- **Color**

The green color was used in the activity room, and it was proven that this color works to provide comfort and calmness (Iftadi, 2018). this color is inappropriate in these places due to this space's need to motivate children. The purple color was used on the activity room chairs and according to (Kaya, 2004). It has been proven that this color provides comfort and laughter and an atmosphere of fun and is suitable and is one of children's favorite colors.

White was used in the library and the corridor toward it, which a study indicated that syphilis reduces blood pressure and psychological stress. However, the results of this study proved that white has a negative effect on children (Gilliam, 1988), which

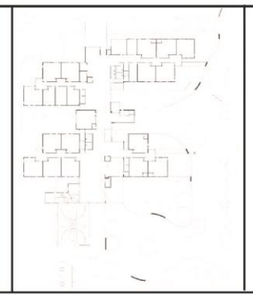
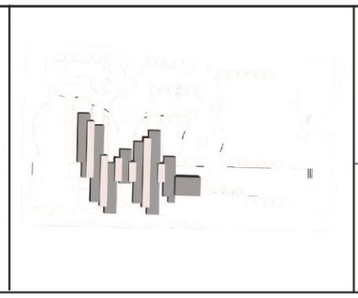
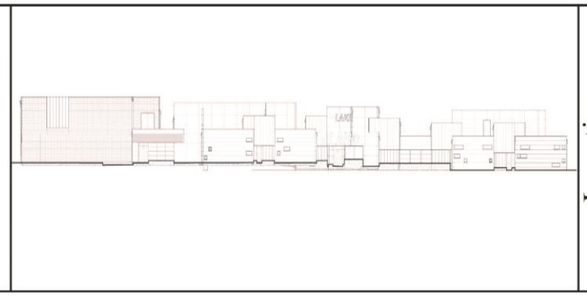
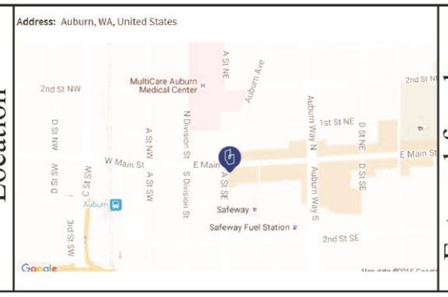
leads to a decline in academic performance and student distraction, as this color is considered inappropriate in such places.

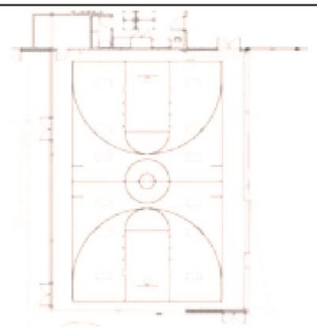
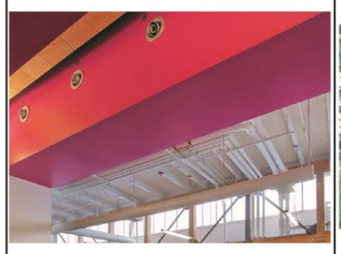
White and red are used in some classrooms, which have been proven to be inappropriate colors and work to weaken academic performance and lose the concentration of students, which leads to a negative impact on children. Moreover, the light blue color was used in some classroom grounds, which has been proven to provide an appropriate atmosphere of comfort due to its association with calm and its ability to stimulate memory not to forget information (Yildirim, 2015), (Iftadi, 2018), (Kumi, 2012).

The color red was used in the external playground (Iftadi, 2018). This color has a positive effect on children in these places by increasing playing time for students and the ability to stimulate physical activity. (Figure 4.106).

Figure 4.106: Colors Exist in Spaces

Table 4.10: Table for Ninth Case

Information							
	Drawings				Location		External facade	
	Photographs		NONE			NONE	
	Description	• 22 classrooms • 4-5 classrooms • 4 large squares • 460 students	NONE	• Twice-large outdoor patio • Some rocks outside • Several toys	• Rectangular tables • Strange type of furniture • Plastic chairs • Sponge sofas • Amphitheater • Wooden chairs	NONE	
NO / YES		Classroom	Handicraft	External playground	Furniture	Visual Elements	Color
	Criteria						

NO / YES	Activity Room	Sport Areas	Technology	Lighting	Type of arrangement	Height of the Space
Description	• One activity room	• Indoor gymnasium	• Thermal system • Internet • Computer lab • Alarm systems • Data-show	• Natural lighting • White lighting • Yellow lighting	• Half-circle • Random arrangement • Flexible spatial arrangement • Small amphitheater • Semi-separate place	• More than 2.5 • Approximately 2.5
Photographs						

4.2.10 Taleny School

All the figures of the tenth case refer to URL 16. The tenth case for this thesis is the Taleny School, an Aro Estudio design. It is located in Mexico. Also, it's located on a plot of 5,000 m^2, and the total building area is 3000 m^2. The school relied on its design to provide personal and school climates to provoke children's interest in innovation and discovery of the surrounding environments (Figure 4.107).

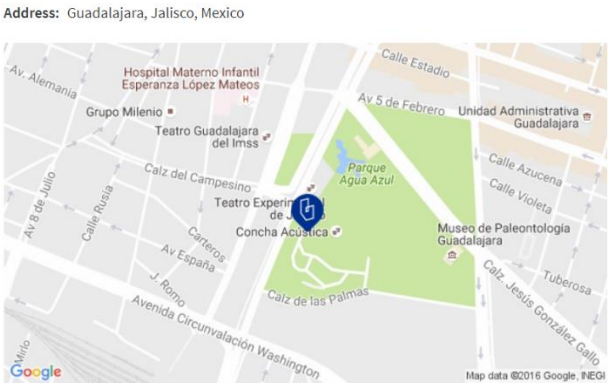


Figure 4.107: Location of Taleny School

The school contains two floors with a design that includes many classrooms, a library, a computer lab, a robotics room, a music room, a handicraft room, and an indoor and outdoor gymnasium (Figure 4.108).


Figure 4.108: Areas Conclude

Picture for external façade to be more understandable (Figure 4.109).

Figure 4.109: External Façade

Checklist Spaces

- **Classroom**

This school has approximately 27 divided classrooms, providing 540 seats for students. The classrooms are divided harmoniously and somewhat separately to maintain a quiet study atmosphere in addition to direct contact with nature by providing windows and facades designed in a good way that keep away from direct sunlight (Figure 4.110).


Figure 4.110: Classrooms

- **Activity Room**

There was no special room for activities in the school. Still, three indoor and outdoor playrooms were provided, which were mentioned in the textual description as multifunctional rooms for all students. Therefore, the teacher can do a lesson of activities in the indoor space, which provides an entertaining environment full of information through playing, because such a room is one of the important elements that must be provided in the school (Sanoff, 1988).

- **Handicraft**

The handicrafts room is full of interest due to its importance in supporting children's skills (Sederevičiūtė-Pačiauskienė, 2019). A handicraft room was provided in the school to allow the children to spend about 6-7 hours per week in it, which has an important impact on supporting the writing skills via the student using both hands, which will strengthen the self-confidence in addition to providing an atmosphere of participatory work among the children (Figure 4.111).

Figure 4.111: Handicraft Room

- **Sport Areas**

As mentioned earlier in the activity room point, sports areas were provided in the school. These places are important to support children to release negative energies and provoke them to search for difficult skills because it has been proven that children when they skip a certain task, this going to motivate them to search for more difficult tasks, as children are in the stages of self-development and these places are working to help them (Dunn, 2012), (Figure 4.112).

Figure 4.112: Sports Area

- **External Playground**

Good areas for playing outside were provided with shades to keep children safe from the sun's rays. In addition, safe equipment was provided in the outdoor playground. It has been shown that these places are necessary (Smith, 2016). They are external educational environments that can strengthen the practical and scientific skills of children, because child psychology prefers to play to study, which lies in helping

these places in providing an appropriate atmosphere for playing and gaining information through realistic experiences, and this will increase the development of academic performance (Figure 4.113).

Figure 4.113: External Play Ground

Checklist Criteria

- **Technology**

Technology is an element that facilitates the education process, but it is not necessary (Morgan, 2010). But in this case, some types of advanced technology have been provided, such as computer laboratories that promote writing and reading for children by using the Internet also as a tool of education in addition to a room for robots.

- **Furniture**

Sponge balls were used in the library in a random order, creating a different atmosphere for each student to maintain student concentration which will support academic performance. Sponge mattresses were used in the sports area to provide an element of safety and to maintain a comfortable environment for children. Wooden chairs and tables with smooth edges were used not to harm children and were placed

in a way that allows some students to sit together to provide teamwork and for students to benefit from each other, which strengthens the relationship between them, in addition to developing personal identity. Furthermore, providing shelves in the library and handicrafts, some of them high and can be harmed children, and a safe circular staircase to go up to the library (Figure 4.114).

Figure 4.114: Types of Furniture

- **Lighting**

White lighting was used on both floors to a significant extent in the internal corridors, classrooms, and the library, which gives a good effect of comfort and lack of eye strain and the possibility to positively affect the academic performance of children through lighting that carries (6000kL), (Comenius, 1967), (Hansen, 2017). In addition to various glass facades that enable natural light to penetrate and save a significant amount of energy (Figure 4.115).

Figure 4.115: Types of Lighting

- **Visual Elements**

Referring to the visual description of the school, none of the visual elements used that maybe could help provide ease of understanding for the student and not be distracted by deep thinking that could weaken their academic performance, these elements must be provided in the educational spaces because of their importance (Bush, 2007). This leads to supporting the student's mental abilities and providing ease of understanding of any information.

- **Type of Arrangement**

A flexible arrangement has been used in the school library, which can give a good feel to create a different atmosphere for each student to concentrate on reading. Another flexible arrangement was used in the handicraft room, which is group tables distributed randomly in the room's interior, which provides the ability for teamwork and students to benefit from each other's mental and practical abilities. The traditional arrangement was used in the classroom, which is considered unsuitable for its negative impact on the academic performance and concentration of the children because the children who sit at the back of the room have been proven to have a very low participation rate (Weinstein, 1979), (Figure 4.116).

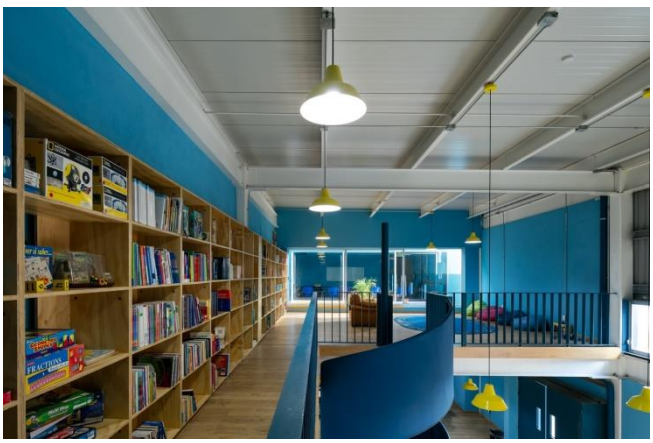


Figure 4.116: Types of Arrangement

- **Height of the Space**

A flexible method was used in the space that connects the library with the handicraft room, which is about providing a high ceiling to increase the activity of students and urging them to move to the handicraft room and also used in the gymnasium, in addition to providing about half that height in the classroom and library for the ability to control physical activity For children because it has been proven that heights above 2.5 increase the physical activity of children, and heights equal to 2.5 or less reduce these activities (Read, 1999), (Figure 4.117).

Figure 4.117: Height of the Space

- **Color**

Blue, red, and yellow were used in outdoor playgrounds, as red and yellow are associated with physical stimulation and increased activity. At the same time, blue is a color that increases playing time, which gives children all the incentives to have a fun time with high physical activity (Lewinski, 2015), (Safferman, 2015).

The color blue and yellow were provided in the library, which are considered the best colors in the educational spaces for the ability of blue color to provide a calm and comfortable atmosphere and increases the ability to remember information and stimulate memory. In contrast, the yellow color stimulates the lungs' functions and increases activity in the current work. Such as reading in the library is one of the

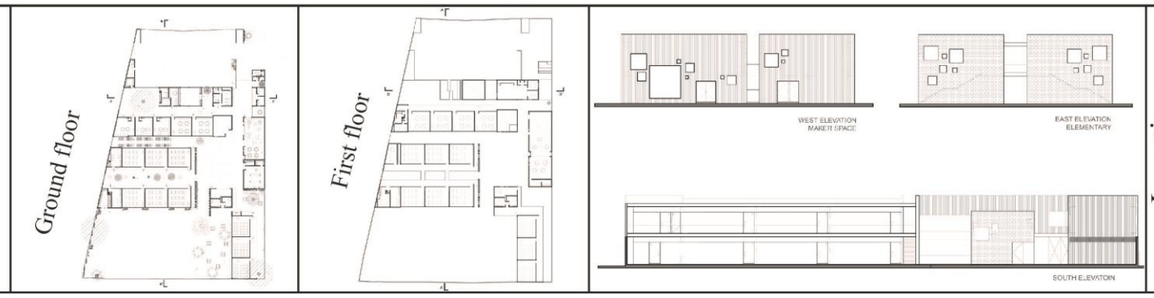
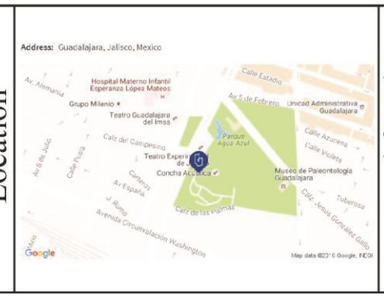
colors that attract attention (Gaines, 2011), (Kwallek, 1990). In addition, the white color on the ceiling of the library room has been proven to negatively affect the academic performance of students (Grangaard, 1995).

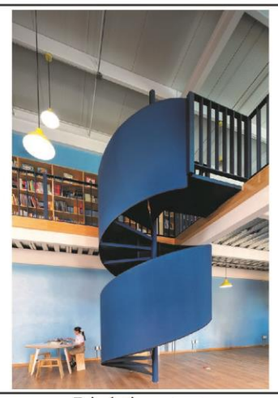
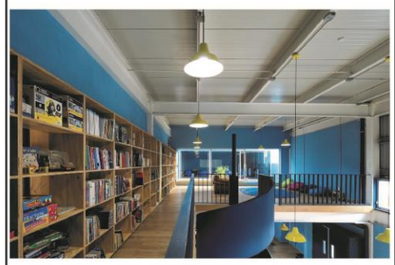
The blue and red color was provided in the indoor gymnasium, which is considered one of the best colors in such places. Although it is contrasting colors, its function is one here, the blue color increases playing time and children's enjoyment. In contrast, the red color increases heart rate, leading to increased movement and physical activity (Lewinski, 2015), (Safferman, 2015).

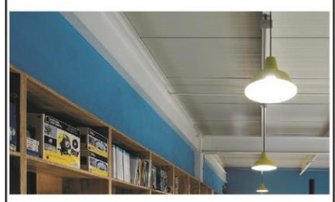
The yellow color was used in many of the external classroom facades and the doors and corridors leading to it, which provides a negative impact on children’s loss of concentration because it has been proven that the yellow color, when it is present in abundance, distracts attention (Gaines, 2011), this leads to eye strain and negatively affects academic performance (Figure 4.118).

Figure 4.118: Colors Exist in School

Table 4.11: Table for Tenth Case

Information		
	Taleny School	
Drawings		
Location		
External facade		

Criteria					
NO / YES	Classroom ●	Handicraft ●	External playground ●	Furniture ●	Visual Elements ●	Color ●
Description	• Approximately 27 • 540 seats	• One handicraft room	• External playground with shades • Safe equipment	• Wooden chairs and tables • Sponge mattresses • Sponge balls • Shelves in library • Safe circular staircase	NONE	
Photographs					NONE	

NO / YES	Activity Room ●	Sport Areas ●	Technology ●	Lighting ☐	Type of arrangement ●	Height of the Space ●
Description	NONE	• One indoor space	• Room for robots • Internet • Computer laboratories	• White lighting • Various glass facades	• Flexible arrangement • Random group tables • Traditional arrangement	• Flexible method • Above 2.5 • Approximately to 2.5
Photographs	NONE		NONE			

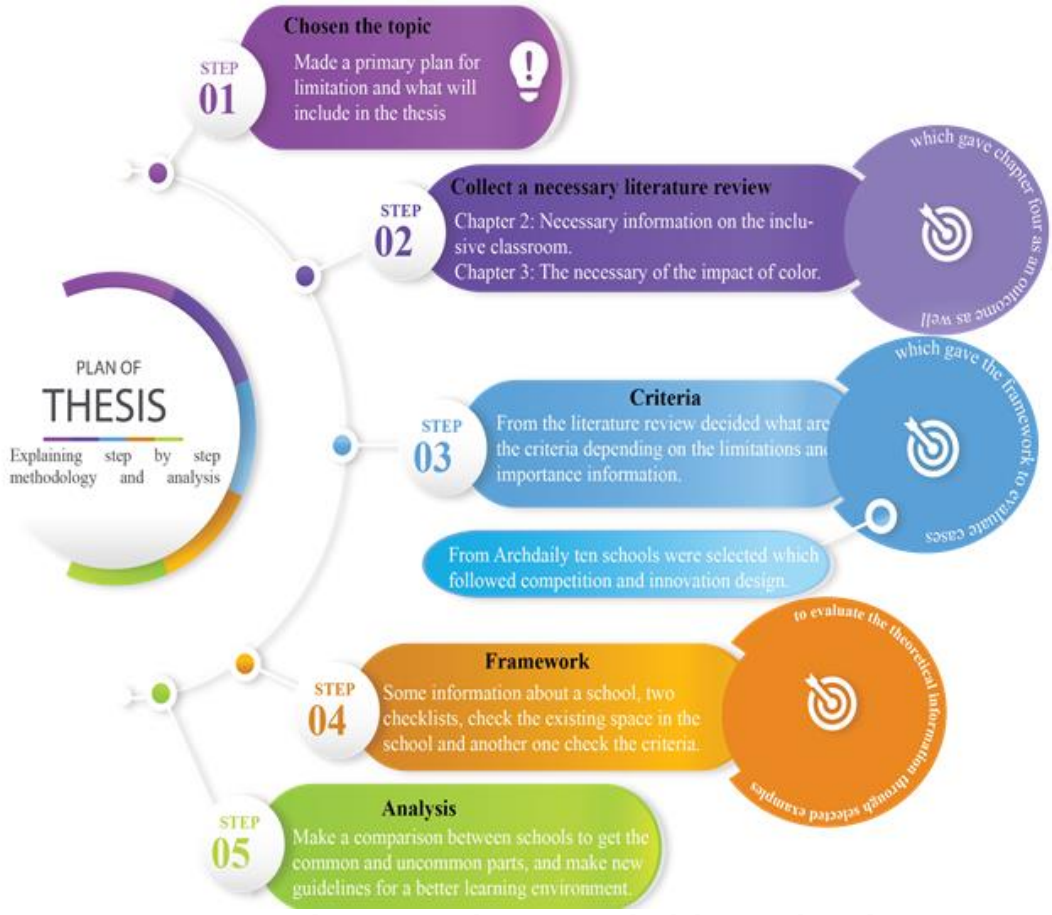


Figure 4.119: Explaining Step by Step Methodology and Analysis.

Chapter 5

CONCLUSION

5.1 Implication for the Study

Elementary schools are educational places located in all regions of the world. However, these schools differ in how they use the internal and external spaces, and this depends on the space given to any school and how each architect thinks—also depending on how these learning areas are designed. In addition, attention should be paid to how to improve the academic performance of children, because as it was proved in the second chapter that children are the age group starting from 5-12 who must develop their self-confidence with some skills such as writing skills and mental skills.

In these schools, which were previously analyzed above, most schools have provided places that work to improve the educational environments, such as the activity room, handicraft room, sports areas, and external playground. It is necessary to provide in such schools because, first, they are not standard but follow competition and innovation. It is considered the future of regular schools. However, some schools did not provide all the places mentioned previously, which gives a weak point for the school, such as the fifth case, Duranes Elementary School, because it does not have an activity room and a place for sports.

In addition, one of the most critical aspects of this thesis is the color. Most of the schools selected for analysis in this thesis used the colors mentioned above correctly and appropriately at a high rate, such as the fourth case, Barcelona Elementary School, which used blue and green in the classrooms to improve student's performance and stimulate their abilities. In addition, in the ninth case, Lakeland Elementary School, the color red was used in the external playground, which is a good point because it stimulates play and activity, and this is the goal of providing such a color outside. However, in some places, the use of color was not appropriate for children based on information collected as a literature review, such as the ninth case, which is Lakeland Elementary School, the use of white on walls in classrooms, which serves to impair academic performance and distract attention the students. Moreover, in the second case, Woodland Elementary School, yellow was used extensively in classrooms, weakening academic performance and distracting students.

Based on the foregoing in this thesis of an analysis of previous studies, books and articles in chapter two and three as well, for the ability to gather sufficient information that gives the ability to answer the main questions that were posed at the beginning with two supported questions, which are:

1. How to create a suitable environment for children that effect positively on their achievements in their learning environment?

Based on the information analysis and its application to the selected cases, verify how to access an educational environment rich in information by providing some spaces that have proven to be very important. Such as the handicrafts room, activity room, sports area, and external educational spaces (external playground). So, these spaces provide a quantity of high information for children because they serve as

educational spaces outside and are preferred for children more than classrooms. For direct connection with nature in outdoor spaces while providing realistic experiences for children in the open air. As it was mentioned in some cases selected for analysis, for the interior rooms, the importance of these places lies in the ability to develop children's physical and mental skills for the ability to develop self-confidence, which has been proven to improve children's relationship with each other by providing teamwork. This leads to getting benefits from the mental abilities of children each other.

Moreover, the sports area is one of the most critical internal elements that must be provided in the school for its ability to provide a lot of fun and entertainment for children. In addition to improving the cooperative relationship between children. Also, it allows children to skip the tasks they face, whether in the classroom or as homework. Because it has been proven that the sports area supports the student's self-confidence by skipping the tasks they direct in such spaces, it will motivate them to search for more complex tasks, such as homework or other tasks.

And the questions that support the first question;

2. Which color that children liked and effect on their concentration in their learning environment?

After agreeing on the design of the interior rooms of the school, which is the classroom as one of these rooms, it is necessary to know about the colors that must be provided within the classroom or any other rooms. Colors are divided into cold colors and warm colors. Each group has a specific effect on children and their concentration. Where concentration is one of the essential elements of capturing information and the ability to reach a good and valuable learning environment for

students. The red color is considered to affect concentration that distracts the children, even if the red color is used at the head of the paper presented to the students, such as an exam or the use of red pens. Gray and beige colors distract attention, reducing the individual's ability to remember the information given in the classes. These colors mentioned before are among the unfavorable ones for children, indicating sadness and violence as for the colors that were significantly preferred by children, which have been proven to activate the sense of concentration for children, which are cold colors in general, such as blue, which works to attract the attention of students in the classroom and works to provide the strong ability to remember information and not forget it.

3. Does the color also can be cause to affect children's academic performance?

Many colors have been studied based on the color wheel, including cold and warm ones, which have been proven to be closely related to the effect on children from several aspects, such as psychology and physiology on the academic performance of children, which is one of the most important goals of this thesis and how to improve the academic performance of children. Academic performance can be expressed as the degree to which students are evaluated in terms of understanding and participation in the activities available in the classroom. It has been proven that colors are vital in affecting children's academic performance psychologically and physiologically. Several colors have been verified. The red color, as this color, has a high ability to weaken academic performance in tests that need much knowledge because it has been proven that it distracts children even if the children participating in the test are not aware of its presence. It has been verified that white-colored walls weaken the students' academic performance, which leads to unsatisfactory grades for students through the effect by white color. Another color was verified: the green color inside the classrooms, which works to stimulate the students' speaking skills.

As a result, the green color stimulates the academic performance of children. The blue color helps support academic performance because it is associated with rest and the ability to increase the brain's work to remember information. Yellow color weakens academic performance in the space that it is present in a large quantity, sufficient to stress the eye. However, if it is provided in a small amount, its positive effect dominates here and helps concentration and support academic performance.

5.2 Recommendations

As a new guideline to provide a better learning environment, schools should pay attention to supplying the school's building with some spaces, such as a handicraft, activity room, sports area, and external playground, for its importance to improve the learning environment, as mentioned in chapter 2. Schools should provide spaces that will enhance children's skills and let them be more confident, making them useful in society. Before entering the color part, the setting arrangement should be mentioned. Schools should avoid the traditional method of spatial arrangement and look for the fixable one, such as the semi-circle arrangement, for its ability to equal the participation between children and attract their attention because the distance to the teacher will be less than other arrangements, which will lead to keeping eye contact between students and teacher. From the color point of view, some colors like blue, yellow, red, green, orange, and purple. It should provide correctly; for example, to gain an excellent academic performance, cold colors should be provided in a classroom, such as blue and green, for their abilities to attract students' attention and support their speech skills.

Furthermore, warm colors such as red and yellow in large amounts, this kind of colors can impair the attention of students, which leads to weak academic performance. Moreover, concentration should be provided for children to improve

their skills, keep their minds fresh to remember the information, and achieve better achievements. On the other hand, cold colors such as blue have an advantage here, and yellow in small amounts can also help students.

Further studies could focus on in-depth research into educational spaces that are additional but important in developing children's skills to support their mental and physical abilities. Because children are the group that is easy to influence, and the influence remains with them as the children age. Therefore, it is necessary to research more about the extent of the influence of educational spaces and the effect of colors on them because color is an essential element to be employed in scientific spaces. Since of its importance in improving the educational environment, they should also focus on the external spaces as it provides the information by fun because children learn in this way. In addition, based on this study's limitation, ten schools were selected around the world from the ArchDaily website.

Nevertheless, further study should try the field experience and interviews with children and teachers to get a real deep experience from the researcher to the thesis. It should go deeper to study the effect of color on children, specifically in learning environments, because they spend most of their time there. Also, to reach a better learning environment for them.

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