THE IMPACT OF THE CLASS ENVIRONMENT ON HIGH SCHOOL STUDENTS' LEARNING IN PUBLIC SCHOOLS IN KESERWAN, LEBANON

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by

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ABSTRACT

Public schools guarantee education that is invariably available to pupils, even to those who have financial difficulties. Being easily accessible, attending such schools has remained high until today; in 2019, US public institutions educated over 50.8 million scholars, to which the national average number of pupil per public school was about 526 scholars (Brian D. Ray, 2021). Conversely, public schools in Lebanon do not enclose such high number of students due to their unsatisfactory reputation: Most of these schools are in bad conditions, outdated, and have limited classroom resources. Also, low students performances have been attributed to the negative effect of the classroom's physical environment (UNICEF, 2018). For this, the following study examines the impact of the physical environment of a classroom on high school students enrolled in Lebanese public schools, specifically in Keserwan city enclosing 14 public schools. The key aim in this research is to gain insight into the role of the physical classroom environment, its modern interior design including purposeful furniture, seating arrangements, connected devices and the finishing.

The literature review section overviews the factors influencing the classroom's physical environment, such as teacher effectiveness, time and behavioral management. It also reveals a theoretical framework of various studies regarding the humanist, behaviorist, cognitive and constructivist theories. Lastly, the section determines the physical learning environment of a classroom by identifying the seven main design parameters: temperature, light, air quality, flexibility, ownership, complexity and color (Peter Barrett & Tigran Shmis, 2019). Data was collected through online researches (due to exceptional limitations) and an online questionnaire. Participants were high school students, enrolled in grades 10,11, and 12, as they are more familiar and aware of their surrounding and classroom's features, and would deliver eligible deliberations. The participants should have been attending their public school in Keserwan for at

least 5 years. Seventy-six students responded to the online survey. The questionnaire data suggests the majority of students perceived their classrooms negatively and lacking innovative supplies. The poor setting of the room also affects their engagement, behavior and performances. Results and implications supported the notion of a classroom's physical setting affecting students' learning. The contribution in this study proposed a conceptual (spatial) design approach of 'an optimum' classroom for a better learning experience, in the form of 3D renderings and an animation.

Keywords: *Classroom, physical environment, public schools, space design, key design parameters, student engagement.*

CHAPTER 1 INTRODUCTION

1.0 Introduction

This chapter presents the background of the study on the thesis topic, statement of the problem, the purpose of conducting this study, and research questions. The chapter also provides the study hypothesis and the significance of conducting this study. The topic "The Impact of the Class Environment on High School Students' Learning in Public Schools in Keserwan, Lebanon" was chosen based on a personal experience with teaching students enrolled in high-end private schools that offer privileges such as high-tech learning devices (tablets, computers, smart boards), a variety of activities (music, arts, sports, computer learning) and excellent classroom conditions (desks, ergonomic chairs, lockers). Known to be 'conventional', 'outdated' and have low and poor infrastructure, it was interesting and important to study the physical classroom environment of Lebanese public schools in order to intercept the reputation they hold. Thus, the analysis and research of the bad Lebanese public schools' conditions and the physical setting of the classrooms is necessary to examine. Consequently, as an interior designer, my contribution in this study aims to re-imagine the optimum classroom for students including the physical design features such as space management, purposeful furniture, lighting, colors, acoustics and ventilation, in order to have the best learning experience and a positive constructive impact on them, with a fair budget.

High school student were chosen as the scope's participants since they are more aware of their surroundings and classroom conditions. Thus, their answers are more authentic and reliable. The study takes place in the Keserwan city since it is a school catchment area and 5.9% of public schools are found in Mount Lebanon, where the latter alone encloses 14 different public schools

in good and bad condition. The study starts off by asking, "How does the public education and its physical setting affect the students?"

1.1 Background of the Study

In 2000, UNESCO outlined the significance of having universal access to education in both developed and developing countries (UNESCO, 2014). It outlined the six education for all (EFA) goals that should be achieved by 2015, and they included: expanding early childhood care and improving such education; providing free primary education; promoting life and learning skills amongst the young population; ensuring a 50% increase in the adult literacy level; achieving gender equality in education; and improving the quality of education offered (UNESCO, 2014). It was clear that UNESCO was destined in improving the quality of education offered; especially the fourth goal, which was on promoting the life and learning skills of the students. Yet, this goal has not been fully achieved amongst the Asian countries including Lebanon.

According to Wolff, Jarodzka & van den Bogert (2016), the effectiveness of the education system across the globe is based on the support that the secondary education gets from the government and other interest groups. In most of the developed countries, such as Lebanon, there is minimal support from the government and this has implied classroom management. In classroom management, Stichter et al. (2009) study note that successful instruction can influence the perception of the students towards the education system developed. Students tend to perform well where there is a positive learning environment and the classroom atmosphere is characterized by optimism. As such, it is important to develop a classroom environment in which the students are feeling secure, cared, and safe, and this is one of the key elements that can realize successful and effective instruction. From the student's perspective, it is always important

to review any possibility of having a classroom environment in which they can easily interact and socialize with one another. In ensuring effective classroom management, equipping such a classroom is important, and this can promote effective instruction dissemination. As such, the physical environment should be maintained in meeting the learning requirements of the students.

Physical environment, from a classroom perspective, is defined as the physical characteristics necessary for any classroom to be effective. It involves a combination of different aspects including chairs, tables, floor, walls, doors, windows, and boards among others (Martin, 2016). Teachers are tasked with ensuring that the physical elements within the classroom are available and they are in good condition for ease in the delivery of instructions (Martin, 2016). Where there is a favorable physical classroom environment, the performance of the students improves as this is considered a catalyst towards reporting high student's performances since it maximizes students' learning and participation (Njabulo Sithole, 2017). Most of the learning institutions appreciate the role that the physical environment plays in shaping their views on the concepts that are taught in the classrooms as it reduces the chances of students having fatigue and restlessness while being taught. In some of the successful learning institutions, the comfort of the students is necessary and this is essential in improving the quality of learning in such an institution. According to Martin (2016), the physical environment is designed in ensuring that both the teachers and students are not obstructed from learning. The same study indicates that there is a direct correlation between the physical environment and the ability of the students to grasp new knowledge and ideas (C. Kenneth Tanner, 2008).

In further expounding on the role of the physical environment towards student's learning achievement, Korpershoek, Harms, de, van & Doolaard (2016) indicate that there is a variety of details that the physical environment should possess for it to be considered effective for learning.

Some of the details include the classroom's structure, size, resource, and ventilation. Also, the colors that are used in painting the walls and floors imply the psychological perspective of the student. However, the psychological detail is not part of the aspects to be considered in this project. On the other, some of the learning institutions instill the need for language learning, and this can be made possible where the language learning area is free from noise and the students have time to actively participate in language learning. As such, it is worth noting that the learning environment is integral in determining the success of the students. Teachers should be constantly involved in guiding the students, but this can only be achieved where there is an effective physical learning environment.

In Keserwan, Lebanon, where this study is conducted, it is observed that students in high school are struggling with their academic performance despite having a qualified teacher. This study aims at linking the need for providing quality education and the improvement in the physical environment in Lebanese - Keserwan - classrooms.

1.2 Statement of the Problem

Most of the researchers have outlined the importance of the class environment in improving the satisfaction level of the teachers and students. Also, low students performances have been attributed to the negative effect of the classroom's physical environment (UNICEF, Early Childhood Development Section, 2018). Notably, high school students that are overcrowded in Lebanon tend to post poor academic results. Apart from the newly renovated schools in Beirut, most of the public high schools have limited classroom resources and this has an impact on the student's achievement in the long run. (Public Schooling in Lebanon: Difficult Conditions but the Reality Can Still Be Changed, 2016).

1.3 Purpose of the Study

The purpose of conducting this study is on determining the impact of the class environment on high school students. Specifically, this study aims at assessing the impact of the physical classroom environment on high school students learning in public schools in Keserwan, Lebanon. The study findings will be used in providing key recommendations for improving the physical classroom environment.

1.4 Research Questions

In addressing the purpose of this study, the research questions to be reviewed are:

1. What is the impact of the physical classroom environment on the high school students learning in Lebanese public schools, Keserwan, Lebanon?

2. What are the key elements of the future modern setting arrangement that create a conducive classroom environment and affect positively the learning of the high school students learning in Lebanese public schools, Keserwan, Lebanon?

1.5 Significance of the Study

The research aims at identifying, highlighting and elaborating the various problematic aspects of the physical environment of a classroom. Hence, this study is important as it aims at gaining insight into the role of the physical classroom environment, its modern interior design including connected devices, audiovisual, and purposeful furniture (chairs, tables, doors, windows, boards…), in influencing the academic performances of the high school students. As such, the teachers, parents, financiers, government, and physical planners will be knowledgeable on the best way in which the school's physical environment should be developed in maximizing the performance level of the students. Improving the physical environment of the classroom will improve high school student's learning.

1.6 Hypothesis

The study hypothesis is given as:

The null and alternative hypothesis is given as:

H_0 : There is a significant relationship between the physical classroom environment and the high school student's learning.

H_A : There is no significant relationship between the physical classroom environment and the high school student's learning.

CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

In this chapter, a critical review of the past studies conducted on the physical classroom environment is provided. The theoretical frameworks and models associated with the physical classroom and learning capabilities are assessed, and it is from this review that the gap in the study is provided. Also, the policy framework that has been undertaken in Lebanon's education sector is assessed.

2.1 Overview of Factors Influencing Classroom Physical Environment

For the students to learn in a given school environment, it is the duty of the teachers and the school's leaders to provide imperative classroom conditions that can maximize the potential for the students. As such, the classroom environment should be desirable and good condition to improve the learning capabilities of the students. The classroom environment cannot be considered to be one specific building; it involves all the physical elements that can influence the learning process of the students including chairs, tables, floor, walls, doors, windows, and boards among others. According to Korpershoek, Harms, de, van & Doolaard (2016), the classroom environment can be divided into four sub-categories – teacher effectiveness, behavioral

management, time management, and physical environment. This study will focus on the physical environment aspect.

2.1.1 Teacher Effectiveness

In the past three decades, the teacher's behavior has been studied in determining its relationship with the academic achievement of the learners (Ramli, Ahmad & Masri, 2013). According to Stichter et al. (2009), it is evident that the actions of the teachers in the classroom can positively impact the academic performances of the students and this is based on the policies that are implemented in the institution such as those on curriculum development, student assessment, community involvement, and staff collegiality. It shows that the teachers have a role to change the perception of the students and influence their success in the education sector.

According to the Stern (2015) study, the teachers had an effect on the student achievement, and it was interesting to note that such effect was long-term, and it positively affected the student's behavior in the long-run. Where the teachers are not involved in the daily activities and motivation of the students, the peer effects towards the performance levels of the students widens, and the students rely on the direction given by their peers in making academic decisions.

The effectiveness of the teacher is measured based on the experiences that they have in teaching the students. According to Stern (2015), where the teachers have demonstrated positive interaction and guidance on the students, there is the possibility that they will improve their academic performances. Teachers often understand that every classroom has weak students and this requires that the teachers must work with the available students in ensuring that are in sync with other students. The effectiveness of the teachers is measured by their capability in meeting the needs of the students and ensuring that the students are provided with the necessary support

in improving their academic success. According to Ramli, Ahmad, Taib & Masri (2014), some of

the students might be slow learners in grasping some of the information that is taught in the

classroom. As such, the experiences of the teachers in facilitating a comprehensive approach in

dealing with the experiences and challenges of the students can be necessary for realizing

positive result and improved performance levels of the students. Most of the learning private

institutions have refresher courses or on-job training for the teachers in ensuring that they

understand the key changes that should be enacted when teaching the students.

However, in Lebanese public schools, the system is outdated and teachers are not trained

enough to provide a better learning plan for the students; Education Development Center's

(EDC) Susan Ross sees the Lebanese educational system in public schools greatly undeveloped.

The latter asks, "Which comes first - fixing dilapidated schools or preparing good teachers? […]

They have to happen simultaneously." Moreover, Ross states:

> "The problems facing this Mediterranean country are daunting. Two-thirds of Lebanese students have left the system to seek opportunities in the country's many private schools. Those who do attend public schools often learn in buildings still damaged from Lebanon's long civil war, which ended in 1990. Science labs lack microscopes and classroom ceilings leak. Many schools do not even offer adequate shelter from the freezing winter temperatures that are common in parts of Lebanon."

For this, a comprehensive rehabilitation plan for these schools' systems, the ways

teachers instruct, and a rehabilitation of all spaces students use to learn should be developed.

Compared to the private schools' privileges, the quality of teaching varying extensively from

classes to others, more should be done to ensure improvement in students' learning. A strategy to

professionalize the instructing force should be planned; starting with a development plan of

instructing and teaching standards, including extensive training the teachers. Instructors' issue

area knowledge should get a boost (EDC, 2014). Ross states:

> "[…] Offering English lessons to teachers who use English as their language of instruction, and training many science specialists on how to use new lab equipment that the

project will be providing to secondary schools […] We hope that these new models of teacher training have really taken root and that the Ministry is expanding and scaling up those models."

Prioritizing the needs of the students and addressing the knowledge gap should be the basis for teachers to improve the knowledge base of the students and influence their success level in the long run.

2.1.2 Behavioral Management

The physical learning environment can imply to the stimulus-response pattern and this can influence the process of implementing positive or negative behavioral response to the students (Ramli, Ahmad & Masri, 2013)

Classroom and behavioral management are two variables that work together in improving the performance level of the students. Some of the students' exhibits inappropriate behavior and this implies the academic performances and contribution of the students in the society (Ramli, Ahmad & Masri, 2013). Teachers understand that the inappropriate behavior should not be nurtured and the students should be subjected to punishment towards discouraging such behavior in the classroom. Where the size of the classroom is manageable, it is easier for the teacher to review an individual's behavior and link such behavior to the academic performances of the students. As such, this has demonstrated the changes that are reported in the organization and the effective ways in which the management can undertake towards encouraging students to improve the performance levels. The leadership of the school should understand the needs of the students and the policies that are developed should be aligned to the key fundamental issues that can improve the quality of the offered education.

One of the theories that explain the behavioral management in the classroom is the skinner's operant conditioning (Ramli, Ahmad & Masri, 2013). In this theory, the author notes that learning is a function of an individual's behavior change. Some changes are reported in the

organization including responses to stimuli or events, and such changes should be reported when managing the behavior of the students. Skinner outlines the significance of reinforcement in ensuring that the desired response is strengthened, and this includes giving good grades, praise, and monetary rewards.

The intention of reinforcement is on ensuring that the negative stimulus is withdrawn and this is integral in realizing effectiveness when improving classroom management (Martin, 2016). In a situation where the instructional development is applied to the students, there is the possibility that the learner can learn to respond to the question asked within the shortest period. Also, there is the possibility of realizing good performances from the students, and instructors can incorporate the modern systems that can be essential in meeting the needs of the students. In realizing success in the behavioral management process, teachers should be concerned with using different interventions in accommodating the student's needs. They are supported to design and implement appropriate reward and incentive design plans that are student-focused and this will increase the reported academic performances of the students. Also, with an appropriate class layout plan, the design management helps and enhances students' classroom behavior.

2.1.3 Time Management

According to Wolff, Jarodzka & van den Bogert (2016), teachers are supposed to understand the key requirements for the students including the physical infrastructure such as chairs and tables and where there are enough chairs, the students will be satisfied and they will be comfortable. The instructional time will be reduced, as the teachers will not be required to separate the students due to inadequate chairs or tables. Completion of the syllabus in high school is important in providing the students with the opportunity to maximize the resources available and realizing improved academic performances.

Teachers have the mandate of keeping the classroom running. This implies that the teachers should create schedules for the individual students and the classroom as a whole. With the available schedules, the teachers can focus on the core subjects that the students find difficult to understand. Physical classroom environment plays a key role in enforcing the schedule developed, and where there are enough resources, it will be easier for the teachers to manage their time

2.1.4 Physical Environment Layouts

This section aims at identifying the various types of classroom spaces and layouts by illustrating the different shapes of a classroom, as well as describing the negatives and positives of each configuration.

Where pupils were once considered a homogenous group, which is arguably reflected strongly in the classroom architecture and the furniture of schools, education now seeks to treat each child as an individual and personalize their development accordingly; this, Gilbert (2006) claims, will enhance pupils' "progress, achievement and participation" (p.3).

Mark Dudek (2001) views school building design as a particularly specialized field encompassing ever changing educational theories, the subtle spatial and psychological requirements of growing scholars and practical issues that are unique to these types of building. He explores the functional requirements of individual spaces, such as classrooms, and shows how their incorporation within a single institution area are a defining characteristic of the effective educational environment. Acoustics, impact damage, the functional differentiation of spaces such as classrooms, music rooms, craft activities and gymnasium, within a single institution are all dealt with. More subtle factors such as the effects on behavior of color, light, surface texture and imagery are considered in addition to the more practical aspects of designing for comfort and

health. Hence, being a reference for how classrooms should be managed as a form and design, it is interesting to know that the space in classrooms is always limited, yet the space that is available must be utilized in such a way that a wide range of activities, which form essential elements of the National Curriculum of Education.

In his study entitled *Inside the Primary Classroom*, which was published in 1999, Galton found that the majority of classroom spaces in use were simple enclosed rectangular rooms, which were difficult to adapt. The classes were of the type generally referred to as 'box like', the key characteristics of which were self-contained rooms enclosed by walls and a door which closed them off from the rest of the school as opposed to more open plan arrangements (which can be seen in many working environments today such as contemporary offices, and many institutions of higher education). The example of a classroom arrangement in an early Victorian building was nicknamed the 'shoebox'.
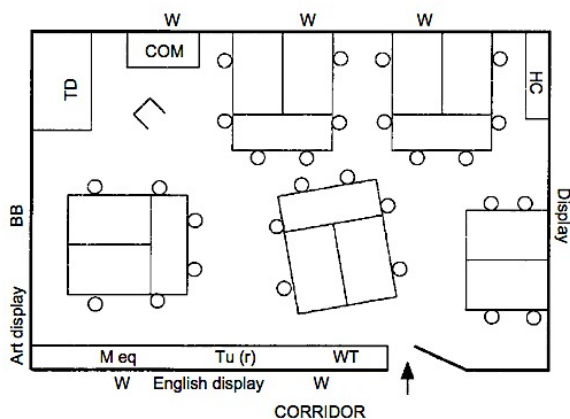
Figure 1: Shoebox Layout.

Source: Galton et al., 1999.

It illustrates even more limitations of space with severe restrictions on the scope for flexibility. Although the size of the classroom meant that it was impossible to create work bays for different activities, teachers still managed to teach - with some difficulty - all curriculum

activities in the space available. The size of the room meant that the whole class could not sit together within a dedicated "carpet space" for whole class activities. Also, it is likely that the proximity of desks would make it difficult for students to concentrate because of noise and visual disturbances within the confined classroom environment.

Another example of a classroom type illustrated by Galton is the L-shaped classroom. In this example the smaller part of the 'L' was believed to be unsuitable for teaching and was therefore used only as storage area. Hence, the remaining teaching area was rectangular and of reduced size, and the presence of fixed storage cupboards down the longer side of the room further reduced the available space for teaching.

A similar L-shaped configuration was discussed by James Dyck in more positive terms. Describing it as the 'Fat L' he illustrates a much wider variety of layouts than the traditional rectangular form allows, however, it also implies that the overall area requires significantly more space in order for it to work effectively. It has to be flexible enough to allow the continual reorganization of the whole class into various sizes and number of small learning groups. This means the space must be as free as possible of permanent obstructions.

It has to be manageable by a single teacher who has command of the entire space. This means the space must be compact and open (Dyck, 1994, p. 44). This design pattern " provides a sense of separation, an easing of the perception of crowding... As long as there are no permanent barriers, the L-shaped classroom can be reorganized to permit a wide variety of student groupings and activities" (Dyck, 1994, p. 44). This form can be integrated into other socio-physical environments.

The classroom may be understood as a behavior setting (Barker, 1968, 1969; Wicker 1979), an entity in and of itself, within the context of the school environment. This entity has

been conventionally designed in the shape of a square or a rectangle. These shapes create spaces that may be "characterized by an excess of the uniform…and the contained…. " (Kennedy & Moore, 1998). While furniture and furnishings may be rearranged, these conventional shapes limit what can occur within the layout. Desks maybe arranged in clusters so that collaborative learning activities are encouraged. Although these arrangements afford small group learning, the layout of the classroom does not provide defined areas in which activities separate from, yet part of the class, might occur simultaneously without disrupting the flow of learning between groups. In addition, depending on how the classroom is arranged, these areas may afford individual, one-to-one, and small group learning. On the contrary, the 'Fat L' classroom design facilitates:

"[…] Good separation by maximizing the distance in each leg, has a long diagonal measurement, …an interior corner to serve as a visual barrier, good visibility and ease of movement for the teacher. It also has excellent nesting qualities and can be easily grouped into pods, clusters or wings " (Dyck, 1994, p. 45).
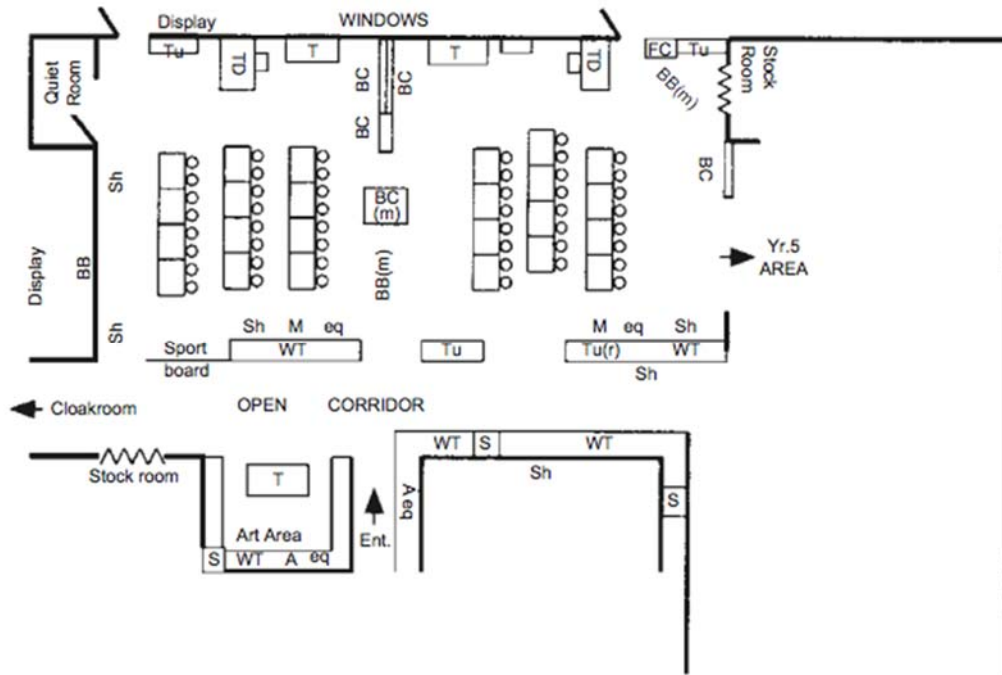
Figure 2: L-shape layout.

Source: Galton et al., 1999.
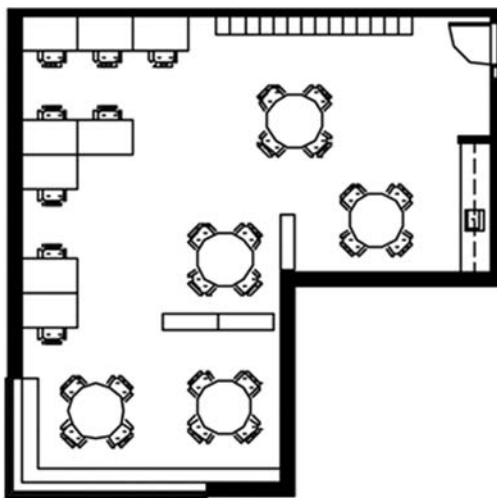
Figure 3: The fat L shaped layout.

Source: Peter Lippman, 2016.

Rearranging furniture within the framework of an existing rectangular room to create an inner rectangular row of desks has a number of social benefits. The so-called 'horseshoe' arrangement was used for many activities including class discussions and for most written work, and it also facilitated paired working arrangements. However, it should be noted that the teacher used other furniture layouts according to the demands of the curriculum, particularly when the task required was designed around small group work, when the tables needed to be rearranged in blocks. Clearly an important notion here is the ease with which furniture can be moved around and reconfigured by teachers. This U-shaped furniture arrangement is claimed to be the most effective for allowing the three main working styles – individual, group and whole class, with a minimum of modification.
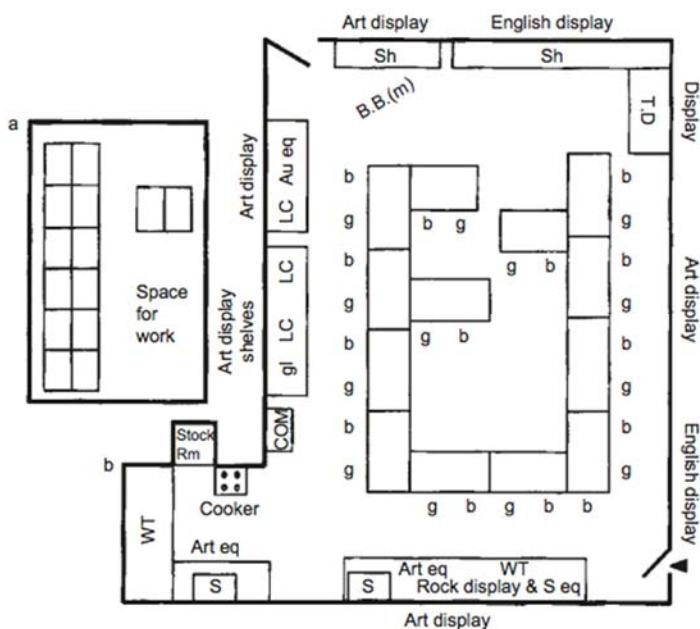
Figure 4: Horseshoe layout.

Source: Galton et al., 1999.

The other classrooms plans were part of open-plan teaching spaces referred to as 'home units'. This suggests that the U-shaped or "horseshoe" class arrangement can be an extremely

effective way of making the most of any rigid enclosed classroom environment. As Galton et al. (1999) state: "The "horseshoe" and "shoebox" layouts demonstrates the need for a high degree of flexibility in terms of his or her teaching techniques on the part of the teachers in question. They represent a considered and deliberate response to a difficult situation, overcoming the constraints on an environmentally inadequate or overly confined classroom environment" (Galton et al., 1999). Interestingly, the descriptions by Bennett et al. (1980) of the use of available space include dedicated "quiet rooms" which are defined as: "Rooms varying in size but not larger than 32 m2, having four walls and a door located within the teaching unit. Originally they were conceived to be a self contained room of less than classroom size for the purpose of small class teaching or for noisy activities such as music or TV which could be carried on without distracting pupils in the rest of the unit." (Bennett et al., 1980).
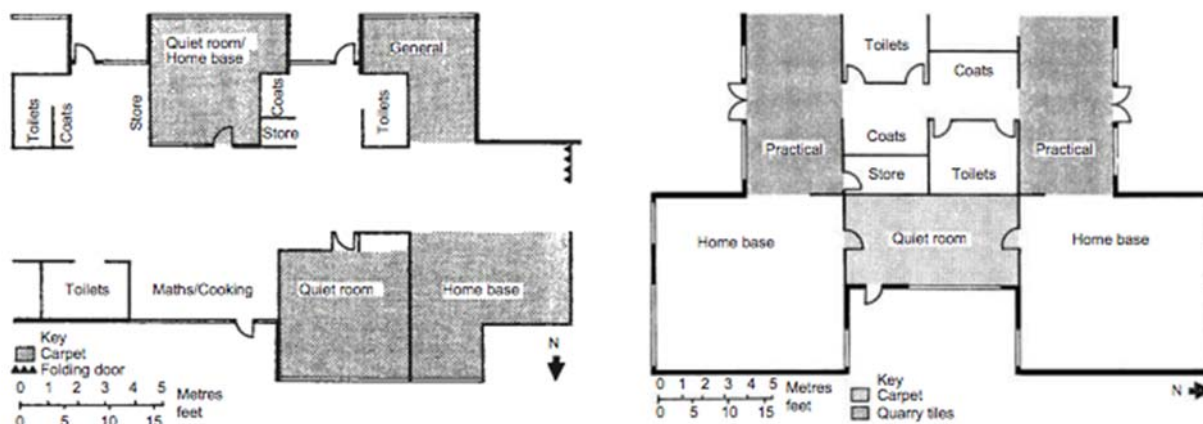
Figure 5: Typical open-plan classroom showing quiet rooms and location of practical areas.

Source: Bennett et al., 1980.

In creating an orderly classroom, the physical environment is important. The physical environment includes chairs, tables, floor, walls, doors, windows, and boards among others. When creating an effective physical environment, it involves designating the various activities to specific places, selecting appropriate furniture to be used, effectively arranging chairs, and

decorating areas that are used for specific purposes (Konstantinidou, Gregoriadis, Grammatikopoulos & Michalopoulou, 2014). The materials that are used in learning such as chalks and textbooks should be available during the learning process. For the walls and floors, it is important to decorate them effectively for the teachers and students to feel and behave in an orderly manner. Classroom furniture should comply with the standard norms of the British and European Standards for "chairs and tables for educational institutions". The following size mark guideline designates the fixed seat and desk standard height norm (in mm), best suitable for each student age group.

Size Mark 1	Size Mark 2	Size Mark 3	Size Mark 4	Size Mark 5	Size Mark 6
3-4 Years	4-5 Years	6-7 Years	8-10 Years	11-13 Years	14-18 Years
Foundation	Foundation/ KS1	KS1 & Early KS2	KS2	Early KS2 & KS3	KS4
Reception	Reception/Y1	Y1, Y2 & Y3	Y3, Y4, Y5 & Y6	Y6, Y7, Y8 & Y9	Y10 & Y11

Chair/table heights: 460mm / 260mm; 530mm / 310mm; 590mm / 350mm; 640mm / 380mm; 710mm / 430mm; 760mm / 460mm.

Colour Code

Popliteal Height Range

350-280mm	280-315mm	315-355mm	355-405mm	405-435mm	435-485mm

Stature

930-1150mm	1080-1210mm	1190-1420mm	1330-1590mm	1460-1765mm	1590-1880mm

Stature; Standing Work Height; Sitting Work Height; Popliteal Height; SIZEMARK 6 Buffet; 760 760; 460 483; 14 – Adult

Figure 6: Chair and table height guide in standard metric norm, according to pupils' age range.
Source: KI Europe, The British and European Standards, 2021.

According to the University of Kansas (KU), when it comes to the classroom furniture standards, KI Europe standard norms are the best and most suitable for students' comfort, flexibility and ergonomics. Accordingly, within a classroom, the chairs and tables should have the followings:

- The number of seats and their configuration must allow minimum 30 inches of linear task surface space (per student).

- The distance between desks at seating have to be minimum 48 inches.

- The distance between desks at the center and at the side aisles have to be minimum 36 inches.

As for the features of the desks and chairs, the desks/tables should have:

- A minimum 20 inches of deep work/task surface.

- A high pressure laminated top including t-mold edges.

- If tables include casters, they should be locking casters.

Whereas the chairs should have:

- Polypropylene backs and seats.

- No book trays, no cup holders, or any other accessories.

- Armless.

According to König & Kramer (2016), furniture within the classroom needs to be arranged in appropriate patterns to facilitate traffic and the materials used should be portable. For ease of movement between the students and the teachers, the chairs and tables should be arranged in groups. This will not only facilitate the movement of teachers across the room but also ensure that the interaction between the students and teachers is improved. For the students with disabilities, it is easier for them to move or be moved across the classroom with a minimal problem (Han, Kiatkawsin, Kim & Hong, 2018). When setting up the chairs and desks in a group pattern, it is easier for the teacher to monitor each student and interact with them in determining their knowledge on the key concepts discussed. As such, it is important to create an environment

in which movement is facilitated, as it will go a long way in reducing the possibility of an accident being reported.

According to Sanchez, Young & Jouneau-Sion (2017), having an attractive and orderly environment has a positive effect on the behavior of the students and this can improve the quality of interactions between the students and the teachers. The activities that are conducted in the classroom can be undertaken with minimal noise or less interruption, as each individual understands the different needs of the students (Irma Ghosn, 2010). Veldman, Admiraal & Mainhard (2017) study concurs with this sentiment claiming that visual learners are better placed to understand the concepts being taught when the chairs and tables are arranged in an orderly pattern. The students sitting at the back will not be disadvantaged in the classroom, and this can be instrumental in realizing positive results and improving the academic performances of the students. As such, the school management should be concerned with improving the physical environment towards improving the academic performance of the students (Irma Ghosn, 2010).

2.2 Optimal Interior Facilities and Amenities in a Classroom Setting

The physical classroom environment has been the subject of most of the prior studies with the intention of being on developing an effective physical classroom that can maximize the academic performances of the students. Akomolafe & Adesua (2016) study was conducted to determine the reason for the student's poor academic performances and wanted to link it with the physical facilities that are offered in school. In physical facilities, the study identified the main physical facilities to include classrooms, school buildings, chairs, recreational equipment, and laboratories. From the findings of this study, the authors noted that the physical facilities available in the public secondary schools were correlated to the academic performances of the students. As the study findings were only limited to the public secondary schools in South-West

Nigeria, it did not highlight some of the factors that can cause the private secondary schools, which are well-equipped to record poor performances. In support of these sentiments, Veldman, Admiraal & Mainhard (2017) opined that importance of most of the learning institutions should be on the provision of physical facilities as this will play an integral role in teaching and learning of the students. The school system should support the purchase of physical facilities that meets the requirements of the students including the number of students that are enrolled in the learning institution.

Furthermore, Veldman, Admiraal & Mainhard (2017) study notes that teachers can perform well where they are provided with the necessary facilities and amenities. It is worth noting that with student satisfaction in the physical classroom environment, there is the possibility of reporting high-performance levels. The arrangement of the chairs and tables within the classroom should be student-centered. This pedagogical approach provided by Tom Perks, Doug Orr & Elham Al-Omari (2016) study has created diverse opinions on the efficacy of the process in realizing the success level in the organization. The current traditional classroom has implicit limitations as they are designed to offer a traditional model of learning, but different scholars have now pointed out on the connection between the classrooms design and the teacher's and student's experiences of learning.

2.2.1 Classroom Design

Although Akomolafe & Adesua (2016) pointed out on the importance of physical facilities in the classroom, Tom Perks, Doug Orr & Elham Al-Omari (2016) was more concerned with understanding the views of the students regarding the classroom design, and re-designing it in an attempt to meet with their specifications. There is a necessity of most of the schools to shift from the traditional classroom design arrangement to the student-centered approach. The spaces

between the chairs and the rows should be well-designed in facilitating the movement of teachers within the classroom, and this ensures that the student's performances can be easily monitored and proper mechanisms implemented in ensuring that they are at par with the pace of teaching provided. The setting of the classroom ensures that the teachers can understand the different needs of the students including those that are fast and slow learners.

Similar studies have been conducted in determining the role of physical facilities such as chairs, chalkboard, and other classroom furniture in improving the learning process of the students. Thomas (2013) pointed out that changing the metacognitive orientation of the classroom environment could have positive implications on the performance of the students. In using the classroom design of the chairs and tables that meets the interests of the students, the teachers can easily move around the classroom and ensure that they assess the understanding capabilities of the students on the subject being taught. The success of most of the students has been based on their close interaction with the teachers, and this can be made possible where the learning environment is re-arranged to facilitate ease of movement amongst the teachers and students. Skiba, Ormiston, Martinez & Cummings (2016) supports Thomas (2013) sentiments highlighting the classroom redesign, from the traditional to student-centered, is essential in understanding the behavior of the students and managing the classroom towards realizing the improved academic performance. As such, it shows that the classroom design has an implication on the cognitive development of the students. In the modern learning institutions, teachers tend to link the behavior including the discipline of the students, with the performances level. Hence, having a classroom design that facilitates the movement of teachers can increase the effectiveness of the teaching process and improve academic performances.

In further expounding on the role of classroom design, Ahmad, Shaharim & Abdullah (2017) study indicates that the student-teacher interaction can be facilitated where the students are comfortable in the classroom. The comfort of the students is measured by the availability of sufficient chairs, tables, and chalkboards (UNICEF, 2016; John Lawrence Tety, 2016). The distance between the students and the front of the classroom should be determined and this should be aligned with the interest of the students being comfortable in the way they undertake their learning. According to Ahmad, Shaharim & Abdullah (2017), peaceful and comfortable learning environment ensures that the teaching and learning process is made possible. Such an environment facilitates the interaction of students and teachers, and this is instrumental in triggering the thinking of the students and refraining them from just memorizing knowledge and facts. The Ahmad, Shaharim & Abdullah (2017) study supports the role of physical facilities including the class size, shape, interior light, seating arrangements, colors used, and thermal conditions in determining the success of the individuals in the learning process. Students' interaction and comfort in movement within the classroom can only be achieved where the seating arrangements are effective and it is based on specific rows and columns. In supporting the role of interior light in influencing the teaching and learning process of the students, Martin (2016) study notes that the furniture and the seating arrangement developed should be aligned to the needs of the students, and this can be integral in realizing commitment of the students to education.

Rands & Gansemer-Topf (2017) study notes that classroom design can facilitate student engagement, which is essential in improving the learning process of the students. Also, Han, Kiatkawsin, Kim & Hong (2018) study was of similar opinion highlighting the significance of classroom design and furniture arrangement in improving the quality of education that is offered

to the students. Where there is limited space, it constrains the engagement of the students and this can have an impact on the perceived implementation of philosophies that can improve the learning behavior. The study highlighted the significance of open learning spaces, writing surfaces, and flexible seating as a way of improving social interaction and ensuring that the students create a synergy in which they can motivate each other and share ideas. As such, with the effective arrangement of the physical facilities in the classroom, the teachers can create an environment that epitomizes a small classroom community. The students can easily interact with one another and they will help each other in working towards realizing optimal academic performances. With this in place, the teachers can teach the students in a holistic environment and this can easily promote student engagement and realize positive behavior in the long run.

2.2.2 Constructing a Classroom Space

Classroom spaces play a critical role in positively influencing the academic performances of the students. Barrett, Davies, Zhang & Barrett (2017) study provided the link between the holistic nature of the classrooms and the student's performance levels. The study mainly highlighted the role of classroom spaces in improving the learning process with authors utilizing the 'naturalness' principle – a principle that relates to environmental parameters (light, temperature, sound, and air quality) that are essential for the physical comfort (Peter Barrett & al., 2015) – as a way of maximizing the contribution of the students towards optimum academic performance. UK classroom buildings have creating minimum standards that should be followed during the construction process including the natural lighting levels and the learning temperatures. However, this is not the case with the developing countries' situation where the scholars are not provided with the necessary resources that can improve the quality of learning and teaching. It is worth noting that the concentration levels of the students should be

maximized, and this includes being provided with a comfortable learning environment. The 'comfort' requirements for the students should be met through the 'naturalness' principle, as this will foster a commitment to the students. As such, the study findings are linked to the Ahmad, Shaharim & Abdullah (2017) study findings, which outline on the significance of having a student-centered approach when constructing classrooms and purchasing furniture to be used in the classrooms.

Gilavand & Hosseinpour (2016) study investigated the role of classroom space in influencing the academic performances of the students. One of the key factors that influence the academic success of the student is on the availability of educational space. The classroom's physical space should not be congested as this creates a boring and dull environment, which can have an implication on the quality of education offered to the students. Most of the students appreciate a learning environment in which they can find space for extra-curricular activities. As provided by Konstantinidou, Gregoriadis, Grammatikopoulos & Michalopoulou (2014), school architecture can be influential in achieving the internal efficiencies of the students and this can be integral in improving the academic performances of the institution. With this in place, the classroom space that is available to the students should be effective in providing them with the opportunity of interacting and discussing issues that affect their academic performances. Teachers should foster interactivity with the students in a classroom that is spacious and having chairs and desks that are arranged in the correct pattern. Students show strong motivation and the desire to commit towards realizing exposure to the academic activities where there is enough space for students to interact with one another.

In further explaining the importance of the classroom's physical spaces, Gallagher (2017) study highlights the importance of physical space in enhancing the student's creativity. The

flexibility in which the physical classroom arrangement is undertaken ensures that the students are comfortable, and they can interact with one another towards fostering a high level of creativity and innovation in the learning institution. Where the students are struggling to move from one place to another due to the poor state of the furniture available in the learning institution, they will not be in the right mind in understanding new concepts and new ideas that can make them be creative. In most of the high-performing learning institutions, the issue of creativity and innovativeness of the student is prioritized as this ensures that the exchange of ideas is encouraged towards realizing success in the organization. Teacher-student interaction is made possible where there are efficient physical facilities, and the teachers can easily provide the students with direction on the ways in which they can capitalize on the available opportunities in the learning institution. Gallagher (2017) supports the previous study conducted by Korpershoek, Harms, de, van & Doolaard (2016), which indicates that the physical facilities available in the learning institution improve the emotional and behavioral outcomes of the students.

Granito & Santana (2016) study further assesses the impact of physical facilities and classroom spaces in impacting the psychological wellbeing of both the students and the teachers. In most of the situations, where a student is taught in a crowded classroom with no ventilation, there is the possibility that the level of concentration will significantly be reduced. Granito & Santana (2016) study highlighted the flexibility that is associated with the classrooms having sufficient physical space and physical facilities such as desks and chairs. Also, the pedagogical blueprint that is utilized in this study articulates a student-centered approach when purchasing the physical facilities that can be used in the classroom. The physical classroom space outlines the significance of environmental conditions that should be followed when constructing the classrooms in maximizing on the instructional methods and techniques to be used by the

teachers. This shows that the author has placed interest in the classroom physical environment in determining the success level of the students, but consideration should be directed to other external factors that can affect the academic performance levels.

2.2.3 The Effect of Limited Natural Lighting in Classrooms

Students tend to appreciate an environment in which there is sufficient natural lighting as they can read and write without straining. Gilavand, Gilavand & Gilavand (2016) study investigated the relationship between lighting and the performance of the students in the learning institutions. The study findings showed that the learning environment drastically affects the academic performances of the students where the physical space has limited lights. It is worth noting that the modern learning institutions appreciate the importance of emotional support to the students and this includes providing them with an environment that is characterized by enough lighting, noise is minimized, the temperature is appropriate, and the coloring of the educational spaces is attractive. The findings of this study were supported by Han, Moon & Lee (2019) study who appreciated the role of classroom lighting in influencing the attitude of the students towards the learning materials. Where the students find it difficult to read the materials given, they tend to demonstrate a negative attitude to the teachers, and this has an implication on the disciplinary issues of such a student. Where the attitude of the students is positive, there will be minimal disturbances in the way the learning institutions are managed, and this makes it easier for the teachers to manage their students. Proper development of the classroom lighting positively influences the attitude of the students towards studies, and this is the recipe for high academic performances amongst the students.

Shaari & Ahmad (2016) study highlighted the significance of the physical learning environment in influencing the readiness of the students in undertaking other community

activities. The study findings showed that the physical environment in Malaysia and other developing economies have always been overlooked with the focus being on discussing the availability of teachers and the cost of tuitions. However, little interest has been directed on the spatial arrangement of the physical facilities and furniture used as this has long-lasting effects on the emotional and academic performances of the students. Shaari & Ahmad (2016) study claims that the poor facilities available in the learning institution has an impact on the quality of the learning offered and this can affect the education of the students and the teachers will be less motivated.

2.2.4 Flexible Sitting Arrangement Changing From a Subject to Another

Physical facilities such as chairs and desks within the classroom should be considered important when teaching students. There are certain subjects that require the sitting arrangement to be changed, and the flexibility in conducting these changes should be integral in realizing quality education and ease in changing from one subject to the other. Garwood & Vernon-Feagans (2017) study indicates that the physical environment should be observed before the implementation of key policies that can regulate the activities of the students. The study appreciates the role that the sitting arrangement plays in facilitating the movement of teachers, which is critical in understanding the weaknesses and strengths of the students towards laying a foundation in supporting them. In support of the flexibility of sitting arrangement, Rands & Gansemer-Topf (2017) study points out on the significance of having a clear framework that can be utilized in increasing the credibility of the operations and realizing success level in the long run. As such, it is integral to implement the activities that can encourage the students to move from one place to another, and this is essential in achieving the academic success of the students (Irma Ghosn, 2010). Flexibility in the sitting arrangement involves providing the students with

enough physical space for them to interact with one another, and this is the basis for improving the academic performances of the students in the long run. With this in place, focusing extensively on the size of the classroom and the number of desks and chairs to be purchased can be essential in improving the flexibility in the sitting arrangement.

Consequently, Kuo, Browning, Browning & Penner (2018) study appreciate the role of sitting arrangement developed in fostering classroom engagement. Most of the learning institutions review the available classrooms, physical facilities available, and the outdoor environment in determining the number of students to be admitted. It is always wise to understand that some of the classrooms are small, and they cannot accommodate the recommended number of students per classrooms. Fitting the chairs and desks to such classrooms can create congestions, and this can prevent the movement of teachers and students from one place to another. In a situation where there is a need for movement of students from one classroom to the other, it creates a chaotic scene as students are overcrowded and the infrastructure makes the space to be smaller. As such, Kuo, Browning, Browning & Penner (2018) study contends that the academic success of the students can be realized where the students can easily access different services offered, and this is integral in realizing the commitment of the students in delivering quality services. As such, it shows that having a flexible sitting arrangement can be facilitated by the classroom size, quality of infrastructure used, number of students, and the number of chairs and desks used. Notably, it is the task of the school management to understand the changes that should be enacted in the learning environment as this is integral in realizing the desired academic success within the institution. A flexible sitting arrangement that can alternate depending on the course that is being taught, improves the

social interaction between teachers and students, and facilitate student engagement; hence, developing their communication and interpersonal skills.

In addition, Nabiryo & Sekiziyivu (2019) study highlighted the role that the sitting arrangement within the classroom can have in improving the writing skills of the student. With the focus of the study being on a developing country, Uganda, the findings were relevant in generalizing the situation that is faced in Uganda and other developing economies. As such, this study was important in shading light on the challenges that are faced in Lebanon. From the findings of this study, the student's engagement with each other improved their English language writing skills. For the student engagement to be realized, the study noted that the physical facilities and the sitting arrangement are integral in disseminating such information to the students. Flexibility in the arrangement of chairs and desks within the learning institution meant that the teachers formed group discussion where the slow-learners were integrated into groups with fast-learners. It was easier to improve their writing skills as they interacted with one another. Also, it provided the teacher with the opportunity of reviewing the challenges that the students faced and implementing measures that can improve the contribution of such students in writing the English language. With this in place, having a reliable and effective sitting arrangement can be influential in realizing credibility of the activities of the students, and this is vital in maximizing the capability and skills of the students in the long-run. As such, most of the students tend to appreciate having flexible sitting arrangement when required to work in pairs or as a group, as this ensures that they can communicate easily with other students and improving their knowledge and skills.

In explaining on the importance of flexible sitting arrangement on classroom engagement, David, Erik & Suparna (2017) study provided high school students are always interested in an

environment in which they can share ideas while not straining. In most of the developed and developing economies, the availability of infrastructure to meet the needs of all the students is a major problem. As evident in David, Erik & Suparna (2017) study, quality student engagement is facilitated with the availability of resources, and this is important when sharing ideas that can improve their skills and knowledge. Although there are antecedent factors that can affect the academic performance of the students, the physical learning environment contributes extensively to these issues affecting the students. For instance, where there is no proper building for the students, there are chances that the bad weather condition such as rain and high temperatures can affect the learning process.

Hence, overall, the following examples demonstrate how a quality learning and equitable physical educational environment can promote skills development in students:

• The layout of the space offers the possibility of sitting in a group, organizing larger round tables and having peaceful discussions (example, comfortable seats for pupils and adults, spaces inside and outside).

• The institution has different communication and information systems for pupils and adults (example, notice board, arrival and departure system, mailbox…).

• Linguistic and cultural diversity is reflected in the equipment (example, books written in different languages and scripts, dictionaries…).

• Diverse linguistic tools allow students to do their homework independently (example, dictionaries, vocabulary lists, learning posters, Internet access).

• A carefully sorted supply of books motivates them to independently use books of various genres or written in different languages. A media library present in class can develop a child's interest to learn.

• The equipment and layout of the spaces encourage them to read and write (example, letters and numbers in the group room, access to a computer and printer).

• Special spaces stimulate the fun and creative use of language, writing and the media (example, printing, post office, writing, photo studio).

• Students can use different digital media, if necessary with the help of competent people, according to their own wishes (example, camera, video camera, computer, recorder) (Cadre de reference national, sur l'education non formelle des enfants et des jeunes, 2018).

2.3 Theoretical Framework

In this section, theoretical models are determined that are linked with the physical classroom environment. There are different theories that are analyzed including the humanist theory, behaviorist theory, cognitive theory, constructivist theory, and multi-disciplinary approach. According to Skiba, Ormiston, Martinez & Cummings (2016), it is difficult for the school planners to effectively develop a learning environment that is perfect for all the students. The learning environment is designed to support a given theoretical framework, which is essential in explaining the education processes.

2.3.1 The Humanist Theory

The theory was developed in 1960 and it outlined the role of education in ensuring that there is development in emotional, cognitive intelligence, and psychomotor. Alexander (2002) indicated that the key assumption for this theory is that the action of the individuals is based on the values prevailing in society. However, this assumption is in contrasts with the aspect of operant conditioning that is advocated in the behaviorist theory where individual's behavior is shaped by the consequences of discovering new knowledge and constructing meaning from a given phenomenon. The humanist believes that the behavioral tenets of the individuals are some

of the elements to be studied, as the focus should be on all human beings rather than their specific behavioral traits.

The main proponents of this theory include Abraham Maslow and Carl Rodgers where they appreciated the role of this theory in explaining self-actualization development process and the autonomous people (Skiba, Ormiston, Martinez & Cummings, 2016). In this study, the humanist theory recognizes the importance that should be placed on personalized spaces in helping the students to appreciate their uniqueness towards expressing their talents (Skiba, Ormiston, Martinez & Cummings, 2016). Where there is enough personalized space, the attention that is given to the students increases and it is easier for the teachers to evaluate the co-curriculum performances of the students. This theory emphasizes on the need of adding value to some of the important aspects in ensuring that ethos within the school environment is reflected in the academic performances of the students (Stichter et al., 2009).

2.3.2 The Behaviorist Theory

The behaviorist theory was developed in the late 19th century, and it proposed that the development of an individual starts at a tender age (Butterfield & Nelson, 1989). Behavioral development of the baby is not always appropriate as there can be positive reinforcement, and this is influential in conducting the transfer of knowledge to various individuals. Behaviorism is based on the stimuli response principle and this can be explained using the external stimuli where the environmental conditions can determine the behavior that is developed by the individuals – be it appropriate or inappropriate behavior (Han, Moon & Lee, 2019). Based on this theory, the teacher has the ultimate responsibility of transferring knowledge to the students.

The proponent of behavioral theory is Pavlov which his work outlined an assessment of paradigm learning and linking it to classical conditioning within the environment (Hanna, Bemak

& Giordano, 1996). This theory assumes that the learner is passive and he or she has a clean slate of mind, where the teacher can shape the behavior by offering reinforcement on the students. Depending on the environment and the availability of the resources, there can either be negative or positive behavioral reinforcement. Reinforcements ensure that the behavior persists; positive reinforcement results to the reinforcement of positive behavior while negative reinforcement causes inappropriate behavior. In controlling such inappropriate behavior, the theory supports the use of punishments in the learning institutions. Teachers are tasked with reviewing the behavior of the students and determining the reinforcement and punishment that should be implemented to such student (Hanna, Bemak & Giordano, 1996).

Based on the behavioral school of thought, the learning environment is teacher-focused with clear structures that enhance the growth and development of the student's behavior. Teachers are required to nurture appropriate behavior of the students by using a reward system that encourages them to continue with appropriate behavior or punishment (Oldfield, Humphrey & Hebron, 2017). These techniques have been known to be successful in promoting learning. Most of the teachers and the school administrators appreciate the seclusion of the school environment and having fenced-in classroom wings ensure that the behavior of the students is monitored towards improving their performances. In this theory, the emphasis is on the role of the internal environment in shaping the behavior of the students, and the open buildings tend to prevent the realization of positive behavior in the classroom. In nurturing a positive environment, it is important to always have a system in which it prevents the external environment from affecting the student's learning process, and this can be done by fencing the school environment.

2.3.3 The Cognitive Theory

The cognitive theory was developed in the mid-20th century following the discovery by the researchers that the behavioral theory did not provide sufficient information on the learning behavior of students (Cobb & Bowers, 1999). This theory stipulates that an individual's mental process plays a critical role in explaining the learning process of the students. The mind is an important organ in the learning process and this should be understood before developing a framework that addresses or nurtures the behavior of the students. The theory focuses on the mental activities of the individuals and it considers the brain to be the 'black box' which when opened it is a valuable tool in understanding the learning capabilities of the individuals. Issues such as thinking capacity, the commitment of memory, and problem-solving initiatives are explored when the mind is triggered. As such, the cognitive theory focuses on mental processes when students are learning new concepts in the classrooms.

According to Cobb & Bowers (1999), knowledge is symbolic constructions of mental activities or a schema, and learning is where the person's schema changes. Their assumption made is that the mental processes are affected by both the internal and external environment, and in gaining knowledge, it is important to review the characteristics of the environment and shape them in improving the learning process. Cognitive development theory supports the idea that people within the community are not programmed to suit the environmental stimuli rather they are required to actively participate in learning new actions and addressing the consequences of such actions (Carter, 2018). The changes that are reported on an individual's behavior are merely observed, and this demonstrates that an individual mind has changed.

This theory provides that the learning environment should be aligned to the needs of the students, and it should be involved in positively influencing the behavior of the individuals

(Carter, 2018). The environment provides an opportunity for inquiry on the best way in which knowledge can be disseminated to the learners and improve their cognitive development and capabilities. Some of the issues that this theory advocates are on the school layouts, the structure of the classroom, size, and walkways that connect the buildings (Carter, 2018). The classrooms are developed based on the grades of the student, and it is important to build each grade level's classrooms per floor as this will encourage the cognitive development of the students. The cognitive theory supports the role of teachers in changing or shaping the mindset of the students. For the students to report improved academic performances, it is the task of the teachers to link the internal and external environment with the classroom needs of the students.

2.3.4 The Constructivist Theory

The constructivist theory was developed in the late 20th century, and it provides that students are involved in an active learning process. The idea behind this theory is that the students are constantly involved in critical thinking of a phenomenon, and they are interested in learning new knowledge that they can apply in their daily activities (Stichter et al., 2009). This theory is against the idea that the mind of an individual is a blank slate rather it supports the notion that the brain is involved in constructing knowledge in gaining new ideas. The subjective nature of mind is evident where new ideas and information gained is based on previous knowledge. This theory assumes that the personal experiences are integral in shaping and constructing knowledge and the learners do not entirely rely on the instructional knowledge gained. Learners are involved in continuous learning of new ideas by social negotiation and testing hypothesis presented in the prior knowledge gained (Stichter et al., 2009). As such, it encourages creative and critical thinking as each individual has a different perspective of an idea based on the personal experiences that they have reported.

Unlike the cognitive theory, for the constructivist theory, the responsibility of transferring knowledge is on the students, and they are tasked with reviewing the different options available in the dissemination of knowledge (Korpershoek, Harms, de, van & Doolaard, 2016). As such, the learning environment and the structure of the classrooms should be aligned to a student-centred perspective (Marlies Baeten & al., 2010). Students are encouraged to research some of the theoretical perspectives that were developed in the classrooms. Students are given projects in which the students can conduct research activities on them, and this can be influential in realizing new knowledge amongst the students.

However, this theory provides that the learning environment in which such activities are being conducted should always be secure, safe, challenging, and comfortable. The classroom setting provides the students with learning opportunities and this includes providing comfortable hallways, outdoors, and libraries among others and this can be instrumental in realizing knowledge on new ideas (Oldfield, Humphrey & Hebron, 2017).

2.3.5 The Multi-disciplinary Approach

For the multi-disciplinary approach, it cuts across different disciplines including education, environment, and architecture, which is essential in understanding the significance placed on the physical classroom environment (Korpershoek, Harms, de, van & Doolaard, 2016). In the multi-disciplinary approach, the psychological and social theories that are developed demonstrate the relationship existing between the classroom physical environment and the student's academic performance. There is always an interplay between the building condition that is developed for the classrooms and the cognitive knowledge gained. The building structures and classroom layout should provide an understanding of the technical facets and capabilities that can be influential in shaping the knowledge base of the students. Most of the students appreciate

a learning environment that nurtures their cognitive, emotional, and social activities of the individuals, and this is integral in realizing the academic success of the students in the long run.

According to Graham, Fishman, Reid & Hebert (2016), there are distinct differences between the building conditions and the structural development of the classrooms. There were major policies that were enacted in addressing the attitude of the parents of the students to the building condition with most of the parents interested in buildings that were of high quality and well-structured. From the study conducted by Oldfield, Humphrey & Hebron (2017), the custodial staff noted that the structural variability of the buildings is linked to the success of the students and development of high-quality and structured buildings towards meeting the condition of the building. The study further explains that the initial perception and attitudes of the parents and the students towards the building developed have an implication on the overall performance levels and the student behavior in the long run. As such, this theory advocates for the need for ensuring that the condition of the building is linked to the behavior of the students.

Stern (2015) provided a review of Cash's theoretical model on the role that the building's structure has on the quality of education offered. From the model provided, the building condition is affected by the structural items (that are based on the financial ability of the school and the custodial staff), and the cosmetic items (that are linked to the leadership of the organization and the maintenance staff). The importance is always placed on the image that is created from the development of such buildings and the parent attitude and faculty's attitude on the building condition can affect student behavior. Some of the faculty members might not be interested in working in such building condition and they might be often absent from classrooms, and this can shape the behavior of the students, which in turn can affect the student achievement

process. As such, it shows that all the stakeholders in the learning institution play an integral role in improving the quality of education and shaping the behavior of the students.

In understanding the role of technology in improving the interaction process of the students, Garwood & Vernon-Feagans (2017) study outlines the significance of instructional technology in the learning process. With the use of instructional technology, it makes it possible for the teacher to organize the classroom in a conducive manner towards realizing improved academic performances of the students. For the instructional technology classes, the spaces available are used in learning as compared to teaching, and this improves the quality of education that is offered towards maximizing the effectiveness of the process. Numerous reasons can be attributed to learning dissatisfaction when integrating technology, and this includes a lack of proper training on the use of such technologies for disseminating instructional and learning materials.

In conclusion, the theoretical framework offers an insight into the issues that affect the learning process. It is important to design classrooms to ensure that they are equipped with modern technologies towards improving the learning process of the students. The next section provides a detailed assessment of Lebanese educational sector.

2.4 Lebanese Educational Sector

In this section, the description of Lebanese education sector is provided. There are opportunities and challenges that the individuals face, and this provides an opportunity for implementation of modern classroom architecture settings.

According to the Global Information Technology Report (2014), Lebanon is ranked 13th out of 148 worldwide in the quality of the educational system (Sami Nader, 2014), owing it to its very high standards. Lebanon is widely known as "the school of the Middle East" for its high

private educational system (World Economic Forum, 2015; Sami Nader, 2014). There are two types of schools: public and private ones. The public educational sector needs deep structural reform (BLOMINVEST BANK, 2016; Lebanese BLOM Bank, 2014) especially after the civil war. Its tuition fees do not cost more than $90/year. However, there is a big gap between public and private schools/universities in Lebanon. Private education is widely known for its high level and quality; however, it is very expensive. The tuition fees' average is approximately $6000/year. Despite cost, Lebanese families choose private education over public schools. The public education is less than 7.1% of public expenditures, which is below what developed countries and neighboring countries spend (Khaddaj, 2010).

Education is compulsory until the end of the intermediate cycle, is available to all Lebanese students, and is attended by nearly 95 percent of school-age pupils. However, compulsory education has not been fully implemented by Lebanese authorities, especially in urban slums and remote rural areas. Low cost government schools are available to all but are of generally low quality compared to private schools. Therefore, those who can afford to pay the cost of sending their kids to private schools would do so and end up paying for their primary as well as their secondary schooling because of the high quality education they receive. There are limited slots in international schools in Lebanon and most of the time, students are accepted based on their nationality. Private schools also have higher school fees compared to local ones. With smaller class size, top-tier facilities, private schools are better options for students coming from middle class and upper class. As well as the fact there are 1400 private schools in Lebanon, where around 70% of the students are enrolled in them (Edarabia, Schools in Lebanon, 2019).

The Greater Beirut area has the highest concentration of all schools and universities. The large population concentration in and around Beirut accounts for its schools' high enrollments.

The Lebanese government provides facilities for public schools, but these facilities are poorly equipped in general. Few of them have libraries, laboratories, and playgrounds. Private school facilities are mostly better equipped than public school buildings (Global Education Reference, Lebanon – Educational System). Thus, the implementation of new ideas and methods has been hampered by the lack of adequate educational facilities and well-trained professionals in regards to public educational institutions.

However, private fee-charging schools practice more progressive and advanced methods of instruction, which are geared towards the increasing involvement of students in the instructional process. These interactive methods made some private fee-charging schools more famous in the Middle East region and attracted many students. Since of their quality education and high tuition fees, these private schools attracted students from the richest families, while poor families, who cannot afford to pay tuition fees for their children's education, have been somewhat satisfied, but not happy, to send them to either public or private tuition-free schools, which are usually subsidized by the government. Private schools are mostly sectarian and controlled by different religious denominations. Other types of private schools, such as the secular ones, are owned by individuals or ran by associations or committees (Global Education Reference, Lebanon – Educational System).

Given Lebanon's political issues and the great downfall of its economy, notably nowadays, the methodological process is about studying and conducting qualitative and quantitative data on classrooms of Lebanese public schools, having outdated educational systems and negative class environment.

CHAPTER 3 METHODOLOGY

3.0 Introduction

In this chapter, the methodology of the study is provided in which research design, general characteristics of the study population, and location or setting in which the study will take place are provided. Also, this chapter outlines the sampling design and procedures, data collection schedule, definition of important term and concepts, and data analysis procedures.

3.1 Research Design

The research design utilized is the *ex post facto* design. The *ex post facto* design was considered to be appropriate as it outlined the cause-effect relationship of the variables and is used for studying environmental effects (Saunders et al., 2007), and in this study, it describes the relationship between the physical classroom environment and the students learning. Both the qualitative and quantitative data collection will be utilized.

In order to address the main research question and discern the extent to which Lebanese public schools can generally be seen as 'outdated institutions with poor infrastructure' (dilapidated classrooms, damaged tiles and ceilings, lack of facilities and amenities, mouldy walls and broken furniture); and the secondary research question which examines a classroom's physical environment affecting the student's learning, I employed a quantitative method approach by making use of an online questionnaire and analyzed survey. I administered an online survey to a sample of high school students of grade 10, 11 and 12, enrolled in Lebanese public schools, Kerserwan, Mount Lebanon, to gain detailed insight about their views of their school's classroom and its physical elements, and the ways through which these views were formed.

3.2 General Characteristics of the Study Population

The study population is the high school students enrolled in Lebanese public schools in Keserwan, Mount Lebanon. The performance levels of the students in public high school in the region have been dwindling and this has created an impression that the teachers are not offering quality services when teaching the students. When compared to their counterparts in private schools, it shows that there has been a major disparity in the academic performances of such students (Bankmed, 2015). There are about two-thirds of the public schools of the total Lebanon high school institutions. This shows that it is important to review the factors that affect the academic performance of the students towards improving the skills and knowledge gained by the future generation. According to Kvale (1996), the small sample size is often used when conducting a study where detailed understanding is required, and this is relevant to the current study. In accordance to what has been said, the study population of this research focuses on high school student respondents in grade 10, 11 and 12, enrolled in a Lebanese public school that is located in Keserwan, Mount Lebanon.

3.3 Location and Setting

The researcher limited and narrowed the population scope in Lebanon to that of Mount Lebanon, Keserwan, for practical motives and the fact that 5.9% of public schools are found in Mount Lebanon (excluding the suburbs) (CERD, 2017). This study will be conducted in Keserwan city since it encloses alone a number of 14 accessible Lebanese public schools (sectarian and secular), as well as being a school catchment area (Central Administration of Statistics, Education in Lebanon, 2020). There are numerous public high schools in the region, and this will be critical in collecting the data on the aim of this study. The intention is to generalize the findings of this study to other regions across the globe as the setting is suitable for

such generalization due to the conditions prevailing in the region (Burchett, Mayhew, Lavis & Dobrow, 2013).

3.4 Sampling Design and Recruitment Process

The parameters to be studied and analyzed include the physical classroom environment, modern interior elements (connected devices, audiovisual, and purposeful furniture), and Lebanese high school students. Judgmental sampling design is proposed for this study (Collis and Hussey, 2003), which ensures that the participants that are targeted are high school students and teachers. This sampling designed was utilized due to the nature of the population being targeted and the available time for conducting the study. 70% of the sampled population, which are the high school students (grades 10,11,12) enrolled in public schools of Kerserwan, will be provided with an online questionnaire to fill in and hence, attain data and general insights

Since Lebanon's literacy's rate is 93.9% and ranks in the 10th place globally for best quality of education (World Economic Forum, 2021), the following country meets 1508 private and public schools, having a total of 43.4% of them public schools (The Education Landscape in Lebanon, 2018) distributed in 5 provinces. As such, the researcher identified students participants as high school students enrolled only in the Lebanese public schools, who have experienced and been exposed to the low and poor cost government educational institutions that are generally, and mostly, of low quality and poor infrastructure compared to the private sectors (Public Schooling in Lebanon, 2017). Therefore, as a leading step towards gaining quantitative data, a questionnaire was conducted recruiting a sample of qualified and eligible students participants.

A convenience-sampling framework was relied upon in order to complete data collection. Consequently, I limited my study to high-school-aged scholars of grade 10,11 and 12, and chose the Mount Lebanon public schools through which I have recruited the student participants. I

initially planned to visit about 10 to13 public schools in Keserwan, and collect approximately over 100-150 surveys distributed to each student of class 10, 11 and 12, over the duration of one semester (3 months). Then, I would assess the credibility and eligibility of the participants and select 5 to 7 respondents (including teachers or school principals) to interview. The interviewees should have been enrolled in their schools for more than 5 years to be familiar and aware of their school and classroom's features, in order to offer an insightful deliberation and deliver reliable (qualitative) data. Participants were required to know and have a general understanding about my research topic in order to discuss it at ease and responsiveness.

With the global outbreak of the Covid-19 virus, a total lockdown occurred in the country and all educational institutions closed for the upcoming months. Hence, it was unfeasible to conduct 'face to face' interviews and to personally distribute questionnaires to students. New measurements and alternatives were taken into consideration regarding data collection procedures and methods.

3.4.1 Recruitment Process

After attaining the approval of the Notre Dame University Research Ethics Board on November 28th 2020 (see appendix A), the recruitment process of survey participants started (see appendix B). My aim was to gather at least 100 completed surveys. This number is regarded realistic, as I will be visiting 10 to 13 public schools, engaging between 5 to 7 high school students of each class (grade 10,11,12) to partake in the research study. It is required for students participating in this survey to have been enrolled in their schools for at least 5 years since a ratio of 2:25 students in a classroom have changed educational institutions and entered directly the higher educational cycle of a new school. This actively demonstrates that a number of student participants would not partake in this survey, as they do not meet the participation's requirements.

The number of survey participants planned did not meet my expectations due to a national lockdown and schools' closure starting February 2020. The following circumstances made it impossible to recruit in person the survey participants, therefore scouting students that meet the requirements was challenging since it had to be completed virtually and throughout online platforms. As a result, while the initial expectation number of participants was 100 to 130 students, we decided that a number of 70 respondents was reasonable and permitted since it is considered a sufficient number to virtually collect and analyze data for the research. Consequently, from January 12 to February 21, 2021, over the span of a month and 9 days, which exceeded the survey's submission timeline expected of 3 weeks, about 83 respondents submitted their answers. Once cleaning all data collected and deleting incomplete questionnaires, there were 76 finalized responses left**.**

While the data gathering process of survey answers was taking place, conducting interviews was supposed to happen simultaneously as a separate research study. However, due to the previously mentioned circumstances, it was difficult and unmanageable to reach teachers and school principals for an interview, as they were overwhelmed with online classes and the new educational curriculum system, as well as the students that were busy with exams and still trying to adapt to the online educational system over Zoom/Skype applications. As a result, the questionnaire was altered in a more convenient and simpler[1] way, as also some changes occurred such as removing the last question of the questionnaire that asked respondents if they were interested to partake in the interviews in order to elaborate on their responses, since most of the survey's questions are close-ended questions.

By the end of fall semester 2020, I have gathered 76 participants in total, being the final number of respondents that completed the online survey in a span of one month and 9 days. The following correlated with the needed number and amount of recruitments, and no added measures were considered[2]. Each survey respondent was presented with the form of consent attained from the Notre Dame University Ethics Board Committee (see appendix B) before the completion of the questionnaire as a proof that the following survey is only for academic purposes and a research study.

3.5 Data Collection Methods

The study uses a short questionnaire (see appendix D) distributed to high school students enrolled in grade 10, 11 and 12 in Lebanese public schools, Keserwan, Mount Lebanon.

3.5.1 Questionnaire

After obtaining the approval and consent of *Notre-Dame University* through an IRB filled form (see appendix B), the researcher uses a self-administered questionnaire that will be used, as this will integrate the views of the high school students and provide their experiences in the physical classroom environment (Saunders et al., 2007). With the use of self-administered questionnaire, the time for conducting interviews on the selected sample population will be increased.

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[1] At this stage, it was a concern that the participants' responses were not as reliable as can be because of the average finalizing time completion of 6 minutes. Nevertheless, the risk of inaccuracy and unreliability with questionnaires is always existing as participants are free to represent and regard their beliefs and themselves in any way they choose to, and are able as such to alter their responses in order to fit in and adjust to the public desirability bias. Yet, it still remains one of the most efficient and successful methods to study and learn people's beliefs, expertise, and insights on an issue matter.

[2] As mentioned before, interviewing the respondents, after gaining their consent through the approval form of the Notre Dame University Ethics Board Committee, was planned as a portion of this research study. Conducting interviews was supposed to occur face to face over the span of 2 weeks while audio recording it for then to be transcribed manually, in order to then proceed with the analysis by thematically coding each interview.

3.5.2 Online Questionnaire

SurveyMonkey was chosen as an online survey data tool due to its easily accessible platform and customizable layout, as it also offers pre-built questions used at times for general inquiries such as education demographics, school climate and learning support. The use of a questionnaire as a first step towards attaining general insight and collecting data about high school students' views or awareness of the "outdated" physical classroom environment is fundamental to identify applicants who are "the experts on the topic" and to derive a "knowledge base" (Schrauf, 2016, p. 138). Moreover, as stated by Schrauf (2016), "when administered to groups of people who are methodically selected as representative of their larger under-lying populations, the survey provides a unique snapshot of cultural sharing that can be gained in no other way" (p. 124). Providing the participants also with "a coherent domain of talk" throughout their systematized forms (Schrauf, 2016, p.138).

In order to discern high school students' opinions and views on their classroom's environment, the questionnaire included close and open-ended questions for a better understanding and a more accurate analysis for the later stages of the study. The quantitative type of data I derived from the questionnaire was correspondingly beneficial and helpful for shaping and tailoring an architectural conceptual approach for my contribution in this research.

3.5.3 *SurveyMonkey* Questionnaire Design Process

The process of structuring a valid questionnaire form through the online platform SurveyMonkey, applying it as an online questionnaire survey and piloting it with test participants was finalized over the span of two months. The final form of the questionnaire is found in appendix D.

Drawn from the theoretical framework and the literature review section, the classroom's physical environment as a spatial area and its variation of physical elements is identified as the main theme of the questionnaire. Participants are asked in the first 14 close-ended (Yes/No) questions whether a physical detail inside their classroom is affecting the room's setting and impacting their focus and learning outcome. This segment also inquires about participants' impressions on their own classroom and its (positive and/or negative) condition. Respondents are furthermore asked, at the end of the questionnaire through two open-ended questions, about their personal opinions when it comes to their educational learning; the aim was to offer and encourage the respondents' ability to personally express (and elaborate) what are "necessary" elements to be improved, removed and/or added in their own classroom for motivational purposes and better academic achievements (Ahmad, Shaharim & Abdullah, 2017).

The purpose of this questionnaire was to assess how much the participants know and are aware about their classroom's physical environment. Close-ended questions were adopted since it incites test participants to provide a clear opinion and express unambiguous views by cautiously deliberating whether they agree (yes) or disagree (no) with the statements presented. Subsequently, this allows me to analyze their responses with accuracy. The survey was designed to end with two open-ended questions, as they are prone to be less assisting and leading than close-ended questions. As a result, the variation of using close-ended questions and open-ended questions in one concise survey allows me to evaluate and analyze the nuances of the respondent's responses with clear and higher precision.

3.6 Data Analysis Procedures

The questionnaire and online research's results will be analyzed using extraordinary themes, which will be formulated based on the meaningful questions from the survey and online information about a Lebanese public school's classroom physical condition, tables and statistical graphs. A practical feature in creating a questionnaire via the online survey tool SurveyMonkey is the automatic generation of data trends as graphic demonstrations containing clear variables representing the number of respondents that selected a particular answer option. This will necessitate a link between the questionnaire results and literature review (Saunders et al., 2007).

Hence, once the questionnaire is closed, the generated graphs are manually converted into percentage tables that represent a defined overview of data trends. At the end of the questionnaire, I opted for two open-ended questions that asked the respondents "What is an architectural element in class that affects their focus and motivation". The following questions are phrased as response or a statement that compares and affirms also the information gathered in the Literature Review section. This form of question was included at the end of the survey in order for respondents to elaborate on their views and points, as it helps the researcher to understand opinions from a student's perspective as feedback is acquired in their own terms instead of stocks answers.

3.7 The Credibility of the Research

The research conducted will be aimed at satisfying the expectations of the researcher by using the member checking technique in which Lincoln & Guba (1985) refers it to be one of the 'most crucial techniques' used in determining the credibility of the data collection methods. This will be essential in determining the accuracy in the interpretation of the results when the participants are involved and affirm that the summarized findings reflect their experiences and

views. Hence, I chose what information and materials need to be collected and the category of people, or in the case of this research study, the type of high school students that are able to facilitate data gathering pertaining to the studied phenomenon. As such, carefully selecting the type of findings that participants would discuss and view should be pertinent to the matter issue and the object studied in order to a point of association and correlation and homogeneity for further evaluation and analysis amidst the different and varied given responses. This affirmation and determination of accuracy and credibility serves to provide original, authentic and reliable results for the research (Birt, L. & al., 2016).

When it comes to research ethics, the researcher observes the confidentiality and anonymity of the respondents as there are ethical implications associated with this form of relationship between the participants and the researcher (Kvale, 1996). Based on confidentiality on the participants' response, the researcher will assure the participants that their responses will be used for the sole purpose of this study and the response will not be discussed with another third party other than the thesis supervisor. Each participant is presented with the form of consent attained from the Notre Dame University Ethics Board Committee. For anonymity, the data will be safeguarded by ensuring that the participants' names are not revealed to the public. In the case of questionnaires, the respondents will be advised not to write their names on the survey paper while the researcher will ensure that the transcript does not contain the names of the respondents.

3.8 Retrieval Data Analysis and Coding Frame

Collected data is automatically retrieved from SurveyMonkey online tool as the following platform generates and represents data trends as statistical graphs and tables with clear and accurate variables stating the number of respondents that chose a particular answer selection (Yes/No). Thus, after the survey and assessment were closed, these representational graphs are

manually embodied in Microsoft Word into crude percentage tables that give clear synopsis of

the data trends. Also, I opted in this survey for two open-ended questions asking participants

about 'any architectural elements in the classroom that affect their focus and motivation'. These

two questions were thematically coded on Microsoft Excel where responses were coded and later

developed into categories using binary measure (value of 0 or 1) to ensure objectivity and

accuracy of the thematic data analysis process.

All 76 survey open-ended answers that indicated identical answers and ideas were

similarly coded and highlighted to easily generate the coding table frame (see appendix E). When

this process was finalized, a document was formed and all the data extracts that are similar were

assembled and organized under broad groupings that were extracted using the survey's structure

and results. As such, extracted data and codes were set into categories, combined and merged

under themes within the retrieval document. Creating a coding frame facilitated and allowed

reviewing, refining, and finalizing the main themes and the subthemes. Such-process and

development ensured a fair unbiased and objective analysis across the whole data set.

CHAPTER 4 REIMAGINING PUBLIC SCHOOLS' CLASSROOMS

4.0 Introduction

An online and scholary research about the schools in Lebanon (Irma Ghosn, 2010; Norma

Ghamrawi & al., 2017; Joseph A. Haddad, 2011) and their physical conditions was a reasonable

alternative. Consequently, this chapter encloses main sections with subsections tackling the

objective and study purpose of this research.

A main section on Lebanese public schools is tackled firstly, and includes subsections

that are related to their physical conditions in order to discern the physical issues and disparity of

classrooms, to find out what are certain key conditions for creating and expanding a conducive

and effective optimal classroom for better learning. These subsections include themes such as; lack of class supplies in Lebanese public schools, the poor infrastructure and school gaps, and creating a conducive and effective classroom. The third subsection tackles the notion of effectiveness and includes subject matters related to key conditions for expanding such notion; room temperature, acoustic, artificial and natural lighting, adequate furniture, space layout, suitable finishing features (based on the UK and US standard norms). Other notions are also addressed in the subsection that includes the optimal classroom size and density, the classroom's layout and desk management. Throughout this chapter, short excerpts, graphs and statistic tables are incorporated to add context and depth to the survey's analysis and results of chapter 5.

Through the educational process in school, students tend to acquire relevant skills, knowledge, attitudes, values and competencies deemed necessary for the everyday life. As a great amount of a student's time is spent in the classroom, the latter is the meeting point for scholars and instructors, where the process of teaching and learning takes place. It is this learning physical environment that helps students to be motivated and thrive. Hence, "with the classroom being such an important place in the growth of a scholar it is important to understand the ways in which to affect this environment in order to receive maximum effectiveness in instruction" (Hannah, Ryan, "The Effect of Classroom Environment on Student Learning", 2013).

Map representing the distribution of Lebanese public schools in Lebanon.

4.1 Overview of Lebanese Public Schools

The Lebanese educational system is split in two main sectors: the private (schools and universities) for which fees are charged for entrance and admission, and the public, which are owned by the government, that are basically free-of-charge. This educational system is well established and touches all population levels. Lebanon upheld this developed educational system structure when training its instructors before the conflict.

Since the amount of students in the public schools has exceeded the two-fifths of the total institute enrollment, the Lebanese government had to open additional public schools in order to meet the requests of the public. Private and public schools differ regarding the elementary phase of the educational system; While the public schools did not pay much consideration to the preschool phase, and necessitated scholars to be five years old in order to be admitted in kindergarten (until the 1990s), the private schools always included a preschool phase and accepted scholars at three years old, according to Educational System, Lebanon (2021). Thus, scholars in private schools take up one year in nursery school, and another year in kindergarten 1, and a third year in kindergarten 2. This could justify the disparity in the academic performances, which usually is higher amongst scholars attending private schools than the scholars attending the public schools (Global Education Reference, Lebanon – Educational System).

Education is required until the completion of the intermediate cycle, is accessible to all the Lebanese scholars, and it is attended by approximately 95% of school-aged pupils. Nonetheless, until today, compulsory education has not been entirely implemented by the Lebanese authorities, particularly in the urban slums and the remote rural regions. Low cost governmental institutions are accessible to all, but are usually of low quality in comparison to

private schools, for example; Lebanese public schools are of very low and poor infrastructure, and lack classrooms' supplies and technological learning tools as smart boards, projectors, computers, advanced labs, comfortable chairs, adequate desks and so on (Situation Analysis of Education in Lebanon, 2016; Grace Chen, Evaluating Public Schools, Public vs. Private Schools, 2019). Therefore, families who are able to afford paying the costs of enrolling their children in private institutions would do so, and come to pay for their children's primary and secondary schooling for the high quality schooling they receive. Moreover, there are limited slots in international schools in Lebanon and most of the time, students are accepted based on their nationality. Private schools also have higher school fees compared to local ones. With smaller class size, top-tier facilities, private schools are better options for students coming from middle class and upper class. As well as the fact there are 1400 private schools in Lebanon, where around 70% of the students are enrolled in them (Edarabia, Schools in Lebanon, 2019). In actuality, the number of students in general education reached 1,073,141 students the year of 2019, distributed (in percentage) as it follows in the table below:

Educational Sector	Percentage
Public schools	30.9%
Private non-profit schools	13.1%
Private for-profit schools	52.6%
UNRWA	3.4%

Table 1: The distribution of students in educational sectors year 2018-19, in %.
Source: Center of Education Research and Development (CERD).

In fact, the Lebanese schools are unevenly distributed among the five provinces. The Greater Beirut area has the highest concentration of all schools and universities. The large population concentration in and around Beirut accounts for its schools' high enrollments. The

Lebanese government provides facilities for public schools, but these facilities are poorly equipped in general. Few of them have libraries, laboratories, and playgrounds. Private school facilities are mostly better equipped than public school buildings (Global Education Reference, Lebanon – Educational System). Thus, the implementation of new ideas and methods has been hampered by the lack of adequate educational facilities and well-trained professionals in regards to public educational institutions. However, private fee-charging schools practice more progressive and advanced methods of instruction, which are geared towards the increasing involvement of students in the instructional process. These interactive methods made some private fee-charging schools more famous in the Middle East region and attracted many students. Since of their quality education and high tuition fees, these private schools attracted students from the richest families, while poor families, who cannot afford to pay tuition fees for their children's education, have been somewhat satisfied, but not happy, to send them to either public or private tuition-free schools, which are usually subsidized by the government. Private schools are mostly sectarian and controlled by different religious denominations. Other types of private schools are owned by individuals or run by associations or committees (Global Education Reference, Lebanon – Educational System).

It is also important to mention *The United Nations Reliefs and Works Agency* (UNRWA) that provides funds supporting a private nonsectarian school system for Palestinian Refugees in the Middle East. There are 65 schools of this type of private schooling that has been very effective in offering education and social services for pupils of Palestinian Refugees residing in Lebanon (United Nations Relief and Works Agency for Palestine Refugees in the Near East, January 2019).

Hence, the majority of schools in Lebanon are private schools; Private schools (free and paid) represent 54% of the total number of schools in Lebanon. The number of private for-profit schools rose from 1,077 in the school year 2011-2012 to 1,177 schools in 2016-2017. As for private free schools, they saw their number increase from 358 to 370 over the same given period (The Education Landscape in Lebanon 2016-2017).
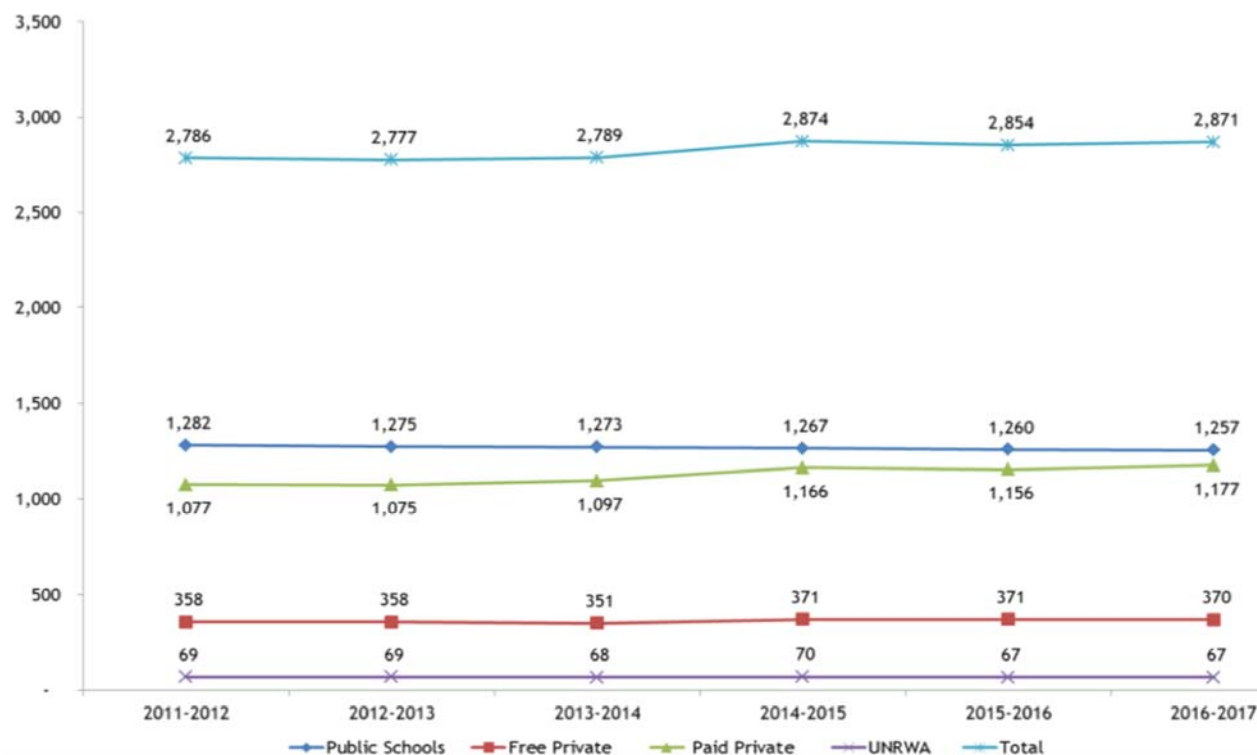
Figure 7: Breakdown in the Number of Schools in Lebanon.

Source: Center of Education Research and Development (CERD)

However, in the years of 2018 and 2019, the number of schools in the educational private/ public sector reached the number 2903 school, presented in accordance with the following table:

Public Schools	43.4%
Private Schools (free of charge)	12.5%
Private Schools (fee charging)	41.8%
Private School (UNRWA)*	2.2%

Table 2: General educational institutions distributed, in %, according to the education sectors year 2018-19.

Source: Center of Education Research and Development (CERD).
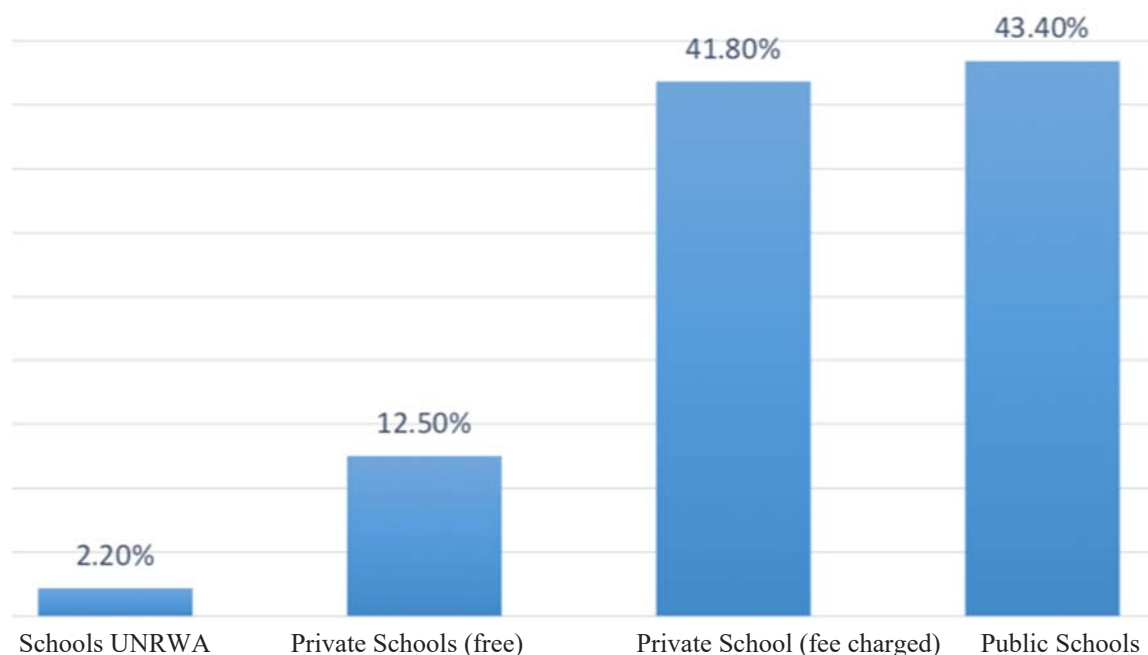
Figure 8: Bar graph showing the general educational institutions (School) distributed, in percentage, according to the education sectors for the school years 2018-2019.

Source: Center of Education Research and Development (CERD).

EDUCATION SECTOR PROVINCE	Public Schools	Private non-profit schools	Private for-profit schools	UNRWA	TOTAL
Beirut	1.9%	0.4%	3.6%	0.2%	6.1%
Mount Lebanon (Beirut Suburbs)	3.4%	2.2%	11.2%	0.2%	17%
Mount Lebanon (Excluding the Suburbs)	5.9%	1.3%	6.6%	0.1%	13.8%
North Lebanon	8.9%	1.5%	4.4%	0.3%	15.2%
Bekaa	4.1%	1.6%	3.4%	0.1%	9.3%
South Lebanon	5.1%	1%	3.4%	1.1%	10.5%
Nabatiyeh	4.4%	1.5%	2.9%	0%	8.8%
Akar	5.9%	1.3%	3.3%	0.2%	10.8%
Baalbek – Al Hermel	3.8%	1.8%	2.9%	0%	8.5%
TOTAL	43.4%	12.5%	41.8%	2.2%	100%

Table 3: The distribution of educational institutions in %, by general education sectors and provinces in Lebanon, year 2019.

Source: Center of Education Research and Development (CERD).

Moreover, due to the latest political and financial crisis that Lebanon has been going through, the crisis pushed 40,000 students to join public schools (UNICEF, 2019); Unable to pay school fees, an unprecedented number of families decided during the school year to withdraw their children from private schools. However, the public sector is not prepared for such an influx (UNICEF, Lebanon, 2019). A sign of the financial distress of Lebanese families, 39,189 students switched during the school year from private to public education, according to data collected by the Ministry of Education as of January 20. This number represents an increase of more than 15% compared to the approximately 260,000 Lebanese scholars registered at the start of the September school year (Justine Babin, Le Commerce, 2020).

The evolution of number of students per school year		
2014-2015	68 701	
2015-2016	69 000	+0,43%
2016-2017	70 163	+1,66%
2017-2018	73 240	+4,21%
2018-2019	75 850	+3,45%
2019-2020	77 038	+1,55%

Table 4: Public schools welcome an increasing number of students.

Source: Ministry of Education and Higher Education, 2020.

Education is however usually one of the expenses that Lebanese households do not compromise on. "The most disadvantaged families often prefer to go into debt rather than putting their children in the public, considered to be of lower quality," says Father Marek Cieslik (Le Commerce, 2020). "It is also a question of reputation: your place in society is assessed by the level of prestige of your children's school," he regrets. The tens of thousands of decisions to

transfer to the public, taken urgently in the middle of the school year, therefore testify to the critical financial situation in which many families find themselves today (Justine Babin, Le Commerce, 2020).

Consequently, Lebanon being one of the best countries in its high educational profile, however uphold a bad reputation on public schools, as they are seen and considered to be of lower quality, outdated and on very low maintenance (Marek Cieslik, 2020). The physical environment of a Lebanese public school and its bad conditions is a fundamental aspect to be highlighted. Accordingly, given the significance of public education globally, it is important to emphasize the various deficiencies of public schools in Lebanon and to address them. Despite the gross enrollment (97.2%) and the satisfactory levels of education and literacy (90%) ratios in Lebanon, numerous burdens and complications characterizing public learning in Lebanon nowadays are showing; lower quality of education, high repetition rates and low passing rates affected by the poor infrastructure and damaged physical environment of the public schools in comparison to the private sectors. In accordance to what has been mentioned, Dr. Ghassan Chakroun, advisor to the education minister, states, "there are few public schools that have adequate and renovated buildings to provide academic materials and extracurricular activities like music, arts, and sports […]" (BLOMINVEST BANK, Public Schooling in Lebanon, 2016).

Hence, a plan for Lebanese public schools' improvement should be highly considered as Education Development Center (EDC)'s Susan Ross urges to revitalize the spaces in which the students learn since the pupils who attend public schools are often learning in institutions that are still damaged from Lebanon's civil war, "Science labs lack microscopes and classroom ceilings leak. Many schools do not even offer adequate shelter from the freezing winter temperatures that are common in parts of Lebanon", as the latter also states the importance of improving these

institutions and the classrooms as they affect the learning process of the students when stating "We focused on making buildings safe and comfortable, from ensuring good lighting to using classroom space in a way that could improve the teaching and learning process" (EDC, 2014).

The following issue of the existing standards and norms governing the minimum and smallest physical condition of educational institutions is unenforced (EDC, 2014). Hence, it is important to investigate some notions and understand the parameters of the bad condition of the physical elements in a classroom, in order to recognize how they are affecting the learning outcome and motivation of the students.

When it comes to the physical conditions of Lebanese public schools, most of them rarely meet a satisfactory level of physical conditions, as these institutions are seen to be outdated and of low quality and maintenance. In fact, "The situation of public schools in Lebanon is way beyond catastrophic, it's horrible and sad," states the Dr. Hassan Kobeissi, writer and professor of education at the state-run Lebanese University (LU), and a member of the LAES - Lebanese Association for Educational Studies (Jocelyne Zablit, Lebanon News, 2016). Principles, teachers and students describe the physical conditions of their school buildings and the poor infrastructure of their classrooms as a "hopeless situation which forces them to cope with the bare minimum, with such basics as heating, school desks, maps, or even a proper playground, toilets or teachers' lounges often lacking. That's not to mention lab equipment, computers or extra-curricular activities like sports, theatre or music, which are non-existent" as also the latter adds "Imagine, I have been calling around for three months trying to find 20 desks for a classroom where pupils are crammed four to a desk designed for two" (Joceltne Zablit, 2016).

As Lebanese public schools majorly lack the quality of educational infrastructure specifically related to physical educational planning and design focused notably on student

comfort, development and academic achievement, the latters are seen as unpleasant institutions to attend since "we are not offering pupils an environment where they can excel and school has become a sort of punishment for them; For example we are supposed to encourage scholars to read, but we have no library, we teach them science but we have no labs, and the list goes on" states Shafiqa Kanj, a French teacher (Lebanon News, 2016). These dire conditions result in poor scholastic scores, high repetitions rates and drop out decisions, as Kobeissi says "statistics show that between 20 and 30 percent of children in primary schools -- which normally should have a 100 percent success rate -- either drop out or fail and repeat classes". This leads to an age-gap of students enrolled in a same grade level and an excess number of them in one classroom. Hence, classrooms become crammed and overcrowded for its size, which affects their focus and learning outcomes (Raouf Ghusayni, LAES).

It is important to note that Lebanese public schools (41.4% of them) are owned by the government, where 5% of the buildings are rented from the municipalities and 53.6% from a proprietor. Hence, the government pays rental on 58.6% of its institutional buildings (CERD, 2017). In Addition, educational institutions do not always accommodate school activities as some of the Lebanese public schools are rented from municipalities and individuals, which were also originally designed to serve housing needs; Statistics supplied by the Lebanese CERD show that 82.6% of the Lebanese public schools display 'school based' architecture and 17.4% display 'residential based/ housing units' architecture (CERD, 2017).

Region	Number of 'School-designed architecture' schools	Number of 'Residential-designed architecture' schools	Total
Beirut	54	18	72

Mount-Lebanon	248	57	305
North	341	135	476
Al-Bekaa	233	26	259
South	151	8	159
Nabatie	139	2	141
Total	1166 (82.6%)	246 (17.4%)	1412

Table 5: Distribution of Lebanese public schools according to their buildings' original architectural design. Source: CERD, 2016-2017.

Moreover, 56% of these institutions do not have or make use of their heating facilities, where only 6% of them possess operational decent heating systems. To continue, the abundance and availability of clean potable water, 67% of them have it. As for the electricity, not all of these Lebanese public schools are supplied with it to their premises, as also 56% of them own phone facilities (CERD, 2017). It is also reported that a major number of 83% of schools lack the presence of a playground, leaving only 14% of them to possess a standard open-air playground where 3% of the schools are to repair and/or alter the ones available in their facilities (CERD, 2018). The following statistical evidence retrieved from the CERD show the suffering of the Lebanese public schools from the adverse and dire physical conditions of the institution and classrooms in which students and teachers operate, interact and learn. The latters also mention the need of modern tools such as computers and laboratories should be included in classrooms in order to apply a better curriculum and enhance learning applications (Mattar, 2012).

Lebanese public schools suffer mainly from low maintenance that creates adverse conditions in the building, specifically in classrooms where students tend to spend most of their school hours and school-breaks in; old chalkboards, damaged tiles, cracked wall paints, broken

desks and uncomfortable wooden chairs and so on.

Teachers at *Sohmor's Mixed Intermediate Public School* mention that "students where learning in dire conditions! There was writing all over the school walls, and the chalkboards were in terrible shape! Our classrooms were grey and gloomy, there was water dripping from the walls, and the cold and dampness affected our pupils' health!" (UNICEF, 2016).

Figure 9: The dire conditions of the Lebanese public school *Sohmor's Mixed Intermediate Public School*
Source: UNICEF, 2016

4.2 Lack of classrooms' supplies in Lebanese public schools

This research aims to understand in what way a classroom can be designed and re-designed in a way it is conducive, efficient and inclusive to learning, since recent studies disclosed that a student's performance in class is enhanced when the room encloses a better

physical environment (Peter Barrett & Tigran Shmis, 2019). The focus continues then to "the

benefits of considering the learning spaces in conjunction with the needs of the students and the

pedagogies that could be most beneficial to them" (Educational planning, 2016).

Friedrich Ebert Stiftung (FES) and Education International (EI) Arab Countries office

conducted a study to determine the physical factors affecting a classroom's learning environment

and a student's learning outcome. Being said so; the report of "Situation Analysis of Education in

Lebanon" demonstrates statistically the lack of access to classroom's supplies and services, also

a gap in their presence in various Lebanese public schools. It has been reported that 137

participants (including teachers, students and schools' admin staff of public Lebanese schools)

noted that the followings lack several materials including computers, smart-boards, desks, chairs

and lockers, etc.
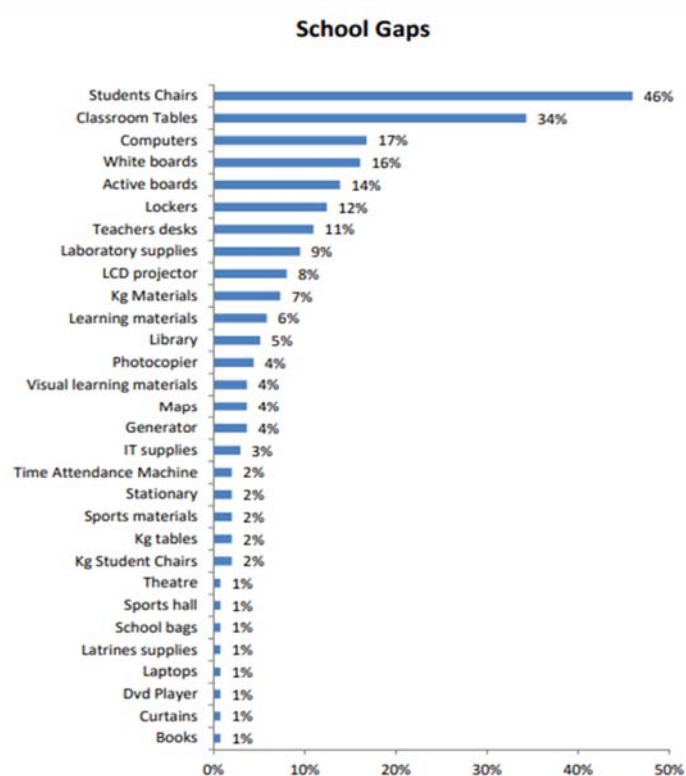
Figure 10: Chart demonstrating the percentage of each element lacking in classrooms.
Source: Education International (EI), 2016.

Furthermore, it was also noted by 167 applicants that infrastructure improvements are needed when it comes to rehabilitation of open-air playgrounds, heating and ventilation systems, windows and doors.
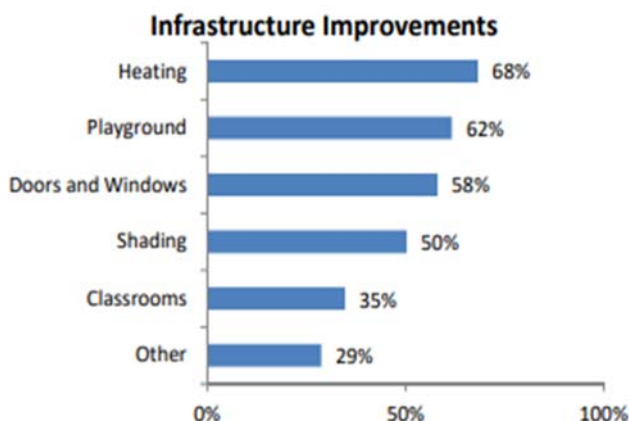
Figure 11: Chart demonstrating the percentages of the needed improvements in classrooms.
Source: Education International (EI), 2016.

In the above chart, "other" improvements mean the following needed improvements: Wall Paint, restrooms rehabilitation, and general maintenance, maintenance of electrical systems, control of humidity, the additions of new spaces and (space) extensions of classrooms.

The physical elements and conditions of a classroom are one of the main factors that affect the Lebanese public schools' performance and the students' learning outcome (Mattar, 2012). Thus it is important to tackle the following findings in order to recommend key suggestions and appropriate amelioration to enhance the dire conditions of the school, notably the classrooms that cover the problem into two main categories: The visual displays such as natural and artificial classroom's lighting, playground, ventilation (air conditioning and heating systems), desks and chairs' layout, walls (materials and colors), and the structural features such as the damaged tiles, the cracked ceiling, humidity and rain/water drainage, etc.

Physical classroom design affects the motivation and stimulation to greater academic achievement by identifying the key parameters that inform the design elements and details, in terms of expanding the efficiency of educational environments to provide – as a result – new conceptual/ architectural approaches to implement and develop future classrooms.

The followings are the parameters and considerations to be inspected (through an online research due to the outbreak of a pandemic that lead to school lockdown) since they are outdated and lack correct space management and physical conditions, especially considering the economical problems and the deficit the Lebanese government is currently going through and experiencing (CERD, Center of Education for Research and Development, 2016). In fact, according to an assessment by the World Bank, Lebanese public schools lack the following key components:

1. A considerable number of Lebanese public schools do not have a playground, a space where students tend to have a break and relax. Hence, they are forced to spend their break times inside the classrooms, where it becomes crowded and disturbed by noise and commotion. This brings light to the fact a classroom should be spacious enough, correctly managed and welcoming for such limitations.

2. Some Lebanese public schools suffer from inadequate and unsuitable lighting conditions, whether it is natural or artificial lighting. This is because some classrooms are overly exposed to sunlight due to the incorrect room's orientation and the absence or lack of sun block curtains or canopy. Also, on the other hand, some classrooms do not have the sufficient amount of direct daylight, given that; artificial lights are - in both cases – randomly distributed and insufficient.

3. Most of the Lebanese public schools are outdated and owned by the government. As Lebanon has been facing financial problems since back then, these schools are not provided with the basic tools, latest technology attributes and equipment, notable the space and tools required to perform experiments.

4. Bad conditions of the structural factors; most of these public schools lack the maintenance required to extend its sustainability. Factors such as unfitting wall printings, bad quality of wall paint, damaged floor tiling, poor installations of electricity exposed directly students to danger, also bad conditions of windows and doors profiles, create insufficient isolation to the classroom. In consequence, acoustic problems would arise, especially the ones cause by the interference noise of the surrounding lectures inside other classrooms (Mattar. D., Factors affecting the performance of public schools in Lebanon).

In conclusion, the features mentioned above are found in school buildings, notably in the classrooms where students tend to spend most of their school hours and breaks inside. Hence, it is important to focus the study on the classroom's physical environment to understand which key element(s) has/have to be improved or added, since recent studies elucidate evidences for the most effective classroom layouts and appropriate resources to aid the conditions of learning spaces and its effect on its occupants, as operational teaching environments increase the chances of students success (Angela Ford, 2016).

4.3 Creating a conducive and effective classroom

The classroom is a critical focus for student's educational and interpersonal growth (Piece, 1994). A student's impression about the classroom can affect his learning positively or negatively, as he is able to perceive and identify the nature of the classroom environment and his perception affects his attitude towards the motivation to learn and achieve. Thereby, a classroom

- if not approached correctly – can be set up and arranged in a condition that stifles creativeness and/or does not promote and stimulate a positive learning setting. Having said so, various and different elements can affect such environment; one main element are the physical architectural components such as the arrangement of desks, the wall art, the lighting condition, the classroom's size and more. Each of these elements can greatly impact a student's focus and accomplishment in class, as also they affect an instructor's attitude in class and towards the students (Hannah, Ryan, "The Effect of Classroom Environment on Student Learning", 2013).

Anekwe (2006) considered a learning environment as including each of the physical sensory fundamentals, such as color, walls, lighting, space, furniture… that described the place in which scholars are expected to learn. Hence, this section investigates the physical elements present in a classroom and the notions of their impact on a student's focus, motivation and learning outcomes in order to understand the effect and the impact of the class environment on students' learning in schools. Also, it investigates and inspects the different and several classrooms adaptation in different public schools.

Steve Grubaugh and Richard Houston depict the importance of physical elements and their arrangement in classrooms. As such, the latters explain the standards for several classrooms today when describing the system of arrangement of the desks today within the classroom being aligned in rows. This organization structure appears to engender a loss of focus and a creation of disruptions in the classroom (Steve Grubaugh & Richard Houston, The Clearing House).

Furthermore, this system of arrangement does not encourage nor enhance interaction between the students but focuses more on the pupil as an individual accomplishing his own tasks. Humans are social individuals that need and seek attention; hence, if students are not able to

receive it from classmates, they will normally act out in order to get the attention from their instructor. Therefore, a student will be making a judgment about the environment, the type and the setting of the classroom he is going to be taking from the first step into the room. As so, students tend to look and notice the system of arrangement of the desks and what hangs on the walls as 'wall art' demonstrates to the pupil that the professor does care about his work enough to hang it and show it off. Moreover, they will further gain an understanding of the teacher's social expectations in class based on how the seats and desks are arranged and organized (Steve Grubaugh and Richard Houston, "Establishing a Classroom Environment That Promotes Interaction and Improved Student Behavior).

In other words, the physical environment of the classroom is one of the first spatial areas that creates and form a noticeable impact on a student's success and motivation. This can pertain and relate to a variation of physical details; it is structural, architectural and elements of design and furniture. All of these criteria play a crucial role in determining and defining whether the classroom is more likely to be conducive for acquiring and learning. As each might not have a large and vital effect independently, however as a combination and jointly, these elements can work to enhance, strengthen and improve students' ability to focus and learn (Dörnyei Z., Muir C., 2019, Creating a Motivating Classroom Environment). Ranchelor (1992) is of the interpretation that an operative and effective classroom (and school) can be defined as a setting that effortlessly motivates the student to learn. Teachers and students perform adequately in a school culture and environment where the motivation to learn and academic success are expected, valued and rewarded. Similar atmosphere and setting where scholars learn to appreciate learning for education's sake, result in improved academic accomplishment, are primary and leading characteristics of a competent, effective and successful school/ classroom.

We can distinguish three main categories of classroom design elements: **Naturalness** (light, temperature, sound, air quality, and associations to nature), **Individualization** (connection, flexibility, and ownership) and **Stimulation** (colors and visual complexity). The following findings are empirical evidences that promote student learning in a conducive environment (Peter Barrett and Tigran Shmis, 2019).

Students will be asked about these design elements in the questionnaire in order to understand how necessary and effective such parameters are to them and their academic achievements. Moreover, these findings will be linked to the research parameters and hence, opted in the conceptual contribution of designing and re-imaging the optimal classroom physical environment for high school students enrolled in Lebanese public schools. As each of these elements is associated with the physical environment of a classroom and the baseline conditions for learning, they reveal a significant foundation for this research project, the contribution and the future initiatives, as also they provide deep insights and recognition that there is a correlation between the physical environment of a classroom and students' achievements, which the main research question of this study is about.

The table below lists the key feature and conditions to improve student academic performance and learning; the design principals, the design parameters and the specific classroom features that improve academic outcomes in relation to these design principals. These findings endorse the significance of the physical environment and design of a classroom to actively uphold students' learning. Furthermore, they reinforce the notion and the study's hypothesis that students' academic achievements and learning is driven by their multidimensional experience of classroom physical spaces and features, which means that the process of planning a conceptual interior design approach as a contribution in this project should

include a careful consideration of these evidences as solutions to maximize the combined advantages and beneficial effects of these environmental factors.

DESIGN PRINCIPLE	DESIGN PARAMETER	SPECIFIC CLASSROOM FEATURES THAT IMPROVE ACADEMIC OUTCOMES
Naturalness	Light	Abundant daylight but a low risk of glare, either through orientation or shading. Also, good quality electric lighting.
	Temperature	Control of heating and cooling in each classroom. The ability to avoid heat from the sun, either through orientation or adequate external shading.
	Air quality	Big window opening sizes at different heights to provide good ventilation in varying conditions. Larger classrooms to dissipate poor air. Air conditioning where necessary.
	Acoustics	Carpeted floors and the absence of adjacent external sources of noise.
	Links to nature	Views outside and, if possible, direct access to and use of outdoor learning spaces. Natural materials in the classroom such as furniture coverings and plants.
Individualization	Ownership[a]	Distinct design characteristics, personalized displays, and high-quality chairs and desks to foster a sense of ownership among students.
	Flexibility[a]	Larger, simple areas for older children, but more varied layouts for younger pupils. Easy access to attached break-out spaces and widened corridors for pupils' storage. Well-defined learning zones that facilitate age-appropriate learning options, plus a big wall area for display.
	Connection	Wide corridors with external views where possible, plus distinctive, orientating features, especially in relation to the doorways of particular classrooms. Circulation spaces large enough to use for educational activities, such as "corridor libraries."
Stimulation	Visual Complexity[a]	Visual variety in the room layout, ceiling, and display in balance with the use of displays to create interest but with a degree of order.
	Color[a]	Light walls generally, but with a feature wall or areas highlighted with brighter color, to produce an optimal level of stimulation. Bright color on furniture and in displays as accents to the overall environment.

a. Classroom features that are strongly related to their use.

Table 6: Classroom characteristics that increase pupils' ability to learn.

Source: Barrett et al., 2015.

The following figure demonstrates the proportions of each design key parameter including light, temperature, air quality, ownership, flexibility, complexity and color that contribute to variations in learning and educational progress. It demonstrates how half of the diagram percentage is due to *Naturalness* features (light, temperature, air quality), with *Stimulation* (color and complexity) and *Individualization* (ownership and flexibility) accounting one-quarter each. It is interesting to note how the latter two groups of features are as significant as the *Naturalness* factors when combined together. The proportions each key design parameter contributed to the variations in student learning progress are statistically shown below. This evidence shows the level (in %) of impact and capacity these factors have

when they are implemented in a physical environment for learning; indicating that there is a meaningful potential for Lebanese public schools to be efficiently upgraded, and for future schools to be build in ways facilitating learning imperatives.
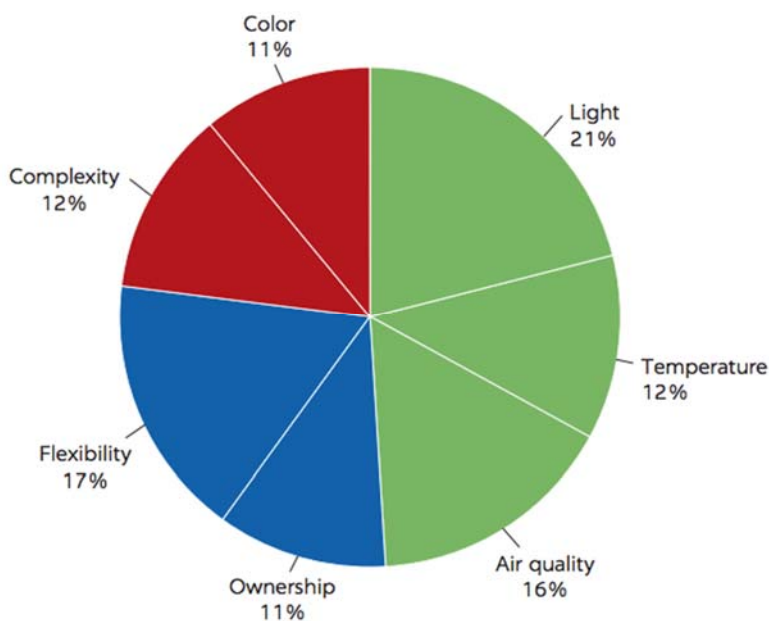
Figure 12: Contribution of each classroom measure.
Source: Barrett et al., 2015

4.3.1 Key conditions for expanding an effective classroom

The physical physiognomies of teaching spaces hold a significant effect on educational success and progress (Peter Barrett, 2019). This impact is estimated to explicate "on the order of 16 percent of the variation in pupils' learning" (Barrett et al., 2015).

Thus, World Bank's report, "Learning to Realize Education's Promise" (2018), and Peter Barrett & Tigran Shmis' book "*The impact of School Infrastructure on Learning*" (2019) found and explained that the followings contribute positively to students' progress in education: Decent and 'natural' conditions (lighting, acoustics, links to the outside environment/nature, temperature regulation), adaptable and personalized flexible learning spaces and opportunities, connections

and links between educational spaces that are easier to navigate and offer additional educational opportunities, ambient stimulation through the use of colors and visual complexities, designing schools from inside-out, from the classroom to the school building, so that each and every space can meet the requirements of it occupants, and lastly creating designs that take into consideration cultural conditions and local climatic.

Taking into account what has been mentioned above, it makes intuitive sense that there is a potential for various existing Lebanese public institutions to be upgraded in an economically way, as also for new institutions to be designed in a way that enables learning imperative.

The study of the negative-positive impacts of classroom design on academic achievements has been examined by many researchers; their efforts reveal a humble relation between students' academic results and the latters' subjective contentment with the physical condition of their institutions (Hopland & Nyhus, 2015). Therefore, the notions and parameters of the physical elements to be inspected in Lebanese public schools are the many factors that should be considered as the main parts from the physical environment of a classroom. The latters are the following:

1. **To review room temperature and acoustics**: Excessive noises from the outside hinder student learning (Klatte & Lachmann, 2013). As the source of noises inside a classroom can vary, it is commonly caused from ventilation and heating units (Architectural Transportation Barriers Compliance Board, 2002). Hence, the sound levels and intensities in a classroom and outside it significantly impact learning process. It is important to reduce background noise and/or amplify the instructor's voice to produce the right and correct sound. Sound levels are adjustable through baffle boards, flooring, or by including soft seating or by using isolation materials such as carpeting, wall panels or special

ceiling, and acoustic planning. Additionally, a comfortable room temperature range is important, as there is indication it can affect the wellbeing of teachers (Sadick & Issa, 2017) as well as the students' academic achievement (Goodman & al., 2018). Recent studies confirmed that pupils favor cooler temperatures (Brotas, Roaf & Nicol, 2015).

2. **To focus on natural and artificial effective lighting**: Since natural daylight in classrooms cannot be substituted, it is important to check and confirm that there is sufficient amount of artificial lighting in class, especially if sunlight is limited. Accordingly, correct and accurate lighting avoid eyestrain and support to keep scholars alert. It is also important when choosing lighting to consider the requirement of altering the lights for some learning subjects and experiences – such as when it comes to presentations on board, watching a short documentary and using the projectors, blackout blinds are needed. Moreover, researchers emphasize the "impact of dynamic variations in lighting" (Wessolowski & al., 2014), also the quality and type of the artificial light source (Markwort & Wessolowski, 2012).

3. **The specific and careful choice of furniture**: Desks in classrooms are greatly important and foremost to the overall educational experience. Students should feel comfortable; as also making sure the seating is of the right size and ergonomically comfortable will assist †o keep them focused. (Classroom furniture should comply with the standard norms of the British and European Standards for "chairs and tables for educational institutions").

4. **Walls and space layout for innovative desk arrangement and room extensions:** Spatiality and room extensions engender all the difference and change in classroom design and size. A clever usage of space layout and a particular system of desk arrangement help to maintain the classroom free from disorder and clutter, as also it

would push scholars to take pride in their own class. Also, extending a classroom for outside natural views or for direct access and use of the outside can improve learning spaces, as well as using natural materials (furniture coverings, plants…) help increase cognitive stimulation; if nature is visible from inside the classroom, it promotes recovery and allows students to rest their eyesight and mind, and improves the physical and mental health of students and teachers (Marc-Antoine Boudreault, 2017). Moreover, the physical environment can have an impact on the class' atmosphere and it has been known as the 'symbolic' environment (Cheryan & al., 2014). Designing an inviting and warm atmosphere inside the classroom through decorative changes, such as painting walls in colors other than white (Tanner, 2015; Grube, 2014), or hanging posters on the walls that are inspirational to all nationalities and both genders (Cheryan & al., 2014) have a positive effect on educational environment and improve learning outcomes of students, as also it does not require the consumption of money and time. The following symbols including wall paint, décor and other "trivial details" and objects displayed in the classroom can powerfully impact class culture; these features being inside a schoolroom shape a student's aspiration and influence his performance (Fisher, Seltman & Godwin, 2014). Moreover, as student should have the ability to see their work and performance hanged on the walls, it is also important to have at least 20% of its space kept clear (Hussain Malik; Abbas Rizvi, 2018).

5. **The finishing features**: Lebanese public schools suffer from low maintenance that is needed for durability and sustainability; damaged tiles, cracked ceilings and wall paintings, bad rain drainages and electrical systems causing danger, dire conditions of windows' and doors' profiles that do not isolate classrooms enough from acoustic

problems and noises of the surroundings, hence interfering the lectures and causing distractions.

6. **Technological educational supplies:** As previously mentioned in the above section 4.3, the Lebanese public schools' classrooms – according to an assessment by the World Bank – majorly lack educational technology tools such as computers, smart boards, projectors and other technology devices.

Technology plays a vital and dynamic role nowadays in education; computers have offered a variety of beneficial roles from facilitating office staffs file students records to supporting and assisting teachers in classrooms. As such, classrooms are relying today, mainly in private schools, on telecommunication and "intelligent automates learning" in order to engages pupils in 'hands-on' learning. This is part of the planning of working and living in a virtual and digital world, especially with the on going circumstances and the outbreak of the Covid19 virus that left people working and studying online. In fact, educational institutions leaders identify the benefits and assistances of technology incorporation in education. Also, tutors are pointing out how much technology is improving learning, as it is engaging scholars into simulated experiences and encouraging the latters to practice collective decision making abilities and skills. If done right, such academic and educational exposure to new technology can deepens understandings and experiences since learners adopt concepts when acquiring accurate skills and authentic abilities (Christensen, 2019).

This actively demonstrates that adopting technological devices in education serve various fundamental roles: simulated experiences, collaborative skills, formative assessments and

interactive connections with learning and pedagogical resources. Today's learners greatly depend on computers and handheld devices that are technologically smart and advanced to communicate, connect and research. Academic expeditions are simulated throughout virtual science experiments, digital field excursions and historical expeditions that augmented curriculums in great ways. Thus, technology allows scholars to form connections in depth with learning. As Dr. Mathew Lynch, a Tech Edvocate author states, "Technology can actually be a major tool, both in terms of pedagogical resources and in terms of connecting with the younger generations." In other words, advanced technology sets the platform for collaboration.

Moreover, not only does technology facilitates connections and collaborations between users, it is also a prominent way to incite active learning. With the use of technology, scholars now can "leverage their knowledge of digital technologies to creatively solve problems, complete projects, gain globally relevant knowledge and accomplish goals" (Williams, 2019; Christensen, 2019). As students usually relied on library books or their mentors for information, twenty-first-century students now – with digital devices and advanced technology – can consult and learn from experts through online networks. This type of learning experience is an interesting and superlative learning process that is considerate to be relevant, equitable and authentic, as it also ensures that students will memorize and recall the lesson (Christensen, 2019).

4.3.2 Optimal Classroom Size and Layout

The learning environment with its physical surroundings is seen to be a 'third teacher' just like *The Reggio Emilia* concept, a pedagogical approach established by Italian educator and pedagogue Loris Malaguzzie, considers it, since weak management systems, poor curriculum and

broken relationships and interactions between learners can result in bad learning outcomes. On the other hand, certain educators dispute the idea of open spaces being not so actually flexible for learning and teaching as the traditional classrooms and connected cellular spaces that allow discrete activities to occur instantaneously (Zhang & Barrett, 2013). In both cases, the matter of structure and layout in the classroom has to be examined and become focus of the educational strategy (Deed & Lesko, 2015). The design and creation of flexible spaces in Norway (Barrett & Barrett, 2016) show that the followings can create a poor level and balance of stimulation, as well as a condition where one does not feel any ownership of a particular space.

Some of the latest longitudinal study reviews (Daniels & al., 2017; Daniels, 2015) detailed the experiences of different schools that are part of the BSF (UK Building Schools for the Future), and one that continued to function in its old structural building. The BSF schools were self-improving and were based to be built as open design buildings, driven by the aim to implement a flexible student-centric pedagogy. The following studies highlighted the varied results of such experiment and the intentions behind them.

One of the examined schools was a success case study when making use of a new pedagogical approach; the latter stood consonant with the provided spaces and was driven by them, hence resulting overall in positive outcomes. Though various complications occurred in the other schools when introducing a pedagogical design that does not suit the built open design of the institution. In relation to what have been said, in two case studies, significant and major physical changes, such as building walls, were made to create additional cellular spaces. This initiative was developed to foster a new type of pedagogy, and so the infrastructure was formed in a way that doesn't allow going back to the way schooling was previously communicated. However, the

case of the one school was still an old building, it was demonstrated how it was hindered by the building's structure when introducing a new pedagogy and approach to educating.

These case studies indicate that the principal goal is to ensure a suitable fit among the spaces and zoning in question and the developing pedagogy in use within the spaces. Yet, given the complications caused by the evolving and varied visions of an optimal pedagogy in relation to the durable environment of school structures, the implication is obvious that flexibility for occupants should be built-in from the beginning. Since change and evolvement is arising in the part of pedagogy, it is understandable to see value in Vygotsky's notion (Vygotsky, 1978) "zones of proximal development" relatively to the educators who need the support and push to change and grow along with the spaces and pedagogy, particularly in there are the drivers of it and advocates for this change. The case studies' outcomes also threw light on the difference between "flexible" and "open", which often are used into the same composite sentence. In 2011, Julia Atkin, an education and learning consultant, put it strongly when she stated for the argument to "move beyond the simplicity of flexible open spaces to integrate resource rich, special purpose spaces with flexible, adaptable multipurpose spaces to provide a dynamic workshop environment for learning." The efficiency of openness relies essentially on the level and amount at which is it implemented; for example, a sizeable cellular classroom including several learning corners could have walls, yet can likely be flexible. This flexibility commonly is enhanced when using folding walls (soundproofed ones), hence allowing the spaces to be frequented and used separately or simultaneously/ collectively in divers configurations. Additionally, these may also function in related and approximate spaces, as Atkin disputes for, or "the openness" that can be applied throughout the educational institution. Likewise, as Tinka Rogic (2014) said it " ultimately the ideal learning space will be different for every school depending on the school's pedagogical

vision and its context." Such matters are not relevant only to new innovative schools; Changes and modifications in classroom design, equipment and furniture selections, also layout can be initiated in existing structures as well.

Conclusively, there is emerging evidence showing that the best approaches to certify and confirm that the layout and design management of classrooms support education and optimal pedagogy are: To strive in order to create and design innovative spaces for teaching and learning, by also recognizing the professionalism of the educators involved – To create rooms that stand spatially flexible, so that on the long run they are able to support instead of obstructing any developments or changes in pedagogical practice – To implement innovative approaches in the educational aspect by making sure there is a consistent and reliable 'fit' among the educators' motivations and capabilities, the vision and concept behind the innovative method applied and the available features of the spaces - To increase and improve the flexibility of the existing school buildings by implementing new fittings and furniture, innovative space management, as also by investing in extensions and alterations.

Since the majority of the Lebanese public schools are old existing buildings, of poor physical conditions, it is important hence to increase flexibility of the classroom when implementing innovative classroom layout by investing in room extensions, spatial zoning within the room and desk management to create focus and motivation within the students. And since major changes are happening in education, educators should consider taking pro-active (physical) environmental changes inside classrooms, Denton (1992, p.31) said it best, "Careful use of physical space can positively affect teacher and student attitudes." Instructors play a crucial role in students' social and academic behavior when they arrange and structure the everyday lives of scholars in the classroom (Hughes, 2014). One of these strategies is a proactive one that includes

making modifications and transformations to the educational environment for promoting learning, which modifies and adjusts this learning environment so unproductive pupil behavior is prevented (OSEP, 2012).

Kame'enui and Darch (2004) suggest that instructors take into consideration whether persistent behavioral problems are raised by the layout and organization of classrooms. This section examines the outcomes and effects of divers seating arrangements and management on classrooms behaviors as a proactive manner of preventing/limiting disrupting behavior, and creating a setting that is more conducive to self-governing learning, as Lebanese public schools' classroom arrangement take the traditional way of seating arrangement.

Martella, Nelson, and Marchand-Martella (2003) elucidated that a well organized classroom results in positive and optimistic interaction and behavior among teachers and students, which highly will reduce the occurrence of behavioral problems in the classroom. Desk arrangements as well as its influence on pupil behavior is demonstrated when Rosenfield, Lambert, and Black (1985) noted that assemblies of desks allowed and assisted the students socially, however hindered their independent work performance. Being mindful of how much the disposition and design of the classroom affects a student's behavior makes it easier for teachers to intervene and to correct the issue before it intensifies into a bigger management issue. These behaviors were recognized in Bonus and Riordan's research (1998) as off-task behaviors: "students delayed response to starting an assignment, inappropriate talking,, unwanted gestures, such as tapping pencils, rolling pencil on desk, flipping through books, and doodling". The latters found that particular behaviors played a role in scholars not obtaining adequate instruction, and their attentiveness to learning was increased and improved when seating arrangement is appropriate for learning and teaching.

Throughout the years, many researchers have established that creating changes in students' environment and setting could be an effective strategy for instructors to use and apply as means, so that disruptive behavior of students often displaying them is minimized (Conroy, Davis, Fox, & Brown, 2002).

Moreover, Richards (2006) showed that the placement of where a scholar is seated within the room could as well impact his academic performance and outcome, thus employing changes to seating arrangement may be a strategy used to reduce disruptive behaviors inside the classroom. Additionally, Daniels (1998) goes on to say that the management of classrooms either fosters negative or positive behaviors. According to Van den Berg and Segers (2012), placing students together and closer to each other decreases peer reported performances and behaviors within the classroom.

Lebanese public schools are known to have big vast classrooms or overcrowded ones (Hashash et al., 2018). However, the public division is not ready or equipped for such a great influx (Unicef, 2019; Justine Babin, 2020). In either case, it is important to study and understand the optimal class size and density that a classroom should acquire.

Having said so, according to PISA, the Program for International Student Assessment in Finland, educational institutions have on average 195 students with 19 pupils in each class (National Board of Education, Finland, 2016). Finnish's minister of Education thinks that a student's potential can be maximized when teaching them and learning in small team work/groups, as adopting such policy would engender a closer and friendlier relationship between the students, teachers-students and the school's community. Therefore, the benefits of having smaller class sizes include better and improved academic outcomes (Bruhwiler & Blatchford, 2011; Blackmore & al., 2011). Moreover, a study carried out by Finn Krueger shows

that students in smaller classrooms (carrying 13 to 17 students) score 5% higher results than the scholars in larger classrooms. Another study conducted by Fidler, and published by Los Angeles Unified District, showed students spending longer hours in smaller classrooms, obtain higher achievements in school. Hence, it was proposed that to acquire full benefits from reduced classroom sizes and alternative teaching-learning practices that are more student-centered, classrooms should contain 15 to 20 students. However, this can cost quite a bit (The Education Endowment Foundation Toolkit, 2017).

To continue, another issue related to this aspect is the density of scholars inside a classroom. Several examiners agree that overloaded settings and environments hinder a student's educational performance. Data collected from a study conducted by the *New York Board of Education* (Marti and Rivera-Batiz, 1995) shows that teachers and students have negative views and opinions towards schools being overcrowded, as they describe being discouraged, overwhelmed and sometimes disgusted. A large number consider the following to be the outmost issue facing educational institutions. In addition, this study managed to find that these thoughts were notably strong in schools that have a high number of students from poor socio-economic background where overloading was strongly related with lower performance and achievement. It is important to note a high proportion of students with such background in Lebanon attend public schools due to the high expenses of private schools.

To reinforce this matter, another study, conducted by Griffitt & Veitch, established that uncomfortable and poor environmental conditions (high acoustics, high temperatures, overcrowded spaces…) are the causes for hostility, disputes and violence, which is likely a case occurring in classrooms. Nevertheless, one limitation or constraint of the following studies is the standard understanding of schools' classrooms as being fixed in space, and a classroom as a

limited number of scholars per teacher. Recently, several countries are trying to improve their educational environment and learning spaces, and designing their classrooms to be more flexible by team teaching, piloting variable and adaptable classroom sizes, prompting small work groups among further variations. Initiating flexibility into educational spaces induces efficiency in teaching and learning, as also it makes the use of school facilities better and more effective. However, more research should be made into this aspect in order to fully understand and examine the openings and risks such developments form (Peter Barrett, 2019).

When it comes to classrooms' layout and desks arrangement, the quality of learning/teaching environment is improved and equalized through upgrading and examining the different aspects of the space, such as the physical 'built' environment and the classroom's layout (Ford, 2016). It is hence important for classrooms to be optimally designed for better learning experiences. Another key factor determining students' academic improvements and achievements is the interaction built between students and teachers that is mediated by the used pedagogy. This section discusses the implications of the pedagogy for classroom design and layout, and how can it be designed to foster a productive learning experience, as well as enhancing focus and motivation in students.

Lebanese public schools, as well as various other schools globally, are still using a didactic pedagogy where students are still taught in the traditional way: scholars are seated in vertical rows facing the teachers and board, who are at the front of the class. This common and usual type of desk management is an effective way to convey facts (Tigran Shmis, 2019) as it encourages students' active participation and engagement in class, develops an understanding of 'self-regulation', recognizes them as core participants and actively pushes them towards organized cooperative learning (OECD, 2013). In 2012 and 2016, UNESCO (institute for statistics) spoke

about an extensive range of models where the conditions influence learning experiences and are conducive to them. So, pedagogies is seen to be not only a stretch from a didactic standard, but also a stretch from blended model approaches to highly student-centered learning approaches; the blended model engages islands of desks with 4 to 6 students grouped together with a series of learning corners such as wet area and a reading zone (Barrett & al., 2015). The following method enables scholars to work and study in pairs or groups, occasional instructions from the front, as also it supports self-direct accomplishments and a one on one intervention by teachers. Evidently, such methodologies require altered and divers spatial configurations (Guney & Selda, 2015), as it has been also demonstrated in Russian Federation when a distinction between the 'institutional typologies' displayed didactic models and more flexible and open 'educational landscapes' in order to support the complex and difficult student-centric pedagogies (Shmis and Ustinova, 2014).

The notion "zones of proximal development" explicated by Vygotsky, a developmental psychologist (1978), illustrates how teachers, the space and pedagogy (figure 14) all assist the student to reach a new stage of development and reach an advanced level of skills as currently it is a global movement to focus on student-centric approaches.
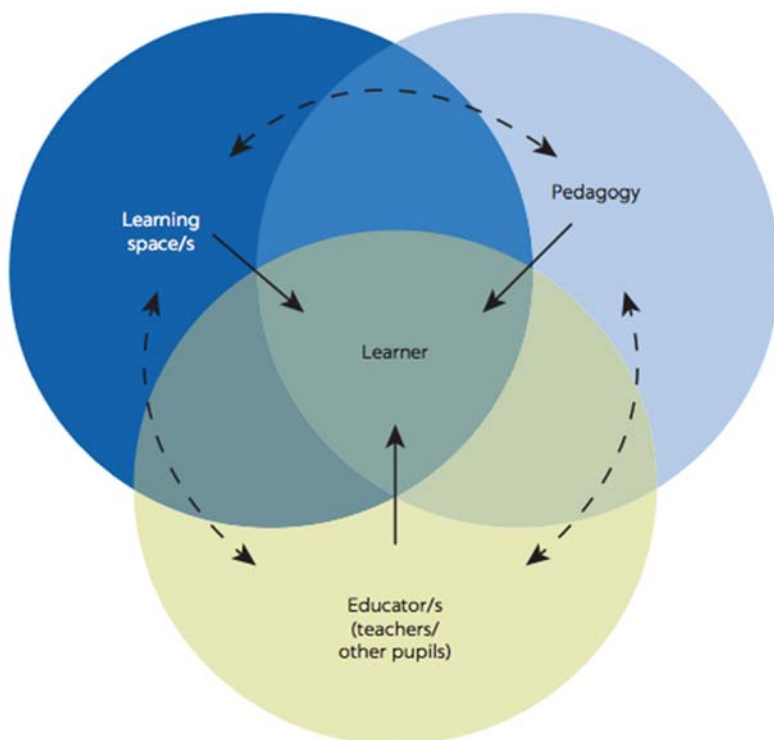
Figure 13: Learning Interactions: Teacher, spaces, and pedagogy.
Source: Barrett & al., 2015.

As the physical environment of a classroom does not only involve the impact and understanding of affective and cognitive measures such as curricular, interacting pedagogical and motivational factors but also a not-so-easy architectural determinism; the most apparent feature of the relationship between space and pedagogy is layout, particularly cellular classroom vs. open or flexible configurations (Peter Barrett, 2019). The following is a complex matter (Blackmore & al., 2011) that has been investigated in numerous studies that did not conclude the influence of flexibility on students' achievements nor the significance of both an open plan configuration and cellular layout (Deed & Lesko, 2015; Saltmarsh & al., 2015). Yet, a newly conducted study (Scott Webber & al., 2014) showed a mass number of students rating 'non-traditional' classroom layout design better as it has a positive impact on several factors such as physical movement in

class, active involvement, collaboration and team work and the ability to create an enriching

practice and the use of better effective learning approaches.

4.3.3 Types of Classroom Seating Arrangements

A classroom's physical configuration is beyond a stylistic or organizational choice by

tutors. Seating arrangements within a classroom affect student motivation, learning, participation,

and student-student and teacher-student relationships and interactions (Fernandes, Huang &

Rinaldo, 2011). It is also important to mention how nowadays, with the on-going circumstances

and breakout of Coronavirus that affected the whole world, teaching and learning have been

instructed in virtual classroom spaces, through real-time online platforms such as Zoom, Skype,

Google Meet… Teaching choices to utilize engagement strategies as well as deliver opportunities

for assessments and feedbacks similarly have a positive and constructive impact on students

learning outcomes and performances (Francescucci and Rohani, 2019). There are numerous

examples and specific strategies that enhance pupil learning in various classroom spaces (Yale

Poorvu Center for Teaching and Learning, 2021).

Instructional communication study theory proposes that seating managements and

arrangements have the ability to impact the way tutors communicate with scholars, and the way

scholars interact with each other, impacting motivation, engagement, focus and learning

(McCorskey and McVetta, 1978). Further recent study proposes that the setup of classroom

spatiality shapes teacher pedagogy, on-task pupil behavior, and choice of accomplishments and

activities. As such, classrooms that have seating affixed and pointed towards a podium or stand at

the front of the classroom results in tutors spending additional time in lectures and scholars

displaying less active participation engagement. In opposition of roundtable seating arrangements

that lead teachers and students to engage in more and better active learning behaviors and

activities, which results in improved learning performances and outcomes (Brooks, 2012). More researches demonstrate that scholars prefer a more flexible seating arrangement (Harvey & Kenyon, 2013).

Particularly, scholars tend to prefer classrooms that include mobile chairs instead of fixed ones, also trapezoidal tables/desks with seats on castors instead of the traditional rectangular desks with immobile seats. Generally, spaces that are designed in a student-centered way, and that focus on learner "construction of knowledge" and collaboration, allow the support of student learning (Rands & Gansemer-Topf, 2017).

In fact, numerous classrooms at schools and even universities are built using a more conventional model for lectures and seminar courses. Teachers could consider methods to modify and adjust seating arrangements, also to align these arrangements with classroom activities' demands to maximize and enhance student learning (Yale Poorvu Center for Teaching and Learning, 2021).

There stand three main seating arrangements, which are significant when managing student performance and behavior. Conferring to Weinstein (1979), because of classrooms lacking space within them, instructors are mostly limited to adopting three classroom-seating arrangements: the row seating, the cluster seating, and the horseshoe (also called semicircle) seating. Below is the description of each seating arrangement type.

1. **Row seating: The desks are placed in horizontal or vertical straight lines**. The row seating arrangement is the most conventional and common one used in classrooms. Studies about the row seating arrangement demonstrated both negative and positive effects when it comes to student behavior. Atherton (2005) notes that students placed in row seating arrangement are passive learners and " are only meant to be seen and not heard in the classroom."

A 1995 research study conducted by Hastings and Schweiso showed that row seating improved disruptive and on-task behavior of students placed in this type of arrangement. Also, according to Lam and Wheldall (1987), students sitting in row arrangement engendered positive behavior and the on-task behavior was doubled.

However, a 1985 research led by Rosenfield & al. showed a rise in off-task behaviors when adopting the row seating arrangement inside a classroom. The latters further acknowledged that such type of seating is the least effective and is not a favorable seating arrangement for improving a student off-task behavior. They additionally indicated that if instructors sought to increase and enhance interaction amongst teacher-students, row seating isn't the arrangement accommodating students' needs. Another research that mainly focused on seating arrangements and scholars asking questions, Further, Marx and Hartig (2000) discovered that scholars ask their instructors more questions as they are arranged in the row-seating format. In 2008, Ruhl and Wannarka indicated that classrooms' seating arrangements ought to be based on particular activities and events that students are engaging in currently. They further add that if pupils are working independently or individually on assignments, they must be seated in a form of arrangement that allows generating fewer interactions with one another, just like the row seating arrangement. Likewise, as such seating arrangement can be adopted in any classroom size; large classrooms often meet uneven level of interactions as pupils in front rows would participate more than pupils seated in the back as they may loose focus (Effective Classroom Seating Arrangements, 2015, 2020).
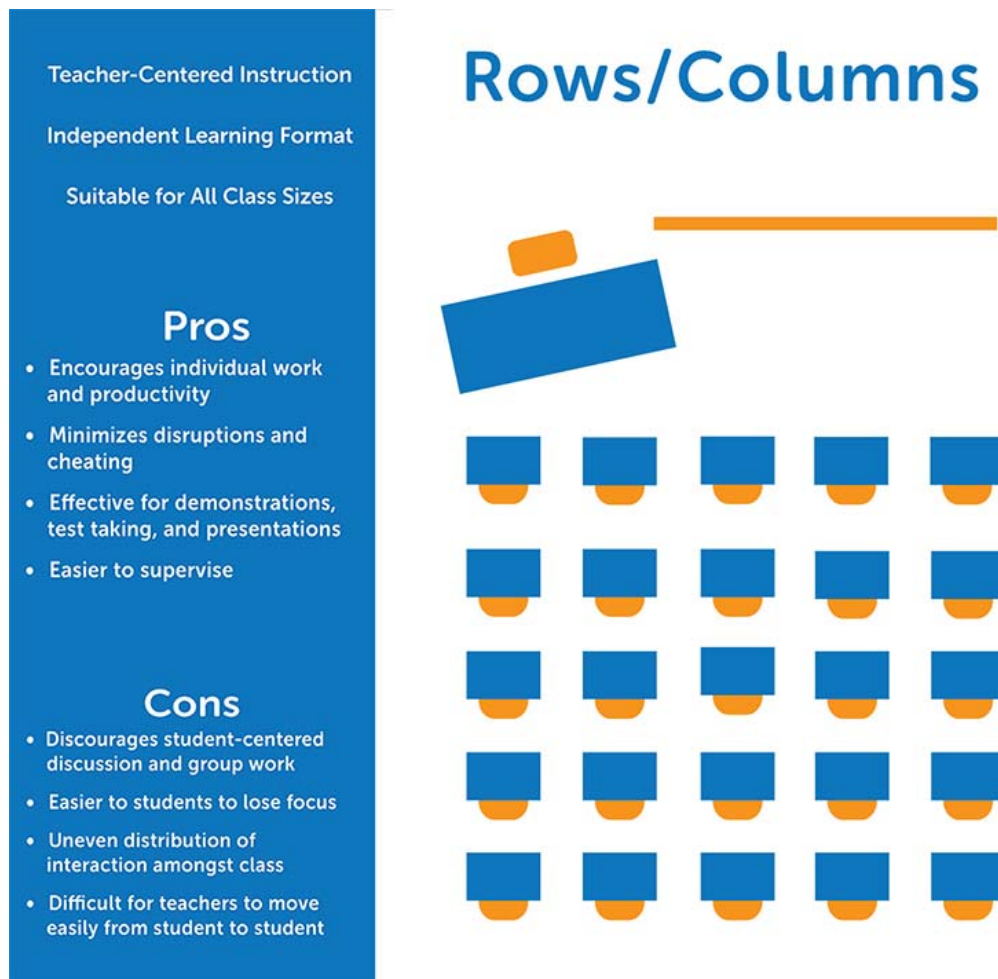
Figure 14: Configuration of Row Seating Arrangement.
Source: Effective Classroom Seating Arrangement, 2020.

2. **Cluster seating**: **A set of four tables assembled with each other, on the same and exact horizontal outlines, and the left and right vertical outlines of the table.** This type of seating arrangement is the second one to be studied, known also as the group seating arrangement. It is found that cluster seating arrangement can be effective in pupil collaborative learning, however off-task behaviors are simultaneously increased in such format. Rosenfield & al.'s study (1985) reveals that cluster seating arrangement has a positive and constructive effect when it comes to social interactions, as also more scholars are actively taking part in class discussions. The latters stated, "common sense indicates that small clusters would heighten

student interaction but might also limit teacher control and/or encourage social interactions that are not conducive to learning." Cluster seating, according to Papalia (1994), allows scholars to partake in games, remedial activities, and endorses peer assistance and support. In addition, Marx & al. (2000) stated that cluster seating arrangement could foster an environment that incites students to interact with each other due to their proximity and closeness. Such seating type of arrangement fosters an engaging and active learning environment (Atherton, 2005). In other words, clustering tables into small assembly stimulates and encourages student-student interaction. Hence, they develop various skills like collaboration, problem solving, communication, and much more in this format. Cluster seating offers comfortable and safe environment for pupils to share notions and ideas. However, this comfort tends to engender off-task behaviors and a surge in distractions and noise levels (Effective Classroom Seating Arrangement, 2020).

Clusters

Predominantly Learner-Centered Instruction

Small Group Format

Suitable for All Class Sizes

Pros
- Encourages interaction of all students
- Creates a more personal and safe environment for students to convey their ideas
- Promotes cooperation and teamwork
- Develops reflection, problem solving, and communication skills
- Flexibility to strategically form groups
- Suitable for small spaces

Cons
- Increased noise level, distractions, and off-task behavior
- Decreased productivity
- Less individual accountability (ex. strongest student may do the bulk of the work)
- Harder to assess students' abilities and level of understanding

Figure 15: Configuration of Cluster Seating Arrangement.
Source: Effective Classroom Seating Arrangement, 2020.

3. **Horseshoe seating: this format of seating arrangement has tables arranged in a U-shape arrangement or semicircle shape.** Wengal (1992) found that this seating arrangement elevated an amount of conversation from students. Yet, it allowed the instructor's course to be much more engaging for them. The latter further indicated that this seating format incited appropriate behavior and participation. Papalia (1994) found that horseshoe seating allows students to focus and pay attention to the lesson and the teacher, to make eye contact, as also it allowed teachers to control the classroom. Rosenfield & al. (1985) established that the horseshoe seating arrangement is the preferred design layout to use if teachers want the classroom to

interact and participate during class sessions and discussions. Student behavior can be projected positively or negatively based on the classroom arrangement design; as Black (2007) acknowledged, a poor arrangement of seating within the classroom can affect a student's learning and performance by 50%. Thus, for an instructor to improve the learning environment inside a classroom and create a conducive setting, the latter should take into consideration a classroom's management and seating arrangement. Small changes like moving furniture (desks and chairs) in order to enhance behavior and foster teaching/learning, is considered minimal change compared to the drastic interventions used to reduce the number of problematic pupils. Moreover, as the instructor's activities and lessons evolve, the seating arrangement and organization must be a constantly changing action. Such modifications within a classroom are often needed since they create a much more positive and optimistic classroom environment for both students and teachers. As a result, instructors can effectively teach and student performance is improved.
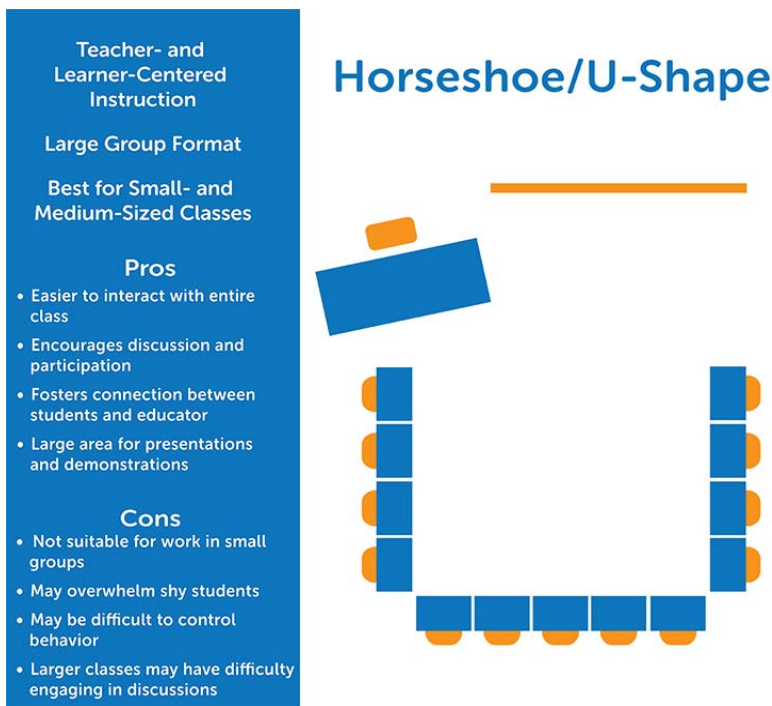
Figure 16: Configuration of Horseshoe Seating Arrangement.

Source: Effective Classroom Seating Arrangement, 2020.

Other seating arrangements exist such as the **roundtable** arrangement, **double horseshoe, group pods and pair pods.**
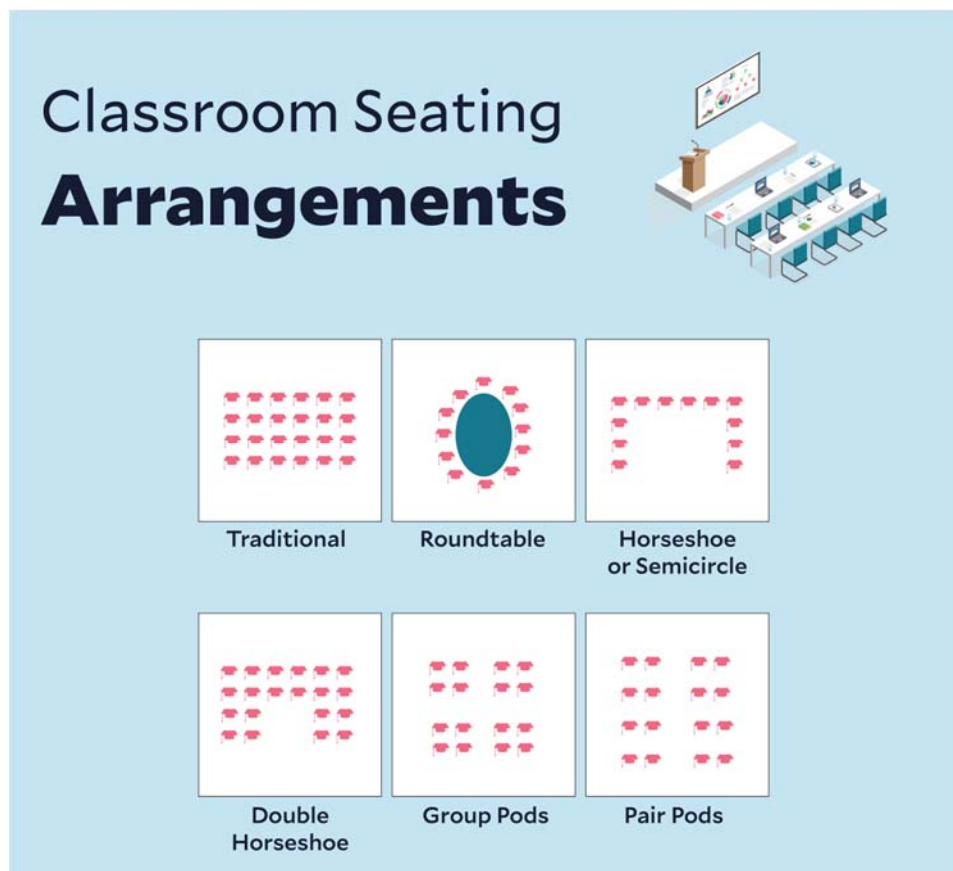
Figure 17: Six formats for Classroom Seating Arrangement.
Source: Yale *Poorvu Center*, 2021.

The roundtable seating arrangement consists of a teacher and the students placed around one large rounded table. This format can be also created using individual tables. Teachers and students all face each other in such setup, which supports a whole-class and a peer dialogue.

The double horseshoe seating arrangement compromises an outer and an inner horseshoe, also, similar to the traditional horseshoe arrangement, the following incites greater

class discussions than the conventional format. There is more limitation in this type of arrangement since the backs of scholars inside the inner set faces scholars of the outer set. Yet, they may easily interact and cooperate more with the ones closest to them, or turn and face pupils behind them when it comes to group activities.

The pods seating arrangement can be done in groups or in pairs. The pair format can be created with circular, rectangular or trapezoidal desks, also with individual tables. Regarding stations, teachers are able to place numerous tables together in order to form pupil groups of 3-4 students, or pairs. Such arrangement is particularly considered advantageous and constructive when pupils work in pairs or groups with one another for a long class period. This format communicates a learning society where learners are anticipated to work together (Yale Poorvu Center, 2021).

CHAPTER 5 RESULTS AND ANALYSIS

5.0 Introduction

This chapter tackles the analysis, the results and the evaluation of the questionnaire as they are reported and stated based on topics and themes that are used in order to cohesively categorize the various segments of the questionnaire. A first section on Lebanese public schools' classrooms is tackled as also it includes sub-sections related to the physical setting/environment of the classroom including matters such as; the furniture (desks and chairs), place management, innovative tools, technological aspects, acoustic, ventilation and lighting conditions, the finishing (walls, ceiling, tiles), and class layout.

A second section addresses the notion of "optimum classroom" physical environment, management and layout in order to have an understanding about my contribution in this study

research and its process of design thinking. Throughout this chapter, survey responses excerpts are incorporated for adding context and depth to the questionnaire's statistics and results. Pseudonyms are employed when referring to the respondents, as their identities will remain anonymous. The excerpts from the open-ended questions about their classroom's environment are correspondingly included to provide additional insights on Lebanese students' perceptions of their own classroom, their disclosure and experience to content and/or discontent depicting it in their answers, and also the potential of framing the class as a "substandard" educational destination for academic achievement and a pleasant constructive emplacement.

5.1 Survey Analysis
5.1.1 Representation of Lebanese Public Schools and Its Students

From the survey created for this study's objective, specific notions and parameters were extracted and inspected in the form of statistical numbers and graphs, as well as excerpts and quoted responses. Analyzing how the respondents (the students) perceive their own classroom allowed me to see from their point of view the positive and negative features of their classroom. Responses of 76 completed surveys were assessed for the findings emerging from the data analysis to be formulated at later stages in order to affirm the proposed hypothesis "There is a significant relationship between the physical classroom environment and the high school student's learning". Analyzing this survey and its results build a representation of Lebanese public schools' classrooms and how the students of the school identify it, feel about it and how it affects their motivation and learning outcomes. Below every segment of the questionnaire is categorized into sub-sections analyzing each key component found within the physical environment and setting of the/their classroom.

5.1.2 Furniture Setting and Place Management

In the questionnaire, students were asked about the furniture of the classroom, their setting and management within the class, and about the comfort of the chairs and desks when used. First, when asked if the desks in their classroom are comfortable and spacious enough when it comes to writing and taking notes, the majority (90.48%) of the students responded with a 'no', whereas the rest (9.52%) were content with their class furniture and found them rather commodious.

Do you think the desks in the classroom are comfortable and spacious enough - when it comes to writing and taking notes?
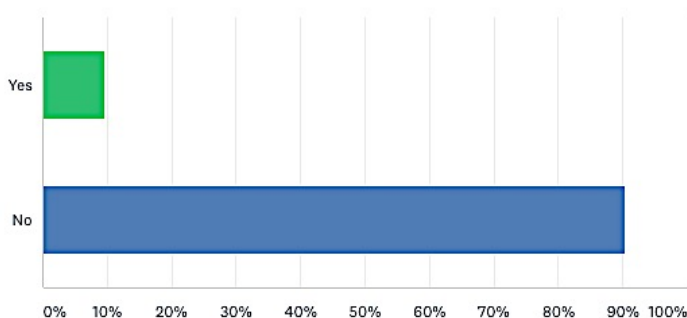
ANSWER CHOICES	RESPONSES
Yes	9.52%
No	90.48%

Figure 18: Graph demonstrating students' responses about desk comfort, in %.

The question is followed by a sub-question to also ask and understand if the chairs are ergonomically comfortable when sitting, for this, 14.29% answered with a 'yes' and 85.71% answered 'no'. This means and demonstrate that as a main physical component within a classroom of Lebanese public schools, the furniture, are poorly accommodating students during long lesson hours, making them unable to feel comfortable and able to focus through a whole session.

-When it comes to the seats when sitting?
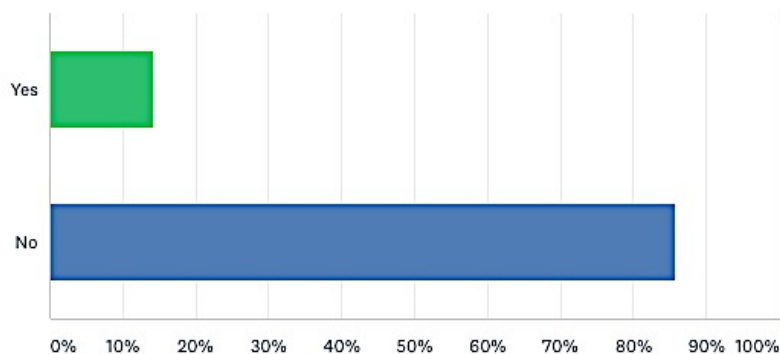
ANSWER CHOICES	RESPONSES
▼ Yes	14.29%
▼ No	85.71%

Figure 19: Graph demonstrating students' responses about seating comfort, in %.

Studying a classroom's purposeful furniture does not only stand at the aspect of comfort, ergonomics and spatiality, but also how it is managed and arranged in class. It is correspondingly important to consider that the organization of the furniture within a classroom can also be related and affected by a classroom's size and density; public schools' classes sometimes tend to be overcrowded, hence affecting a physical environment's setting and furniture arrangement. For this, respondents were then questioned if they believe their own classroom's size is adequate and fair when it comes to its dimensions, to which a number of 71.43% answered 'no' and 28.57% found it actually sizeable enough as a classroom space capacity.

For a further understanding about their perception of classroom size and density level; the survey's next question asked if the students think their classroom is large enough for the number of scholars enrolled in this room; 71.43% think their classroom is not large and spacious enough to handle the amount of scholars in the room, and 28.57% considered their room convenient and sufficiently good-sized. This question was inquired to understand if desk and seating

arrangement within their classroom is adequate and fitting. Accordingly, the next inquiry asked

the statement above; a combined number of 85.71% did not see their desks and seating

arrangement appropriate and satisfactory. On the other hand, 14.29%, a below the average

number, were pleased and found their desks arrangement suitable.

Do you think the arrangement of seats and desks in this classroom is appropriate and adequate?

ANSWER CHOICES	RESPONSES
▼ Yes	14.29%
▼ No	85.71%
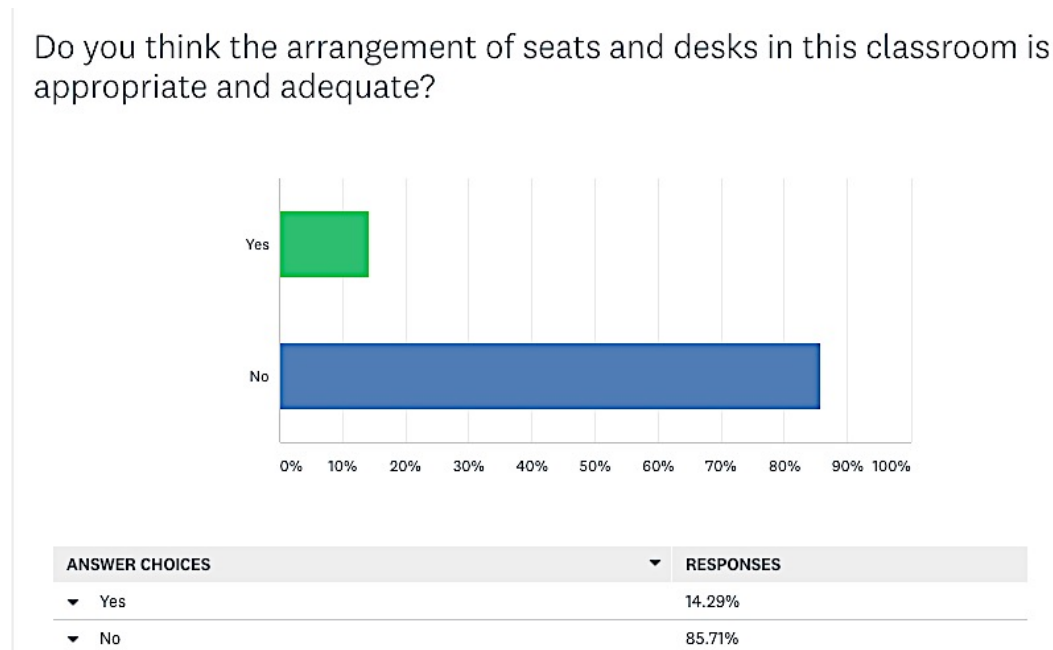
Figure 20: Graph demonstrating students' responses about desk and seating arrangement, in %.

Whether the desks arrangement within the respondents' classroom was satisfactory to

some and dissatisfactory to others, it was important to see if their placement was helping in

improving interactions between students, no matter if the furniture is placed and managed

adequately inside the room or not; For this, scholars were asked if that was the case. A trivial

difference of 20% in opinions was noted as 60% of the students believed the furniture place

management was facilitating interaction and communication between each other, whereas the

other portion (40%) did not think so. As it was mentioned in the literature review, interactions

between students can affect a student's academic achievement positively at some point since

more cooperation and collaborations are generated. Yet, on the other hand, interactions can also

affect negatively learning outcomes as they created disturbance in class, disruptive behaviors and distraction. Thus, to have a better understanding about these improved interactions that were engaged by the place management of desks and seats, students were asked if these exchanges were affecting them positively or negatively when it comes to their learning outcomes. A combined 80% of respondents claim their academic results were affected negatively, while the rest (20%) answered with negatively.

Is the furniture (the desks) place management helping in improving interaction with other students?
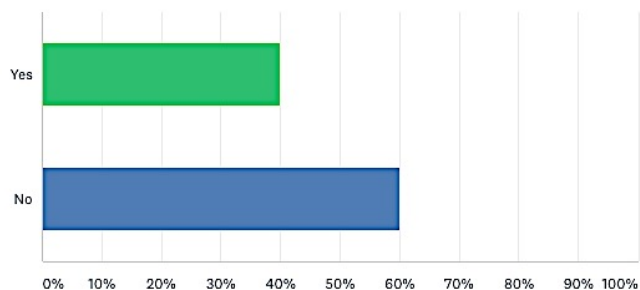
ANSWER CHOICES	RESPONSES
Yes (1)	40.00%
No (2)	60.00%

Figure 21: Graph representing students' responses about furniture place management improving interactions, in %.

And does it affect you positively or negatively when it comes to your learning outcomes?
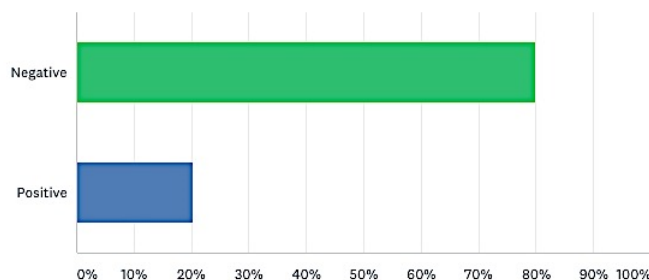
ANSWER CHOICES	RESPONSES
Negative	80.0%
Positive	20.0%

Figure 22: Graph representing students' responses about furniture place management affecting their learning outcomes positively or negatively, in %.

In review, student responses confirm and verify that Lebanese public schools' classrooms do not enclose comfortable and suitable desks and seating, notably when they are in use, and consider their arrangement and place management within their class is poorly adequate. The institution does not take into consideration the classroom's spatiality in order to conveniently manage the furniture inside it for better learning outcomes and high academic achievements. The analyzed statistical results also validate how important it is to carefully manage the classroom and the desks as they produce interactions between scholars. However, these interactions were not improved as it majorly affected their academic results negatively. On occasion, students compared and answered the inquiries to beliefs and views they hold towards public schools and its poor infrastructure. However, such representations are experienced by each respondent personally and result in such answers, mainly negative reactions. In the upcoming subsections, other physical key components related to their classroom's physical environment, and in which way they suit, fit and affect their knowledge, impressions and motivation, will be broken down in detail.

5.1.3 Acoustics, Lighting and Ventilation

Other key features affecting student's learning outcomes and motivation in class are acoustic conditions, natural and artificial lighting, and the openings and ventilation systems within an inclusive classroom. The followings were investigated by asking the students about each component to identify and discern if they are causing them some troubles in focusing and a distressing problem during class hours.

First, the survey inquired students about the noise condition within their classes as "Each room or other space in a school building shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use" and "The acoustic conditions and sound insulation of each room or other space must be suitable, having regard to the nature of the activities which normally take place therein" (Building Bulletin 93: Acoustic Design of Schools, 2014). Hence, respondents were asked if there is any disturbing noise coming from outside their classroom, to which a great gap (80.96% gap) was seen in its answer; the majority of students approved that disturbing sounds and external commotions were heard during lessons (mentioned by 90.48% of respondent students), whereas the trivial number of the rest (9.52%) had an opposing answer. This major gap in answers demonstrates that most of the Lebanese public schools' classrooms are not designed in ways that insulate external acoustic disturbances or have soundproof walls and partitions.

Therefore, the followed question was only intended to the respondents - which was the majority of them - that answered with "yes, there is a disturbing noise coming from outside the classroom" in order to recognize and correlate if such noise condition is associated with their focus and learning outcomes. As a matter of fact, most respondents (76.19%) do actually be of

the opinion that this noise condition is often a problem in their classroom and affects their

academic results.

Is there disturbing noise coming from outside of the classroom in this class?
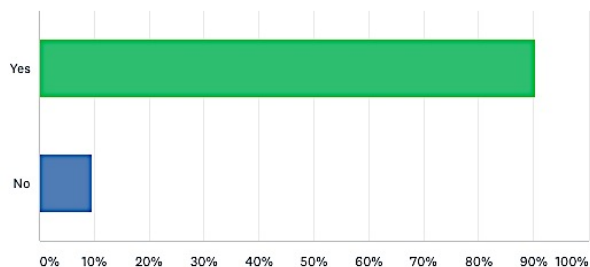
ANSWER CHOICES	RESPONSES
Yes	90.48%
No	9.52%

If yes, do you think this noise condition is often a problem in this class and affects your focus and learning outcomes?
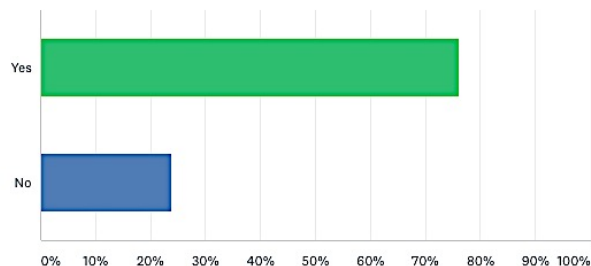
ANSWER CHOICES	RESPONSES
Yes	76.19%
No	23.81%

Figure 23: graphs demonstrating students' answers if an external noise condition is seen as a problem affecting their focus and learning outcomes, in %.

It is inevitable to completely insulate external noise disturbance, particularly in an

educational institution that encloses a great number of students. Furthermore, it is crucial to

mention how the majority of school buildings design the classrooms adjacent to the hallway, a

passage used regularly by students, teachers and schools staff. Hence, acoustic conditions within

a classroom are unavoidable and expected, leading to disturbance and student distraction. By means, the students' answers are validated, accurate, logical and biased or based on their beliefs or views about Lebanese public schools and the reputation they hold within the Lebanese community. Other sources of the physical environment of a classroom inducing external noises are the ventilation systems (fans, exhaust fans, mechanical ventilation systems…) and window openings (natural aeration). Since the studied survey answers are of students enrolled in Lebanese public schools located in Kerserwan, which is considered a city, most of the schools edifices are located next to main roads, neighborhoods, and active streets. The commotions such as car honking, particularly noises that include voices, and other sounds are affecting students during class hours, leading to student distraction and discomfort, "Noise has been shown to profoundly impact reading, writing, and comprehension skill learning, as well as overall academic performance" (Melina Uncapher, 2016). The following openings not only correlate with acoustic conditions, but also indoor air quality. "To improve students' learning performance and to reduce the risk of health problems, ventilation may help minimize students' discomfort" and "The current ventilation rates in classrooms are still inadequate and lower than office and residential buildings" (Gao et al., 2014). This important segment is also mentioned in the survey since "Inadequate ventilation can cause an increase in absenteeism, which is a negative consequence to impact learning" (Mendell et al., 2013). Since Lebanese public schools are known to be poor in their infrastructure, low in classroom resources, and inadequately funded by the Lebanese government, it was important to ask students' if "the classroom has enough openings and windows for efficient ventilation" to which 53.38% answered 'yes' and 47.62% answered 'no'. Complaints about the ventilation systems and indoor air quality were mostly mentioned in the open-ended questioned.

Window openings in a classroom do not only help with natural aeration, but also incorporate natural light. As mentioned in the previous chapters, lighting –natural and artificial- are important key factors to the classroom environment and student's well-being. According to many studies, natural light has shown to enhance and benefit pupils' health, test scores and concentration if it is correctly incorporated for an effective classroom lighting scheme.

Unfortunately, "It is not always possible to incorporate completely natural light into an existing classroom due to architectural constraints" (Innova, 2014). It is also essential to implement the right quality and amount of artificial lighting inside a classroom as "Low illuminance has been linked to slower reading, reduced concentration, poor posture and long term weakened vision. An excessive variation of illuminance can also be an issue – this has been shown to actually reduce visual performance, causing discomfort and hyperactivity. A level of *uniformity* needs to be achieved to avoid excessive contrast and distraction" (Innova, 2014). Accordingly, students were asked if the lighting condition in their classroom, artificial and natural lighting, is adequate during lecture, audio/visual presentations, and other class activities. A combined 57.14% did not think the lighting scheme inside their room was enough and adequate, whereas the rest (42.86%) saw it differently.

5.1.4 Finishing and Visual Items

A classroom is embodied using three main architectural structures: a ceiling, floor (tiles), and walls. The followings create and build a concrete room for its consumers to inhabit or use it. Correspondingly, these three physical elements should crucially be in their pre-eminent and best conditions. International assessments determined that the Lebanese public schools "lag behind the average for other countries at a similar level of development when it comes to learning and the establishment" (Abby Sewell, 2020).
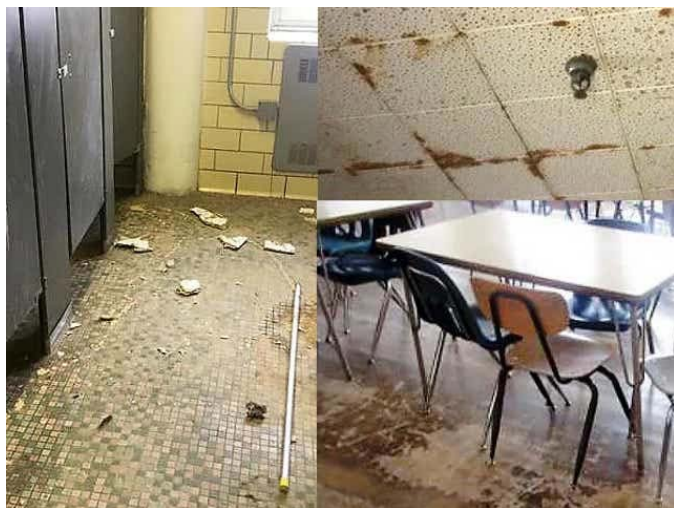
Figure 24: Photographs of Lebanese public schools in Kerserwan, grades 10 & 12, showing damaged finishing work, 2019.

Source: The Monthly, Public Education in Lebanon: Facts and figures, 2019.

For this, students were asked if their classroom's finishing work is in good condition; 64% of students, which is the majority, claimed to have their classroom's ceiling and tiles in bad condition.

Are the classroom's ceiling and floor in good condition?
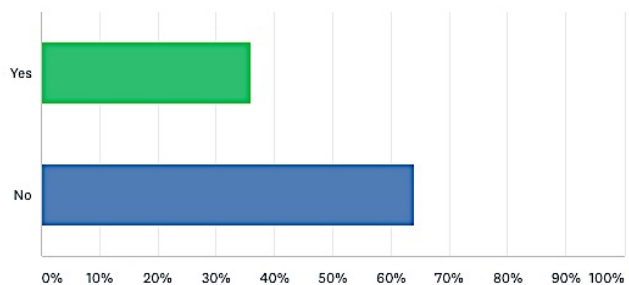
ANSWER CHOICES	RESPONSES
Yes	36.00%
No	64.00%

Figure 25: Graph representing students' answers about their classroom's ceiling and floor condition, in %.

The survey later inquires students about the walls of the classrooms and their functionality and purpose; as walls are structural elements used to enclose, divide and mainly to shape the periphery of a building or a room. Moreover, walls have other purposeful aspects such as holding insulation (temperature), hiding ductwork and electrical wires, providing sound barrier, partitions... Also, walls induce an atmosphere and a general mood in a room if they were used esthetically: displaying posters, artworks and class works, implementing colors by painting them, adding wallpapers, implementing different materials, install wall units and shelves, bulletin boards and collage kits and so on. This can induce positivity and a mood board within the classroom, hence broadening the minds and creativity of scholars. However, as esthetics in a classroom can be seen as a "good view" inside an inclusive room, esthetics matter but learning matters more; is it just decoration or distraction to students? Accordingly, the survey asked

students about the walls and other visual items and if they see themselves often distracted by them. Students choosing the 'yes' option were later on asked to define what are those visual items distracting them during class hours. Consequently, when they were asked if the classroom's walls were functional and had purposeful usage, 52.38% answered with 'yes' and 47.62% answered with 'no'. Then, a great gap (of 61.09%) in opinions and answers was seen as 80.95% of students mentioned that they have not been distracted by other visual items or any other physical element in their classroom. The other 19.05% of students who claimed to be distracted during class hours were asked to define the factors leading to their distraction; Walls, posters and drawings, windows, flickering lights, and bright colors, were amongst the most mentioned elements by high school students.

Are you often distracted by other visual items or physical elements in this classroom?
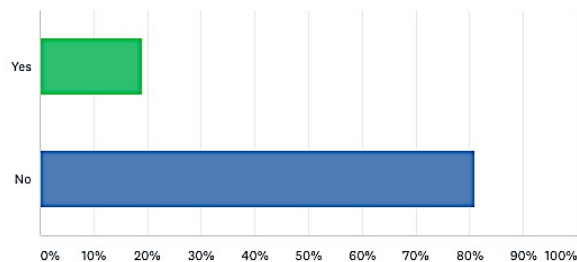
ANSWER CHOICES	RESPONSES
Yes	19.05%
No	80.95%

Figure 26: Graph displaying students' answers about being distracted by visual items in the classroom, in %.

-If yes, define the item:

The walls, windows, curtains, drawings on side board, posters, pencils, posters, hanged papers, the window, flickers of lights, the fan, lights, windows view, posters in class, the color yellow, posters, school bag between my legs, pencils, windows, drawing on the backdoor, the lights, bright lights, bright colors of drawings, strong bright lighting, the noises from outside, pen papers, students chatting during class, unstable desks, posters, the openings, flying curtains, the view from the window, pens, colleagues talkings, whispers, drawings, the color red and green

Figure 27: Students' answers when asked to define the element distracting them.

As a result, the statistical graphs and students' answers helped in shaping a better understanding of Lebanese public schools' classrooms and the resources they lack. As most of the responses were negative and the pictures above of the classrooms (of Lebanese public schools), this has led the researcher to analyze the data and recognize three main issues:

- **The ceiling:** Stained, cracked, bowed, sagged, buckled, discolored… Signs of a ceiling that is damaged or in bad condition due to low maintenance and/or poor infrastructure.

- **The floor:** Tiles are cracked, dislodged, broken or popping…Signs of flooring that is damaged or in bad condition due to low maintenance and/or poor infrastructure.

- **The Walls:** Paint peeling, chipping, cracking, paint flacks…Signs of wall painting that is damaged or in bad condition due to low maintenance and/or poor infrastructure.

The followings validate the reputation these Lebanese public schools hold. Such basic structural elements ought to have clean finishing work that is in its best condition and frequently maintained for a durable life span. If not, these adverse conditions might affect students' well-being, motivation and learning outcomes as "Poor building conditions may contribute to these problems, resulting in greater school absenteeism or poorer performance. However, few studies have evaluated associations between school building conditions and student absenteeism" (Elinor Simons & al., 2010). This analysis demonstrates how a whole building can impact its occupants, which shows and supports the importance of the notion "inside-out design".

Unlike the negative responses about the finishing work conditions, visual items and other physical elements within a classroom did not affect students' focus and learning achievements. This created an association between esthetics and functionality, as well as esthetics and learning.

Accordingly, posters and artworks hanged on walls are tools that allow visualization in a classroom for student learning to be fostered. Visual displays of information can be used as a support tool that provide the opportunity to link visual learning and guidelines with lectures, textbook readings and homework assignments. Thereby, posters that are created by scholars to visually exhibit a developing research, a meaningful course project, or particular perspectives to the class to consider (Yale Poorvu Center for Teaching and Learning, 2021). Based of the data collected from the survey, it is recommended for instructors to implement posters and visual displays in the classroom by using what we call "the backward design process" so they develop with students a poster activity that aligns with course leaning results. Examples that can provide approaches to such strategy are the followings:

- **Timeline Posters** (historical figures)

- **Before and After assessment of knowledge posters**

- **Class Brainstorm posters**

- **Summary of main ideas posters**

- **Diagram of process posters**

- **Concept Map posters**

- **Problem-solving posters**

Hanging posters and students' artworks in the classroom enhance motivation and positive behaviors. However, through the respondents' survey answers, it is determined that esthetics do not affect learning and do not prompt distraction. Yet, it is important to mention that 57 out of 76

respondents were not affected and distracted by visual items since their classroom lacks these features and Lebanese public schools' teachers do not give importance to them (wall displays, posters, colors, visuals…).

5.1.5 Technology and Innovative Tools

Another key factor in Lebanese public schools that is not given significance and is highly absent within a classroom or the building's facilities are technological devices and innovative tools such as computers, smart boards and tablets for educational purposes. Nowadays, taking into consideration the prodigious developments of smart technology in all its aspects and its fast widespread amongst scholars in Lebanon, it is important to study this key feature as this new generation of students uses the Information and Communication Technology to a great extent. As the students enrolled in Lebanese private schools gained the chance to practice class courses using new technology, notably tablet for educational purposes, their motivation and desire to attend classes and gain knowledge could possibly increase (Farah Zain, 2016). Hence, it is essential to enhance and develop today's teaching ways by making use of these new learning technological devices. Thus, integrating such type of technology tools (tablets, smart board, projectors, computers…) into Lebanese public schools learning process and among high school students became an essential aspect to explore and examine.

On that account, students were asked if their classroom lacked innovative equipment (projectors, computers, tablets…) and if it is considered as an "outdated" classroom regarding such contemporary learning methods. The majority (84%) saw these tools and devices absent from their classrooms. The student's answers hence show the lack of innovative resources in Lebanese public schools. Moreover, integrating tablets and computers in a classroom will increase students' satisfaction and engagement with learning and the school, as also it is a more

enjoyable way to gain knowledge. Therefore, respondents were also inquired if, in their opinion, they think such forms of technology would improve their learning outcomes, to which 92% of them answered with a 'yes' and an insignificant number of 8% answered 'no'. This indirectly demonstrates how much students are eager and enthusiastic about implementing this kind of technology into class curriculum.

Given nowadays classrooms are equipped with innovative tools such as computers, smart boards, and projectors... Do you think this classroom is lacking or outdated regarding these contemporary learning methods?
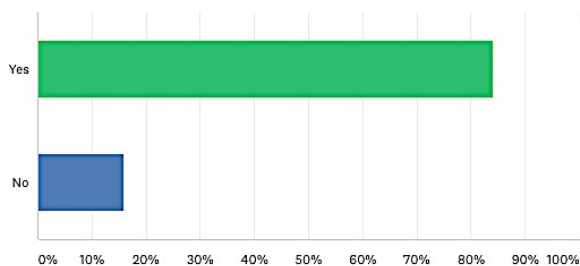
ANSWER CHOICES	RESPONSES
▼ Yes	84.00%
▼ No	16.00%

Regarding the previous question, do you think access to these technological aspects would enhance your learning outcomes?
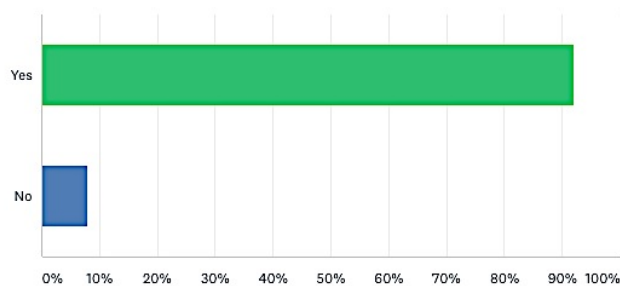
ANSWER CHOICES	RESPONSES
▼ Yes	92.00%
▼ No	8.00%

Figure 28: Graphs demonstrating students' answers about technological devices, in %.

It is important to mention, considering that Lebanese public schools extremely lack technology devices within their classrooms and the institution, how much "technology's integration into education is a remarkable fact all around the world" (Wang & Reeves, 2004). Studying the usage of technology for educational purposes has increased highly in importance since it is considered to improve and expand the capabilities and skills of both students and instructors (Saba, 2009). According to Ismael & Al-Badi (2014), the latters believe that technology enhances teachers' instructing style, as also it improves students' learning experience.

5.1.6 Open-ended Questions

The survey leads up to an ending question about students' satisfaction about their inclusive classroom's environment to which, the majority (80%) claimed that they are not satisfied with the physical environment of their classroom. The rest (20%) were overall pleased with its physical condition.

In order to have a better understanding as to why students perceive their classroom in such ways (content/discontent), open-ended questions were inevitable in this case. This leads students to elaborate more and voice their concerns, views and feelings towards Lebanese public schools' classroom environment and condition. The followings help the researcher to progress in her investigation for a stronger and fitter contribution that answers their needs and desires in the most efficient and effective way possible. For that reason, respondents were asked about the necessary elements - in their opinions - that should be improved, added or removed within their classroom when it comes to their educational learning.

Hence, each student's response was extracted and categorized into tables summarizing the necessary elements to be improved, added and removed within the classroom. The first table conveys the elements that should be improved.

Furniture	Technology	Spatiality	Finishing
Desks and seating*	**Use of technology systems***	Interior Design	**Lighting (natural and artificial)***
Desk management and organization	**Learning tools (tablets, E-board, E-books and computers)***	**Spacious room (adequate size for student number)***	Ventilation (heating/cooling systems)
Board		Interactive walls	Tiles and ceiling

Table 7: The necessary elements that should be improved within a classroom, based on students' answers of the survey.

* Sections highlighted in Bold are the most recurring answers.

The following table summarized students' answers about the elements that should be improved within the physical setting of their classroom. It was sectioned into 4 main categories, based on the mentioned elements: **Furniture, Technology, Spatiality and Finishing**. The highlighted sub-categories are the most recurring answers of the students. Analyzing the table, we can conclude that when it comes to the furniture aspect, students mainly complained about the desks and seating being uncomfortable and badly managed in the room. Elie's description of these elements sums it up:

"Desks should be more practical for the students because they are in a really bad condition when it is about the shape, form and material. The wood and steel materials are very uncomfortable for us to use and write. […] Desks should be more comfortable and organized to have better interaction and engagement in class. In our class, tables are broken and damaged. […] The chairs creak on every movement".

The ergonomic shaping of furniture and their organization within a classroom do not solely affect students' learning and focus, but also their physical health and well-being. Moreover, desks conditions and organization are also correlated to other physical aspect of a

classroom's setting, creating another problem for students. Christine even goes as far as saying

that:

"For me, the arrangement of our tables and chairs are not ideal for a classroom organization. The problem in this class is not about our furniture's condition itself, but how it is affecting us, even physically and healthily. […] I am someone that sits front row to focus better. However, as someone who has allergies, each time the board is being erased, my allergies are getting worse. Therefore, in my opinion I think we should manage our classroom seating arrangement in another way to be ideal for students in my case."

The furniture of a classroom should not only be comfortably accommodating and in good

condition, but also practical and functional; they should combine convenience with function, and

their configuration should be multi-functional. Flexible seating and desks should include

considerations such as physical abilities, posture, adaptability, and storage compartment to opt a

practical solution. These features, if not considerably measured, can affect a student's wellbeing

and posture (Colleen Beck, 2019). Jad's description of these characteristics sums it up:

"[…] The desks in our classroom are very basic and for only one purposes which is writing or taking notes. You can find a lot of desk shapes and styles in other schools; of course I'm talking about the private schools. For example, our desks don't have a storage box under it to put our books and other stuff. […] This is my last year before I leave to university, so we have a lot of studies and books, and since we can't leave some of our belongings in class, we have to take everything with us, which is making my school bag feel very heavy on my back and causing me back pain all day".

Raphaella adds:

"Our desks are not large enough to hold supplies, books and other personal belongings. The surface is limited and not suitable enough for a desk to work on tasks during hours […] Seats and tables are broken, useless […] The chairs are really uncomfortable, my hair always sticks to the back of it because of the screws and cracked wood".

Lastly, Imad states:

"The furniture is never organized properly, it is very chaotic and it is a mess in my classroom. There is no comfort and physical safety when we are sitting or writing. Some chairs are even unbalanced and this makes me want to swing and move during the whole session".

The following statements demonstrate the problems students enrolled in Lebanese public schools are facing; the furniture within their classroom are not functional, practical, comfortable and suitable for learning tasks. An important component of the learning setting oftentimes counted out from studies about physical structure of classrooms is the type and configuration of seating within the class (Alicia Stapp, 2018). Studies imply that scholars that are expected to stay and spend prolonged hours sitting in conventional desks and chairs with limited movement recess breaks during school days are prone to increased off-task behaviors and inattention to acquiring (Wingrat & Exner, 2005). Hence, it is crucial to consider the furniture aspect in the contribution in order to optimize a constructive inclusive classroom.

In addition, another physical feature to review is technology. Innovation and technology were mentioned regularly and to a great extent. Knowing Lebanese public schools lack the technological systems and tools in learning environments, students complained about it and were eager to implement it in their curriculum. The term "Digital Native" was first adopted in 2001, by Marc Prensky; it is nowadays used to designate this new generation as they dwell in a "technology-saturated environment" (Morgan, 2014). Accordingly, it is unsurprising for students to ask for technology implementation within their class learning systems. Tablets, computers, and E-boards were the most common technological tools/devices requested. The reason why these components were oftentimes mentioned by the students and seen significant in the learning sector is because, as Omar puts it:

"We need more modern ways, for example computers and tablets, to enhance our learning experience. If you visit private schools, you can directly notice that they are more advanced than us in their learning ways and it is more fun and engaging for both, us the students and the teachers. You can say that it also creates motivation and interaction between us and the teacher, which I really think should be the case in our classroom, because we truly are seen as outdated and 'stuck in the past'. […] We should give importance to education and its ways of forming students because this stays with us on the long-run".

As technology nowadays is playing a big share in our lives, educational institutions are pulling an effort to make usage of it to offer a superior learning experience and environment for the students (Agostini & al., 2010). According to Morgan (2014), it is believed that when instructors use student's technological skills assistance, as well as when they guide them to achieve their tasks using innovative tools such as tablets, excitement and interest is sensed frequently within the classroom. Moreover, Manuguerra (2011) considers the 'iPad' now as a tool for engagement, inspiration and motivation for tutors throughout its developed performance features and communication means. The latter also believes that such device reformed the pedagogical approach since it simplifies students' learning experience, yet it makes it deeper. Nour's answer compliments the following statement. She said:

"I prefer if our school starts being familiar with E-books instead of carrying books and notebooks that are heavy for our backs, and it releases the stress of forgetting a book at home or in class. It is not necessary to have computers and expensive devices like the laptops, but at least each 2 or 3 students can share an iPad or any tablet and enjoy working in groups and discovering new learning ways through technology. I personally would be motivated and excited to go to school if we were using iPads and E-books during our courses. Let's say it's a change of scenery and an innovative way to understand, instruct and even learn".

Joe adds:

"I think it would be nice if we had projectors and an E-board. Every time we had to present a task in front of the whole class, we had to stick papers or even write the highlights on the board to present. Touching a screen, sliding the pages and presenting my topic with pictures and an automatic screen can really improve my presentation, motivates me and boost my confidence to show my work in front of a whole class. If our school cannot afford computer labs, laptops or TV... I think the least they can integrate within a fair budget, are tablets and smart boards".

One student's health case demonstrated the benefits and advantages of implementing technological elements such as a smart board when she voiced the following statement:

"I am a student that has allergies, so since our classroom has a chalkboard, every time the teacher or any student erases it, the chalk powder and the dust is affecting me in a bad way. So I am obliged to sit at the back of the classroom, which is affecting me a lot because I am no longer focusing on the lesson, or fully hearing the teacher, or even getting a clear vision of what

our teacher is writing on the board… It's too far for me and so, I am having more interactions and conversations with my classmates at the back. So, if our classroom uses a smart board instead of the traditional board, that would be great for someone like me and the whole class […] Just like the International College (IC) private school, they have a smart board, even school apps like E-learning, E-portfolio and Moodle".

For this, it is necessary to understand the importance of technology in education. As we live in the 21st Century, the meaning of a classroom that is well equipped technologically has reformed, and the challenges still arise correspondingly. Projectors, computers, smart boards and various other devices are being used to improve learners' experiences. Nonetheless, since the emergence of handheld tech devices such as the iPads (in 2010), educational institutions (such as Sabis and IC private schools) began paving their ways into implementing them into their curriculums. In fact, each new technological device - on it own – offers the learner a different and new learning experience (Farah Zain, 2016). Vu (2013) expects that tablets will replace not only computers and desktops, but also the books within a classroom; while the followings not only replace printed sheets, they also increase teaching resources' availability and communication.

However, when initiating such curriculum, students must understand that when the tablet is in their hands, it is used for educational purposes only and for the idea of enhancing their learning experience since a device like this stores games, camera, applications and wireless connections, which can generate distraction in class. It is argued by Karsenti & Fievez (2013) that there is no "foolproof classroom management strategies" when using tablets in a classroom. In order to avoid this, the school can offer a classroom system management where teachers are able to control students' tablets, just like in the UAE. Thus, tutors can ensure that students are doing what they are expected to carry out (Ali Syed, 2013). Additionally, instructors are able to teach easily and move around when using the tablets. As also, he/she can grab students' attention

while moving around and monitor their work. In times when tablets are not in use, they have to

be kept away under the tutor's supervision.

Moreover, the spatiality of the classroom was another aspect students believed it should

be improved within their classroom. Specifically, students asked to have a spacious room that

can hold enough students, and the size of it to be adequate and suitable; as Gaelle mentions:

"I'm not sure about other classes but ours is really overcrowded. A lot of students come
to our school in the last 2 years or fail their classes and end up in ours. We are basically 31
students in a small classroom. Sometimes we have to share desks to have enough space for
everyone. For me, this is a problem my own class should fix. This is causing the students sharing
desks in the back to talk a lot. […] I have official exams and the noises are distracting me a lot."

Yara, complaining about the same issues, adds:

"This is an important year for us, we should find proper ways to be motivated and
focused! The size of the classroom is not allowing us to be comfortable and manage an
acceptable number of students. It's a problem that should be fixed as soon as possible because an
overcrowded room is causing disturbance and commotions […] it's affecting us a lot during
lessons".

A space used frequently by its users should be visually pleasing, functional and

engaging. In this case study, students should have a room that is constructive and enhances

learning experience. Such space can be created using print-rich walls such as interactive walls

and word walls in order to improve literacy and education development of students. Interactive

word walls are effective literacy and learning tools that can potentially enhance the vocabulary

learning of older students if opted in combination with instructional effective practices (Harmon

& al., 2009).

Various studies show evidence of how much print-rich (books, reference resources,

bulletin boards, word walls, posters) settings are important in classrooms, and how such

environments are connected to pupil achievement (Neuman, 2004; McGill-Franzen & al., 1999).

Methodology books for student learning in upper grades also discuss the significance of

classroom wall libraries (Vacca & Vacca, 2005). Interactive and word walls used in different

various ways in higher grades can be effective and beneficial for high school students:

challenging words to spell can be displayed, mathematical symbol can be illustrated, historical

terms can be categorized for scholars to remember (Harmon & al., 2009). Elias, who used to be

enrolled in a private school, shared his perspective about his classroom's spatiality when it comes

to functionality and interactive walls. He said:

"We should see the classroom as a functional space that has a purpose, the purpose of educating and instructing. It is a constructive place were us the students want to develop and be prepared for the next step of our lives. I personally suggest, not to renovate or change the whole space, but at least to have interactive walls were we could hang some projects or information related to our studies, because if they are always displayed in front of us, we will eventually memorize them mentally and visually. Also, these walls will help to esthetically change our room and create an enjoyable scene".

Hence, the implementation of interactive word walls within an inclusive classroom is a

feature to consider since such instructional design wall does not only have an effective literacy

development, but also other significant components including social interaction, student

engagement, choice, ownership and motivational factors (Gambrell & Marinak, 1997). For high

school students, such instructional intervention can broaden and deepen vocabulary knowledge,

maintain and develop awareness, motivation, and interest to learn new terms; in other words,

word walls promote vocabulary consciousness and awareness (Scott & Nagy, 2004).

Lastly, the finishing elements of a classroom were also mentioned by the students.

Associated materials are of great importance for a clean and long lasting finishing, which is not

the case in Lebanese public schools. Broken tiles, damaged ceilings, cracked wall paint,

splintered doorframes were the most recurring elements mentioned to be in a bad condition in a

classroom. Aya said:

"The ceiling in our classroom is damaged, therefore we can't use the AC for cooling or heating because it drips water and makes noises if we turn it on […] and the tiles in the room's corners are broken. We have to wear our jackets the whole time and this is quite annoying us when we need to focus or write some notes."

Additionally, students complained about the lighting condition inside the room, as Mario puts it:

"The natural light in our classroom is okay. There is enough lighting coming inside the room, but the artificial lighting is bad. It's a very warm color, more likely a yellow to orange color that is affecting my eyesight. […] Even when I'm wearing my reading glasses I can't seem to focus because I just feel sleepy. I prefer if our school adds white color lighting so we stay awake and alerted".

As natural lighting (daylight) increase visual acuity and impact schools and student's wellbeing, performance and development, so does the artificial lighting within a classroom, "Light is the most important environmental input, after food and water, in controlling bodily functions" (Wurtman, The effects of light on the human body). Nevertheless, artificial lighting must supplement it since today everyone is exposed to artificial lighting more than the natural light (Veitch, 1997). Hence, lighting implication is an important factor for students learning as it affects their functioning, behavior and concentration.

For several years, (public) schools use fluorescent lighting since it provides efficient energy and high illuminance for the classroom environment, as also they have developed to incorporate full spectrum lamps simulating daylight. Yet, recently, light-emitting diodes (LED) have been the forefront lighting because of their longevity, efficiency and capability to deliver smooth, unbroken and full spectrum (Morrow & Kanakri, 2018). Researches have demonstrated major growth in positive behaviors and perceptions within tasks and classroom environments when LED fixtures with high CCT (correlated color temperatures) are incorporated; notably, they have shown positive engagement as well as a major increase in student on-task behavior (Dydell, impact of light on behavior). Hence, it is important to consider in the contribution the amount of daylight integrated and the best type of artificial lighting, which is LED.

It is recommended to use LED with a 4000-4500K color in working spaces that need concentration, such as classrooms, libraries, offices and meeting rooms, since this lighting color approximates sun and daylight color in order to create a calm and serious atmosphere, and to protect the eyesight and visual acuity maximally in comparison to other CCT. Generally, panel lights or tubes lights (4000-4500K) are the best choices for schools, classrooms and workshops (UPSHINE, 2021).
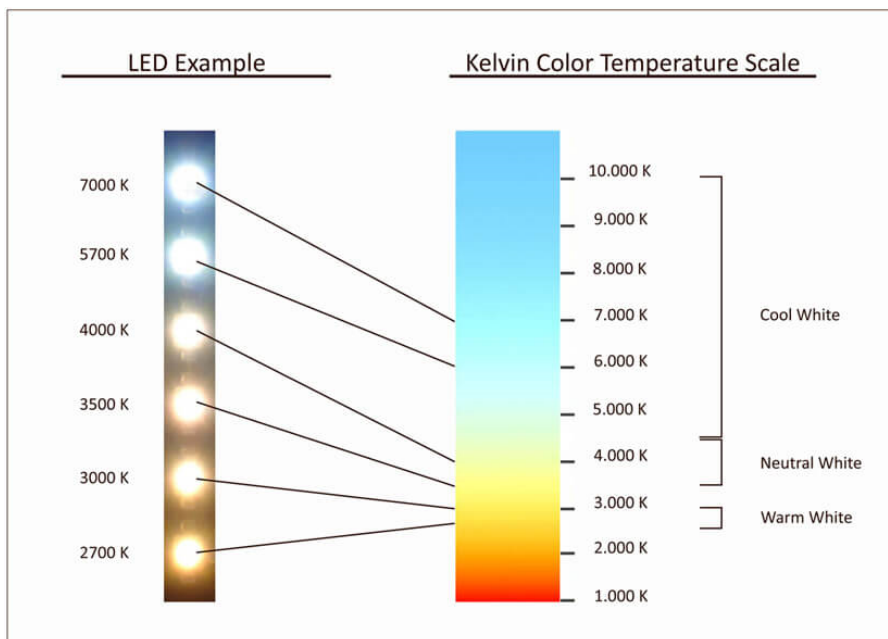
Figure 29: LED Lighting Kelvin Color Temperature Scale Chart.

Source: LED Corporations, 2012.

Secondly, the survey asked students "what are necessary elements that should be added within their classroom", to which the answers were summarized in the following table.

Furniture	Spatiality	Technology	Finishing
New and comfortable desks*	Wider space for equipment	**Technological learning tools and devices***	**Light and warms colors for a mood***

Couches or benches*	Desk and room layout	Tablets, projectors, speakers, computers*	Cooling systems, AC, Ventilation*
Curtains and a clock to check the time	**Corner for interactive white boards***	Higher tech and screens	**Heating systems or a heater***
Management of chairs and tables/desks*	Posters, pictures and displays about school subjects on the walls	Whiteboards and digital boards	**Lighting (natural and artificial), LEDs and table lamps***
Lockers	**Wall units to arrange books and belongings***	Music	Acoustics, sound proof walls
Wider and bigger tables	**Flexible layout for collaboration, diversity and navigation***	School applications (E-learning, Blackboard, Moodle).	

Table 8: The necessary elements that should be added within a classroom, based on students' answers of the survey.

* Sections highlighted in Bold are the most recurring answers.

As it is not surprising for students to mention again the desks and chairs as a physical element to be improved, students indicated other types of furniture seating to be added in their classroom, as Marc says:

"Our classroom needs new desks that are comfortable and wide enough for us to properly write. But I would suggest adding in our classroom a couch, or beanbags or a bench with some cushions so we can use them during recess time or free time. This would be really interesting to sit on if we want to read or revise or just talk with friends when we have free time, since we spend recess in our classroom on the same chairs and desks that basically are not comfortable […] In a way, if that was the case, our mood will change and this will be a fun interesting experience in education!"

Moreover, students mentioned other interesting physical elements to complement their

room such as lockers and wall units. In fact, students' congregation and occupation in spaces

affect the context of "citizenship in education" and construction of identity (Jennifer Tupper,

2008). This notion of identity formation creates a sense of responsibility, ownership and

belonging to a certain environment. As previously mentioned in Chap. 3, one of the three design

principles to structure a space (classroom) is *Individualization*, which includes ownership,

flexibility and connection. The following dimension can be structured though visual elements

such as a wall unit, lockers or cubicles. Integrating such feature in a classroom not only minimize

students' back pain, but also engender a sense of identity formation, responsibility and

ownership; students will be able to arrange their books, store their belongings and personalize

their compartment. For this reason, the student will feel responsible about his school possessions,

and affiliated to his classroom. Subsequently, Sarah's response included these features when she

detailed:

"When I used to live abroad, my school in the USA had lockers in the hallway to keep our stuff […] it was surprising to see the schools here in Lebanon don't have them. I felt a bit lost and confused where to keep my belongings because every time we had to leave school I had to make sure I had all my books with me, and I had a small fear of forgetting something home. Having lockers in a classroom is really important because it makes you develop a lot of characteristics, for example you'll feel responsible, independent and even connected to your school, like it's your second home."

Another requested feature that students asked to be added in their classroom is a white

board, instead of a chalkboard. In fact, according to Poorvu Yale Center (2017), white boards:

- Make teaching more practical

- Increase a student's engagement

- Allow quick assessments

- Allow unplanned activities and tasks

- Elicit collective brainstorming

- Using markers makes the learning experience innovative, fun and exciting

- More practical for screen projectors than chalkboards

Thierry voiced the need to implement a whiteboard instead of the conventional chalkboard within their classroom when he said:

"I would like if we use white boards and markers because it makes the room feel more advanced and fun. We can easily write and erase the board if we are revising for our tests during recess. Also an important remark, white boards don't dust our clothes when we erase the chalk or dust the whole room. Basically, it helps with our wellbeing, health and class hygiene. Bonus: It's even more fun to always write with markers and use different colors".

Talking about colors, this necessary characteristic was articulated by many students since, based on their answers, classrooms of Lebanese public schools seem boring, basic and plain. As much as the white color on the walls in a classroom is crucial for many reasons, the integration of other colors is inevitable. Colors in a learning environment maximize knowledge retention, stimulate learning and elicit energy. Also, creating a specific mood through colors can promote focus and visual pleasure. The differences between spaces opting and not opting colors in the learning environment are presented in the following table:

Spaces with colors	Spaces without colors
The positive effect on students' morale	Causing tiredness and dull-ness in long hours
The positive effect on students' progress	Creating unwillingness for continuinag education
The positive effect on compatibility of students with the environment	Creating disinterest to the educational setting
The positive effect on reducing stress	Creating dissatisfaction
Creating a refresh-ing environment	Creating unattractive and boring environment

Table 9: Learning environment opting/not opting colors effect.

Source: Ahmadi & Tabaeian, 2017.

According to the table, spaces that are not colorful enough can cause dullness, tiredness and create an uninteresting environment, which most of Lebanese public schools' classes are about. Kamal, a student who loves to paint and is passionate about art, expressed:

"I am someone who is into plastic arts. I spend my free time drawing and painting, so I'm someone about colors and moods. Therefore, for me, our classroom is really boring and plain, it is just old white paint on four walls where at some points is cracked. I would suggest to add some colors like blue, green, red, etc. just to give the room some liveliness and dynamism."

Yara compliments Kamal's answer when saying:

"This classroom is so white and dull that it feels like being trapped in a prison cell or hospital room. It makes you feel bored and tired, and obliged to spend hours learning in it. We should paint the walls with some pastel colors and add some vibrant touches to feel alive and happy to be where we are! […] If not on the walls, we should add colors using posters, pictures or painting the tables and chairs so we change our mood."

The fundamental purpose to create an educational environment conducive to studying and learning in classrooms is to not 'over-stimulate' the learners. Over-stimulation is caused when using big quantities of bright colors such as orange and red. Happiness, relaxation, comfort and calmness are the feelings elicited when using the colors blue and green. It is suggested to use neutral and calming colors on walls and ceilings, and add splash of colors on furniture in order to avoid a dull room. Orange, yellow or red colors slightly used can attract students' attention and

can lead them to a specific part of the classroom for an engaging task. Yet, if the purpose is to match and connect all the elements of the classroom, the colors used on furniture should be similar to the wall colors that focus on the relaxing colors blues and greens. In fact, researches show that bold and primary colors can promotes positivity and playfulness, which is ideal for elementary and pre-school environment. Warm, subtle and cool colors are best to be used for middle and high school environments since they endorse stress relief feelings and concentration, which is basically common amongst the students of this age (Smith System, 2020). According to a study titled *"Relationship between color and emotion: a study of college students"* conducted by Kaya & Epps in 2004, the latters found that:

- Green associates with calmness and relaxation, accompanied with comfort, happiness, and naturalness.

- Blue associates with security and comfort.

- Yellow associates with energy and liveliness, also elicits positive emotions linked to summertime and the sun.

- Red associates with stimulation, dynamism, excitement and intensity.

- Purple is stately and dignified.

- Gray associates with the negative emotions such as boredom, loneliness, sadness and tiredness.

Color	Concept
White	Thinking and science
orange	Energetic and jolly
Pink	Happiness, power, science thinking
Yellow	Energetic anti-tiredness provocative
Red	Life-giving powerful, anti-tiredness
Green	Thinking, science, provocative
blue	Thinking, science, provocative, calm

Table 10: the concept of colors according to student perception.

Source: Tabaeian et al., 2011.

level	Proposed colors
Elementary School	Red, pink, blue
	Red, green, blue, yellow
Middle School	Green, orange, light yellow
	Green, orange, light yellow
High school	Green, blue-green, light yellow
	Green, blue-green, light yellow

Table 11: Proposed colors in the design and applying the educational environment.

Source: ACECR, 2013.

Lastly, the survey asked the students "What are the necessary elements within the classroom that should be removed" to which the answers are summarized in the table below:

Physical elements that should be removed from the classroom	
Broken and outdated chairs and desks	Desk hierarchy
Chalkboards	Plain walls
Ceiling/wall fans	Damaged tiles and ceiling
Yellows artificial lighting	Overcrowded classroom

Table 12: The physical elements to be removed from the classroom, according to students.

Ultimately, the last question in the survey asked students about one key element within their classroom that affects their focus during class hours and causes them to be distracted. The most recurring answers are demonstrated in the table below:

Key physical element within the classroom causing distraction during course hours		
Creaks of old desks and chairs	Humidity of wrong window positioning	Nothing stimulates attention and concentration
Size of classroom compared to the number of students	Sunlight/ daylight does not enter	The shape of the room/ Classroom layout
Bad lighting/ Flickering lights	Chalkboard/ board not straight	Tight spaces between desk rows
Plain walls/ bright white walls	All of the room, the mood and design	Room organization and desk management
Cracks on walls and ceiling (feels unsafe)	Uncomfortable chairs and small desks	Large windows/ the exterior

Table 13: The key element within the classroom affecting students' focus during class hours, according to students' survey answers.

Discussion

The improvement and performance of scholars in school depends on various factors and features of a classroom, a place where students spend most of their school hours. The condition and quality of the physical elements within the classroom reinforce the learning environment, as well as students' behavior and academic achievement. Hence, it is fundamental to build a conducive setting that is positive and enhancing, in which students would feel motivated and safe to learn. Accordingly, there are a series of design aspects and approaches, which influence and

stimulate learning in classrooms. When it comes to the environmental factors of a classroom, a study recently completed by the University of Salford documented how a classroom design affects students' performance; it could impact a pupil's academic achievement and performance by 25% over the span of a year (How Classroom Design Affects Learning, 2021).

According to students' answers in the tables above and the results, it is determined that the effects of furniture comfort and norms, amount of natural lights, types and colors of artificial lights, classroom colors and mood, desks management and room orientation, temperature, noise and technology, play a crucial role in students' academic progress and concentration. These factors should be always maintained and in respectable condition, visually pleasing and stimulating the learning experience. In fact, the University of Salford's study found that 73% of the progress variation is assigned to these environmental features faced by students, which means the majority of scholars are affected.

As a result, a practical and progressive classroom design and space planning management should associate with changing technologies, school programs and functionality as they have altered the notion and approach to today's classroom design. Thus, modern and new classroom design planning should be beneficial, bespoke and built to accommodate and cater the needs of all scholars, as well as the objectives of school programs and curriculums. Classroom design should be management in a way that is conducive to every discipline taught inside the room (practical and theoretical), with an installation of intuitive, intelligent classes that are able to flexibly benefit students. Hence, allowing an understanding of the purpose and totality of the curriculum, and enhancing motivation and the learning experience.

Based on students' answers of the survey, analyses and results were gathered and shown in the created infographic design below, overviewing the ideal classroom design that affects students positively.
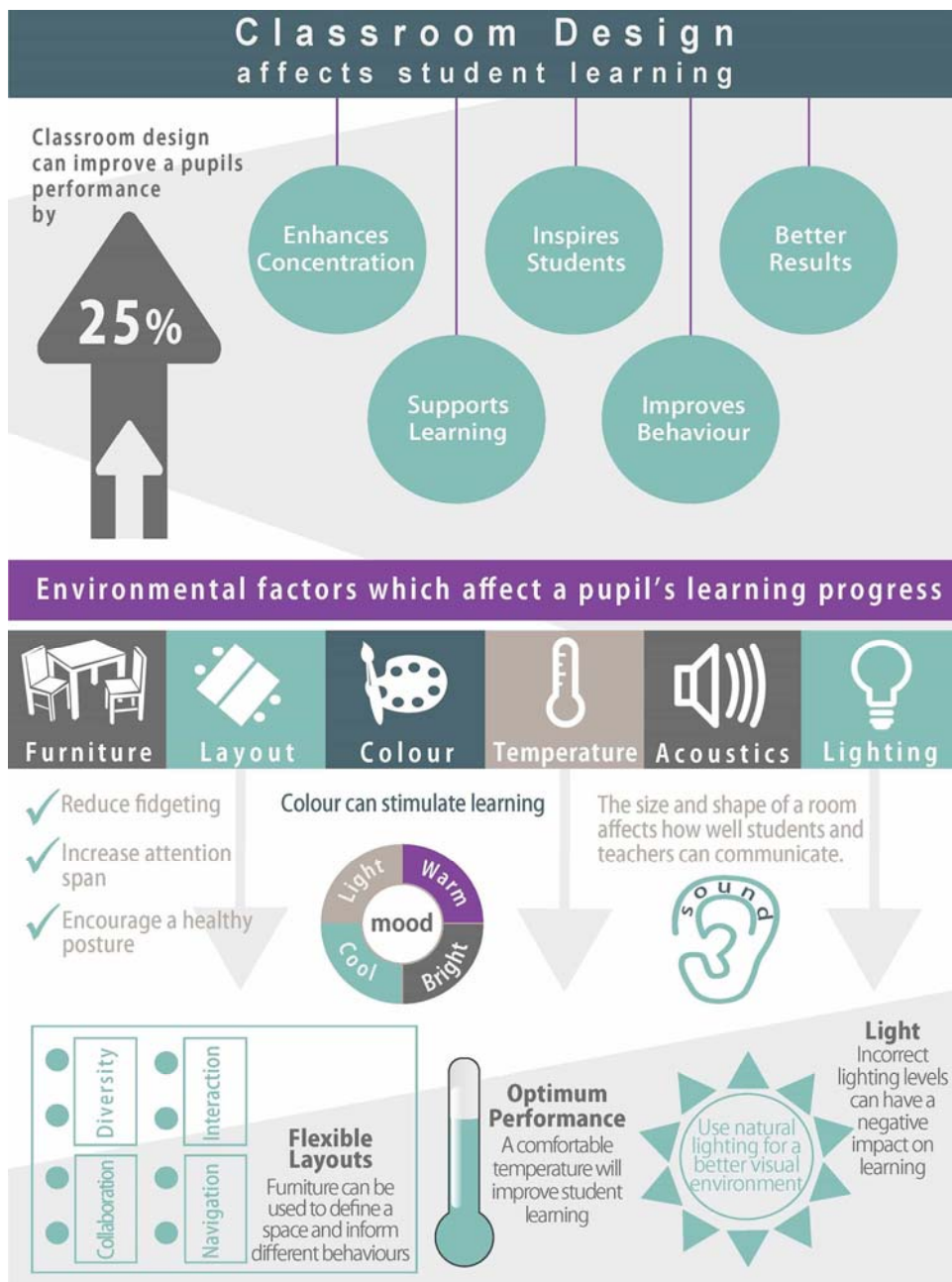

Figure 30: Infographic demonstrating features of an ideal design.

As George puts it all together in his answer to close up, he states:

"Obviously the desks have to be in tip top condition. The board needs to be well maintained or if it is learning via information on a laptop, the wall has to enable the students to read and view the information displayed perfectly. I think, we could increase technology in classrooms, helping the students learn via iPads or tablets. It would take the stress of getting all the information the professor writes down on the board. Sometimes you just don't get all the information because the teacher erases the information. Other than what I've mentioned, there should be natural light in a classroom that would give the students the feeling they are outdoors. This would help in learning in my opinion, not some dark place or a dark classroom where they wouldn't feel comfortable. I think all class rooms should have interactive walls dedicated to learning, filled with quotes, information, books, theories on the specific subject that is being taught."

To close up, it is important to consider each environmental factor mentioned by the students in order to cater for their needs and requests in the contribution, which would be a conceptual approach of space (classroom) planning management design. The following will include the physical studied features below (elaborated in chap.6):

- A multi-functional room, given the fact Lebanese public schools lack facilities for different school activities.

- A classroom learning that "empties" into a connected community.

- Comfortable furniture to encourage healthy posture.

- A flexible layout to encourage diversity, interaction, collaboration and navigation.

- Colors to stimulate learning, create a mood, and please visually.

- Acoustics by considering the shape and size of the classroom for better communication between teacher-students.

- Noise reduction by integrating wall units with specific materials that help decrease sound emission.

- Materials that have positive effects on students.

- Natural lighting for better visual environment and wellbeing.

- Correct artificial lighting types and levels (LED/Tubes).

- Implementation of technology (tablets, smart board) to enhance the learning experience.

- Functional wall unit for space saving, desks spacing at ease, books arrangement, a warm atmosphere, esthetic artifacts, pictures and educational posters display, mechanism and fixtures for functional desks and chairs.

- Cabins for personalization for flexibility, responsibility and individualization.

- Bench to create student centric corner for free time and interaction.

- Walls displaying students' work to encourage progress and motivation.

- Create a space that is seen as a "third teacher".

5.2 Limitations and Alterations

As no study is completely inclusive of all possible aspects, some limitations throughout the study were to be noted. The sample selected for this study was specifically high school students enrolled in grade 10,11 and 12 in Lebanese public schools. The results obtained in this study may not be applicable to students outside of this designation. Hence, a convenience-sampling frame is measured by some to be inaccurate or undependable as it is not depictive of the entire population. Nevertheless, students are the representatives of the population that is enrolled in school, and since the scope of this research was limited to high school-aged students, enrolled in public Lebanese schools; it was characteristic of this cohort. Therefore, the convenience-sampling frame was acceptable for the purposes of this research study.

In addition, the requirements for the participation in the questionnaire indicated that participants had to be in their last 3 years of school years as they are more aware of the topic and can present more definite answers. Moreover, the latters had to be attending - in particular - a public school located in Keserwen, in order to focus the study and narrow it down to one region in Lebanon. The following made the scouting process challenging and required more allocated time than we initially predicted. Additionally, personally handling the questionnaire to students and having the opportunity to carry a face-to-face discussion with them for a better understanding and more elaborated description was considered a main limitation since the pandemic of Covid-19 occurred and urged schools' openings to be halted. The strict safety measurements and prohibition of social meetings refrained me from conducting interviews and discussions.

Also, the political and financial crisis that has overtaken Lebanon for the past year until today, in addition to the revolution against the Lebanese government and the lockdown of many regions, and the Beirut port massive explosion, made it difficult to conduct an "on ground" observation and a spatial inspection. In consequence, alterations were considered for the methodological data collection; records collected through online research (Lebanese public schools, Irma Ghosn book, Farah Zain articles…) and new extracted findings from the structured online questionnaire that were analyzed and discussed in the later stages of the research.

CHAPTER 6 CONCLUSION

This thesis started off by asking and studying 'how does the public education and its physical setting affect the students?' After a detailed research process, the following study has endeavored to answer this thesis' leading research question: *What is the impact of the physical classroom environment on the high school students learning in Lebanese public schools, Keserwan, Lebanon?;* and the secondary research question: *What are the key elements of the future modern setting arrangement that create a conducive classroom environment and affect positively the learning of the high school students learning in Lebanese public schools, Keserwan, Lebanon?*

The physical setting and design can impact learning and engagement in classrooms, promote focus and motivation for better academic achievement and an enhanced learning experience. In fact, the correlation between learning outcomes and classroom design is beyond than a simple conjecture; recent studies such as a 2015 research published in "*Building and Environment"* journal demonstrated that altering particular core elements within the classroom design increases a student's learning outcome by 16% (Connecting Elements, 2016). Moreover, oftentimes design is not a primary factor cited when asked what could affect learning and engagement in the classroom. However, the ongoing researches conducted by Salford University document that the learning environment could in fact affect student progress by 25% throughout the academic year (Innova Education, 2015). In order to show the effects classroom design has on students, the extracted facts of the study demonstrate the following numbers:

- 75% of the variation in pupil performance can be explained by the built environment.

- 15% of students affected by the air quality of a classroom.

- 15% of pupils show a variation in overall progress because of the learning environment.

- 20% of students affected by the lighting of a classroom.

- 12%of students affected by the color of a classroom.

The following thesis set out to determine if the physical environment and classroom design of Lebanese public schools, in the specific area of Keserwan and a particular focus on high school students respondents, can have an impact on their behavior, engagement and academic achievements, as well as what their views of them (their classrooms) are.

To answer the research question, the physical environment of the classroom and its key elements can effectively impact students. However, it can negatively affect students by engendering off-task behaviors and distraction if the setting was not correctly and appropriately managed. Also, some of the classroom components simultaneously disclose positive and negative results such as the seating arrangements, the mix of colors and technological devices; for this it is essential to carefully select only the constructive proportion of them. Opting for a constructive space design layout and implementing the right elements that correlate with the students' age group, needs and desires, can efficiently enhance their learning experience, positively affect their engagement and thus, prompt higher chances of academic achievements and performances.

6.1 Results and Implications

The question of the classroom environment's impact on students, and the positive and negative outcomes of its design on their academic performances have been examined through the whole study, as well as by many researchers. It has been revealed there is a modest correlation between the students' academic results and their individual satisfaction with their facility's condition (Hopland & Nyhus, 2015). This thesis' results have shown students' satisfaction with

their learning environment has evidently a "deeper dimension than just an infrastructure condition".

The results of the thesis study have operated on three levels: the respondents' perceptions and thoughts about their classrooms, their representation of an optimum classroom (i.e. key elements to remove/ add), and finally, the depiction of contemporary learning methods (i.e. devices, technology, innovation). These results are significant foundations to apply future initiatives since they offer insights and reasons to why various physical design features are important, and if these depictions can dismantle the "outdated" and "poor" image of Lebanese public schools.

While the respondents' views and thoughts of their classrooms seemed mainly negative, their subjectivity in their answers was based on what their facility had to offer when it comes to their learning experiences and their comparison of their own schools to others. This shows how they perceived their public school as more 'outdated' and more 'backwards' than the other schools, as they believe theirs lack 'various school supplies' and attributes. This, in combination with the fact that some respondents based their answers and views of their classes on that of the private schools' classrooms, demonstrates that Wolff, Jarodzka & van den Bogert's (2016) statement of "the effectiveness of the education system" across the globe is based on the support that the secondary education gets from the government and other interest groups. In most of the developed countries, such as Lebanon, there is minimal support from the government and this has implied classroom management, created a gap between the private and public sectors and a lack in what the facility has to offer its students. Hence, their statement is reinforced in the case of the Lebanese public institutions. Moreover, Stichter et al.'s (2009) study is underpinned when they showed that "successful instruction and class management" can influence the perception of

the students towards the education system developed and their facility; Students tend to perform well where there is a positive learning environment and the classroom atmosphere is characterized by optimism. This explains students' thoughts about their school and classroom being 'outdated' and 'more backwards' than other schools.

Moreover, on representations, the results have shown that respondents believed the source of their classroom's environment impacting them negatively stands on 'traditional' elements in bad conditions. Thus, a significant number of respondents (92%) represented the 'optimum' classroom that is conducive to learning by implementing technology and innovative tools within their classroom and curriculum. This does not come in surprise as today's generation uses smart technology on a daily basis and in every aspect. As technology has been implemented in education and for learning purposes, it can be considered now, just as the classroom, a "third teacher". However, as the respondents depicted an ideal classroom should integrate technology, and gave little focus on other elements, it is important to mention that technology acts as a distracting feature and may cause poor academic outcomes. Therefore, it should be well addressed and monitored when in students' hands.

Additionally, incorporating significance and attention to the classroom's structure and its physical elements will provide valuable effectiveness and optimism to the classroom, as each element partake a key role in impacting students. Yet, such components enclose positive and negative features, consequently they should be addressed in the right environment, physical settings and designed based on its users. Accordingly, Martin's (2016) study is reinforced when noting that the physical environment is designed in ensuring that both the teachers and students are not obstructed from learning. The same study indicates that there is a direct correlation between the physical environment, and the ability of the students to grasp new knowledge and

ideas; to which the hypothesis of this thesis *'There is a significant relationship between the physical classroom environment and the high school student's learning'* is defined.

To have a developed understanding and an improved perception of how the physical environment and design of a classroom affect academic outcomes and educational performance and experiences, is important and useful to advance in such sector. The research studies, results and evidences presented in the following thesis study demonstrate that a wide variety of salient features can feasibly be addressed and adopted with the correct planning approach.

6.2 Conceptual Approach

It makes insightful sense that an 'optimal' physical classroom environment must not be alienating, uncomfortable, and/or either boring or chaotic. What the evidences and results show is that several elements relevant for establishing a conducive and healthy environment, previously covered in the sections above, have in addition a significant influence on learning. Yet, so do the supplementary features such as the choices about furniture, colors, displays, fittings, and how the space is "dressed" and exploited. This thesis' findings and results indicate that a great potential sets for numerous existing educational institutions to be modernized and upgraded in a very economically way, as well as for the future-built institutions to be designed and developed in ways facilitating learning imperatives.

Thus, a conceptual approach of classroom space management and design, and every feature such as type of lighting, colors, material and functionality, was developed based on the literature review, the findings, and results of the questionnaire. The following approach depicts students' needs and desires when it comes to their learning experience, as well as it encloses main and supplementary factors that play a role in ensuring a conducive and constructive learning environment for them.

As a first step in creating such design, the idea of a multi-functional wall unit was conceptualized in order to create a space that is also multi-functional and spacious enough to fit in a reasonable number of students. The wall unit is divided through a grid into sections with a purpose that could enhance several deficiencies:

1. Installing indirect lighting displaying artifacts for an esthetically pleasing room.

2. Lockers used for students to keep their personal and school belongings.

3. Cabinets that can be personalized by students for identity formation and sense of belonging, giving the room the feeling of a 'second home'.

4. Integration of colors and educational posters displays for stimulation and visual complexity.

5. Transparences to keep natural light and aeration entering inside the room.

6. Space for flexible unfold of the tables/desks through a simple mechanism, giving a sense of dynamism and innovation and interaction.

7. Arrangement and customization of the seats/chairs.

Thus, the wall unit is a flexible, innovative and multi-functional element that helps saving space in order to use the classroom for other purposes since Lebanese public schools are known to lack facilities for activities such as sports, music, group discussions, art class and so on. A 3D construction was created to elucidate this design element, as it also explains the mechanism of the integrated furniture within the wall unit itself. This first conceptual design of the wall unit displays the sectioning of the wall through a studied grip, and accentuates the mechanism of the folding desks/tables (in orange) and the arrangement of the chairs (in blue).
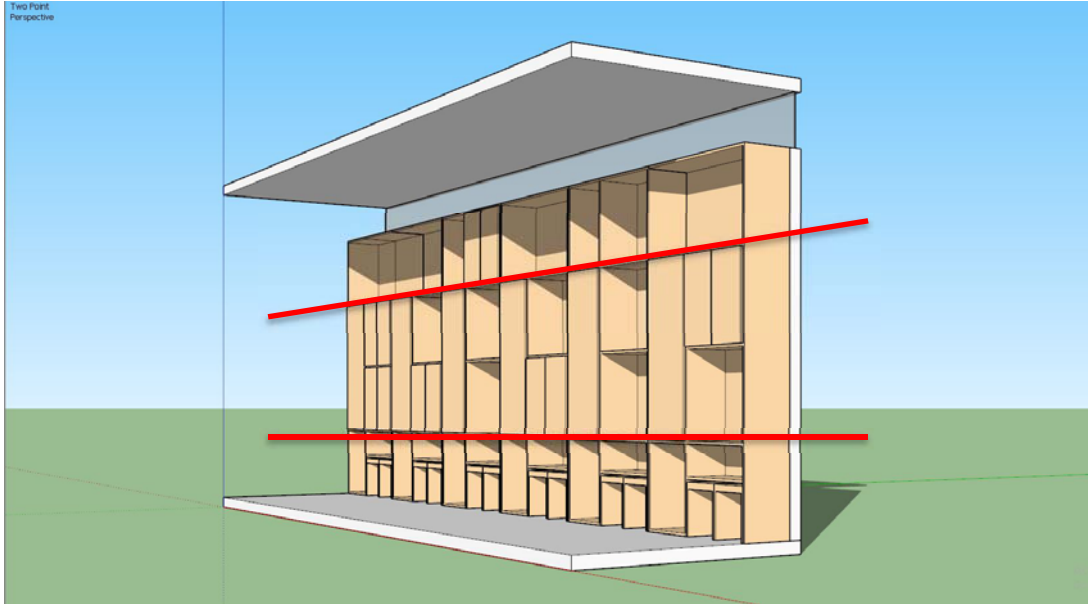
The wall unit in perspective angle, displaying the sectioning using a design grid. The wall unit is divided into 3 main sections: The first (top) can be used to display artifacts and posters, the second (middle) is for the folding tables and personalized cubic, and the last part (bottom) is used to arrange the chairs inside the cubic and students' belongings. Above the wall unit a slit made of glass is created in order to allow natural light and sunlight to enter the room easily.

This perspective demonstrates the positioning of the tables/desks (in orange) and the chairs (in blue). The following are folded and arranged inside in order to clearly understand how this walls function when not in use. Hence, space is saved and the room can be used for other work activities of the curriculum.
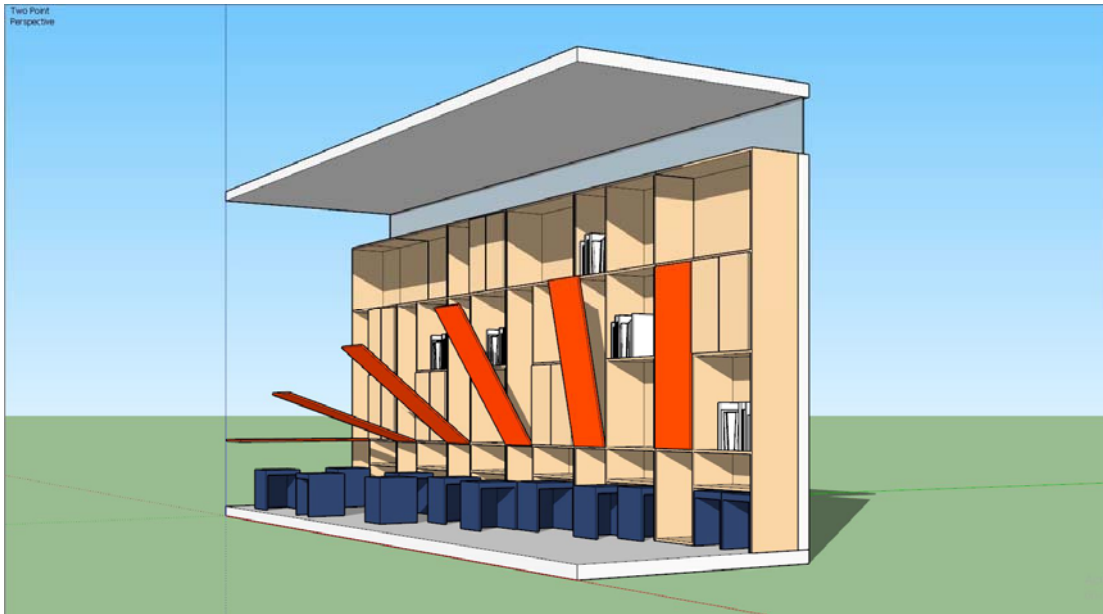
This perspective shows how the tables can be opened in order to use them during class hours. Also, the chairs are pulled away from the bottom cubic for seating. This mechanism is flexible, easy, and innovative for the students, as the process of it is done manually. The other sections can be used for arranging books and other educational displays.
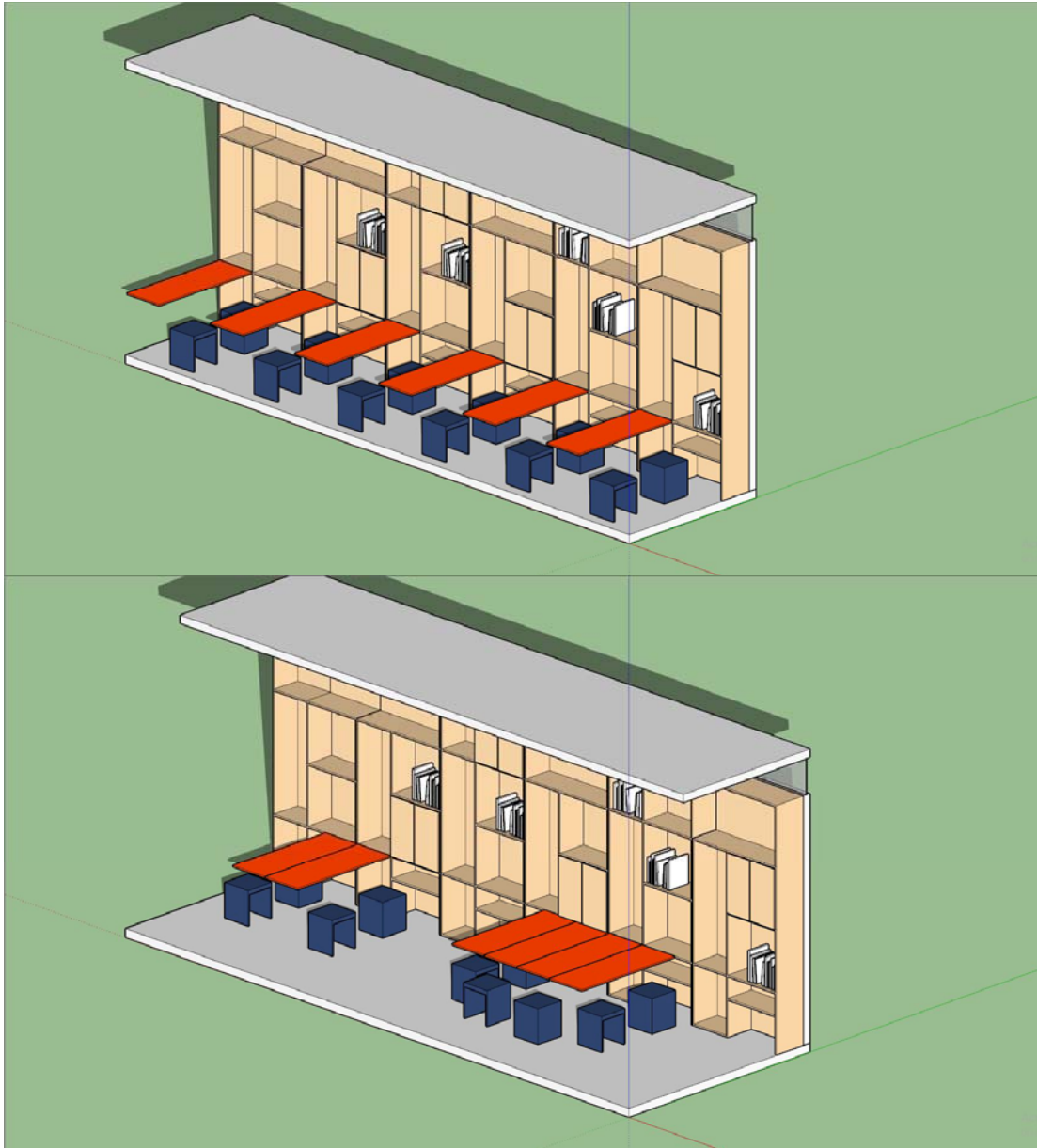
The following perspectives show how the tables can be moved in order to create interactive and cooperative group works, class discussions, brainstorming sessions in pairs or more. Tables are moved through an implemented rail for easy movement and safety. This allows students to interact better with each other, share views and instructions acquired during class, as also it creates student-teacher engagement. The notion of flexibility here accentuates the sense of dynamism and enthusiasm.

Pictures showing the façade view of the design grid of the wall unit, when the tables and the chairs are arranged, opened and joined together.

The wall unit is the main design element that includes several functions and other factors such as the furniture (tables and chairs) and others. Nevertheless, the other important supplementary features are also considered in this conceptual approach such as the choice of

materials, colors, lighting and technological tools and devices. Being said so, each features adopted in this design contribution plays an important constructive role:

- **Light Wood (sustainable biophilic material):**

Figure A: Visual presence of wood inside the room as a finishing material.

For the wall unit, light wood is chosen since several research studies have demonstrated that the versatility and resilience of wood allows it to be a very suitable and appropriate building material when it comes to schools as it helps in creating an inspiring, safe and healthy environment. Also, as a material that has an important impact when it comes to aesthetic quality within the indoor environments, a research conducted by FPInnovations and the University of BC (Colombia) determined that wood's visual presence inside the building allows stress relief among the occupants, which is suitable for high school students that have to be prepared for their next step in the academic life. Moreover, the same study concluded that the use of wood is beneficial for chaotic places and environments, as also it converges on biophilic design trends (Eduardo Souza, 2020). Other advantages that make wood the perfect fit for a classroom is the fact this material is versatile, renewable, is used at various and different scales, construction systems (mass timber, solid wood, wood frame) and finishing uses. In addition, it has sound absorption and attenuation coefficient properties, which offer acoustic benefits since wood's porous nature has acoustic functions for sound quality.

Furthermore, wood acts like a sponge and absorb/releases moisture which improves the room's air quality since it moderates humidity. Considered hypoallergenic, wood is easy to clean and prevents the accumulation of dust and particles. These properties are significant for the indoor air quality of the classroom, the well-being of the students, notably for the ones who have allergies. What also makes wood beneficial is the advantages in fire, wind, and seismic resistance which makes it extra safe.

For educational institutions and classrooms, wood is the most suitable material since it does not consume a lot of time for construction or renovation; lightweight systems and prefabricated wood speed the construction process in comparison to concrete. Also, a survey led in Canada showed that wood is the least vandalized material since it is perceived as a 'finishing material' (Eduardo Souza, 2020).

Thus, typologies such as schools require robust, durable and economical solutions, hence adopting environmental sustainable materials and systems like wood plays a significant role as a developing solution that includes air quality, safety, sound absorption, well-being of its occupants, biophilic design and aesthetic quality.

In other words, classrooms are formative physical environments where students' identities take shape and grow. Adopting the right material within their everyday environment is important in order to impact the occupants positively. Thus, avoiding blank walls and dull spaces by using wood can add texture and pattern to elicit stimulation and positives responses. It is proven that such material is calming and simultaneously engaging without creating distraction, which is important in this case since students tend to get easily bored and distracted during class hours. Also,

as a natural material, wood can enrich the classroom both tactilely and visually as it gives the space an inviting, warm and relaxing quality (Joe Mayo, 2017).

- **Pastel Blue, Green and Brown Colors:**

Figure B: Creating a mood using different tonalities of pastel colors.

Since the design of this classroom is notably directed to high school students (grade 10,11,12), it is fundamental to consider which colors best suit their educational environment. Over-stimulation is caused when using big quantities of bright colors. Thus, it is suggested to adopt neutral, pastel and calming colors, such as green or blue, that elicit happiness, comfort and relaxation within students. A splash color of yellow, red or brown can be used in order to attract students' attention, avoid a dull room and lead to task engagement. Moreover, it is suggested to use such colors on furniture instead of walls or ceilings to avoid the distraction of students during class hours. Additionally, it is important to create a mood using different tonalities (light, warm, cool) of colors without "over-stimulating" the learners; in fact, researches show warm, subtle and cool colors are best to be used for middle and high school environments since they endorse stress relief feelings and concentration, which is basically common amongst the students of this age (Smith System, 2020). Also, according to a study conducted by Kaya & Epps (2004), the proposed colors that are best applied in the educational environment for high school students are green, blue, light yellow and orange since the concepts of these colors, according to

students' perceptions, are "calm, thinking, science, energetic and naturalness" (Tabaeian et al., 2011).

Furthermore, according to Krims (2013), green is a popular color among high school students, and blue has a growing preference towards it. Nevertheless, orange accents and brown also have some interest as they stimulate and add dynamism to the environment. Greens and blues enhance students' ability to focus; thus the latter suggests such colors (blue/green, light green) to be used on the sidewalls. Moreover, Pilaroscia states, "In high school, you want softer colors. You want students to be able to concentrate more and be more introverted in their studies […] You can do a focal wall or accent at the front of the classroom […] Side walls can be softer and more neutral". (Spaces4Learning, 2013).

For this reason, in this conceptual design approach and contribution, the colors light blues and greens were painted on the side walls on the wall unit, as it will enhance concentration and calmness amongst the high school students. The colors are amplified using indirect lighting, which also creates a warm and soft ambiance in the classroom. Additionally, a focal wall was accentuated using a stronger color such as brown, since it reveals alertness and attentiveness between students as they face the front wall the most during class hours. Eventually, the combination of these colors inside the classroom creates a stimulating environment that is engaging and visually pleasing, encouraging the feel of warmth and 'home' within its occupants.

- **LED and Indirect Lighting:**
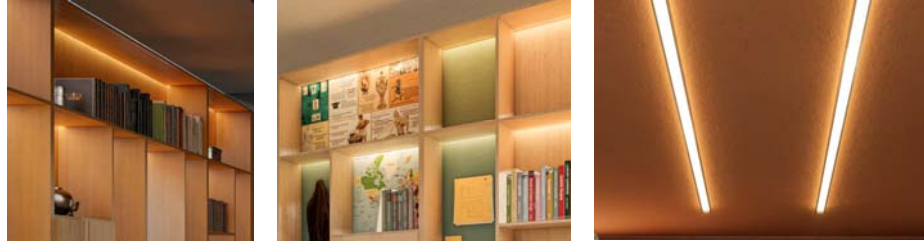
Figure C: Visual acuity and high illuminance through indoors-artificial lighting.

As lighting, whether natural or artificial, is one of the most significant environmental inputs, it was important to consider which type of lighting to use in this contribution in order to increase visual acuity and students' wellbeing and task performance. As nowadays everyone is exposed to artificial lighting more than natural lighting, the latter must be supplemented indoors for visual complexity and better functioning, especially in classroom as it affects students' behavior and concentration when reading, problem solving and working on tasks. Public schools have used fluorescent lighting for several years since it provides high illuminance and efficient energy for the classroom. Also, as covered in the previous sections, these types of lighting also have developed to incorporate full spectrum lamps simulating daylight. However, since recently LED is the forefront lighting because of their efficiency, longevity and capability to deliver smooth, unbroken and full spectrum, it was chosen as the type of artificial lighting in this contribution. The use of LED lighting was the best fit in this conceptual design approach of a conducive classroom since also researches have demonstrated major growth in positive behaviors and perceptions, positive engagement and major increase in student behavior and classroom tasks.

The LED fixtures with high CCT (correlated color temperatures) are best used in working spaces such as a classroom since a lot of concentration is needed. As

previously covered in chapter 4, the LED fixture will have a 4000-4500K color since it approximates sun and daylight color in order to create a calm and serious atmosphere, and to protect the eyesight and visual acuity maximally in comparison to other CCT. The lights are in the form of 2 vertical long tubes of LED lights since it is the best choice for schools and classrooms (UPSHINE, 2021).

Furthermore, the wall units on the side walls of the classroom include indirect lighting to add some warmth and an inviting feeling for students. It will also make the whole aspect visually pleasing and will create an ambiance in the space. The use of indirect lighting in this contribution was to help accentuate some specific areas in the wall unit, as well as illuminating the surrounding. The wall unit will hence seem as a personalized library for each student where their work, artifacts and belonging are displayed. This design feature also include opening facing the windows and a slit in order to let enough natural light inside the room. This will impact and increase the wellbeing, performance and concentration of the students.

- **ICT Tools; Smart Board and Tablets:**
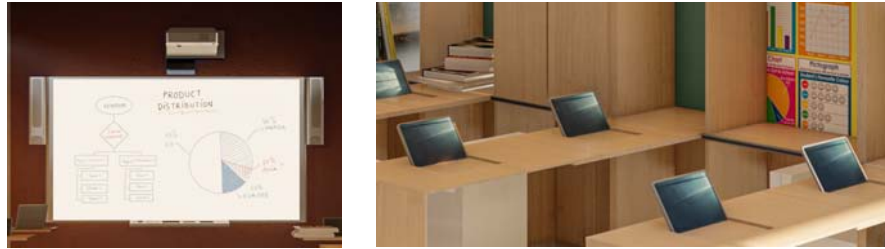
Figure D: Information and Communication Technology as new learning tools.

"Educational technology involves the disciplined application of knowledge for the purpose of improving learning, instruction, and/or performance" (Spector, 2015). Today, taking into consideration the great advances and widespread of technology and smart devices in all facets among the scholars in Lebanon, new generation is described as 'smart' since they use to a great extent the ICT (information and communication technology). Furthermore, the use of new technology (notably tablets) in education increases their interest in attending school and gaining knowledge. As a result, it is no surprise that the most recurring answer among the students was the integration of technology as it will enhance and simplify the learning process. Hence, nowadays' teaching styles in Lebanese public schools need to be enhanced using new learning tools and technologies. Therefore, this contribution included some new technology devices such as tablets and a smart board, which can be used by both teachers and students.

The idea of implementing a smart board in this conceptual design came from the fact some students complained about the chalkboard being outdated, cracked, and causing some allergies and chalk dust inside the room. In fact, introducing a smart board into their classroom meets various advantages when it comes to the wellbeing and learning of the students; this smart device replaces now both the chalkboard and overhead projector, enhances the student's learning experience by

providing an enriched learning/teaching experience through projected visual

elements, which allows scholar to view charts, diagrams, videos…on the screen.

Hence, their learning process becomes more active and dynamic, and a fun

interesting way to learn. Also, through a smart board, instructors can

accommodate different and various teaching/learning styles. Additionally,

students acquire more when fully engaged. As this smart tool can have separated

workspaces, several students are able to use it at once; this makes it an interactive

tool that provides its users the ability to take notes, write, or draw, as well via a

tablet. Also, a smart board offers it learners an easy access to various online

resources; teachers can access to a great extend knowledgeable databases in order

to reinforce the lessons, and students are able to easily access countless resources

to complete a task. A smart board also allows technology integration when

connecting other devices such as computers, microscope, video cameras… which

aids in instruction. This tool requires low maintenance, does not need markers or

chalks, it is easy to use and clean, and is environmentally friendly since it

eliminates the need for paper, ink, printing and photocopies.

Lastly, the use of smart boards in classrooms has proven success rates as they

boost attentiveness, enhance literacy, increase comprehension, improve students'

learning, and most importantly increase students' engagement. Such interactive

tools provide a classroom environment that offers different and various learning

styles. It is an easy-to-learn technological device that ensures developing skills

and improved academic performances and achievements (Janelle Cox, 2019).

In addition to the smart board, this contribution implemented another new technology tool: Tablets. In order to save space inside the classroom, tablets are used since also, as previously covered in the sections above, they enhance the learning experience and improve the skills. Such devices are flexible and easy to use, can be integrated into the desks, and each student has his own tablet, which makes him/her more responsible and independent. Moreover, integrating tablets in a classroom will increase students' satisfaction and engagement with learning and the school, as also it is a more enjoyable way to gain knowledge. Yet, tablets can cause distraction to some students since many fun applications can be downloaded. Thus, in order to avoid such behavior, the school and teachers can take control through classroom management system, and monitor students' work. As tablets are hand devices, instructors can easily teach and move around, which will grab students' attention during class hours. When not in use, the tablets can be kept aside inside the wall unit or under the instructor's supervision.

- **Transformable Physical Environment:**

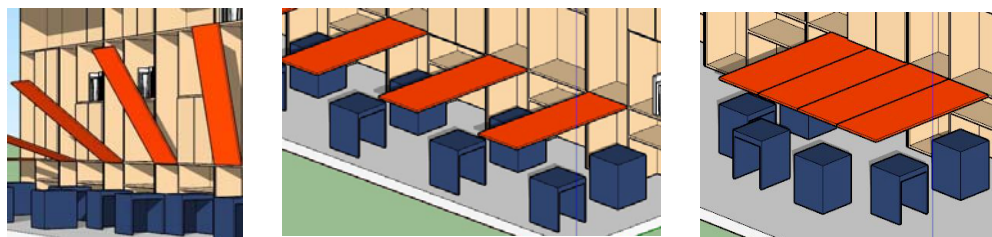

Figure E: Foldable desks and seating arrangements for flexibility and innovation.

In this project's case, there is a correlation between the space management and the seating arrangement. The idea of a multi-functional wall unit was conceptualized in order to create a space that is also multi-purposeful since Lebanese public schools lack facilities for several class activities, and spacious

enough to have a flow of movement and to fit in a reasonable number of students. The wall unit is designed to be a flexible element that includes the seating arrangement and furniture; the folding panels turning into the desks and the mechanism of the rail to assemble the tables for group works, create an innovative design.

This versatile element became an alternative of the side walls, and is formed by an alternation of movable and foldable panels with 90 degree movement, in order to be turned into the desks, which allows the creation of a work environment within the room. Also, the inclusion of a thin rail allows horizontal movements of the tables in order to also create an extra place for community assemblies, work groups, conference table and brainstorming sessions.

Furthermore, when the tables are unfolded, the seating arrangement is managed in pair pods; each desk seats 2 students, in vertical rows facing the front wall and the board. Nevertheless, after studying the different and various other seating arrangement, the pros of each was extracted and included in the mechanism of the rail: from the cluster, promoting teamwork and cooperation, interaction of all students, suitable for small and medium classrooms, developing reflection and communication skills; from the horseshoe, fostering connections between both students and teachers, encouraging discussions, and easing interaction with the entire class; from the roundtable, supporting a whole-class and a peer dialogue; and lastly from the row arrangement, minimizing disruptions and cheating, making it easier to supervise and encouraging productivity and individual work.

The facades include some openings to allow indirect and natural illumination of the classroom, as well as natural circulation of air and ventilation. Another characteristic is that when the panels are converted into desks or tables, a cabinet is formed where students are able to personalize it as their own zone, which helps in identity formation and personal creativity. Thus, such element combining local material (wood) and modern innovative construction systems engenders an active participation and engagement during class hours, an input of a community that allows the creating of an inclusive, wide and multi-functional space that in harmony with the environment and its occupants.

An animated video was created in order to elucidate and explain the mechanism of the wall unit and the panels transformed into desks, and how they can be assembled together for gatherings and whole-class discussions. It is found on YouTube on:

https://youtu.be/vq6xcT0veec

The following 3D renderings demonstrate the finalized conceptual design approach of the 'optimum' classroom, based on the results and findings of this thesis.

The process of thinking and designing can be found in Appendix F.

N.B: The renderings' high resolution and colors may differ from a device to another.

Perspective A depicting the wall unit as a whole entity, fully made of light wood material. It also demonstrates the pastel colors of green and blue used in some sections. Other sections are used to display visual items and arrange books and the students' belongings. The middle section shows how the tables and seating are arranged within the unit, other sections show the unfolded desks and chairs. Also, indirect lighting and LED lights are represented in this angle perspective.

Perspectives B & C *demonstrate other angles of the conceptualized classroom. Natural lighting is seen entering the room. Also, technological tools and devices such as the smart board and the smart tablets are adopted. A focal front wall is accentuated through a strong color (brown). These perspectives depict the whole mood and atmosphere of the classroom.*

Perspectives D & E show the classroom's atmosphere if the curtains are closed. Also, it is embodied how some sections of the wall unit are/ can be personalized by students (sticky notes, personal items, wallpapers…). They also showcase the place and furniture management is organized if all the desks and chairs are unfolded. Indirect lighting and LED lights are also shown in the following renders.

Perspectives F & G *demonstrate a contrast. One showing the classroom with lights turned off and curtains closed when the smart board is in use for projection, showing how indirect lighting can create a mood within the room; the other showing how daylight can enter the room through emptied sections, in order to enlighten the environment and for better visual acuity. The colors blue and green are also shown on the walls of the wall unit, as well as the use of colors light blue and brown on the back of the chairs. Moreover, these perspectives show the chairs being light-weighted and designed in a way for the bags to be arranged inside them. It is also important to mention how the wall unit also allows students to hang their jackets or scarves, which helps in reducing noise disturbance coming from outside the room.*

Perspectives H & I *show the classroom in use. Also, the second perspective demonstrates how easily the belongings can be arranged for space management. Each desk contains 2 tablets for each student to use during class hours. Each folding tablet has its own space arrangement without taking much space of the table.*

Perspectives J & K *demonstrate how the desks/ tables when unfolded, can be put together for cooperative or group work during class hours. Through a thin rail implemented in the wall unit, the tables are easily moved horizontally in order to join and assemble the 2 tables or more together. Also, perspective K shows how students can sit facing each other, as well as from the side by lifting the tables' support from the side. This unfolding concept projects the notion of 'flexibility'.*
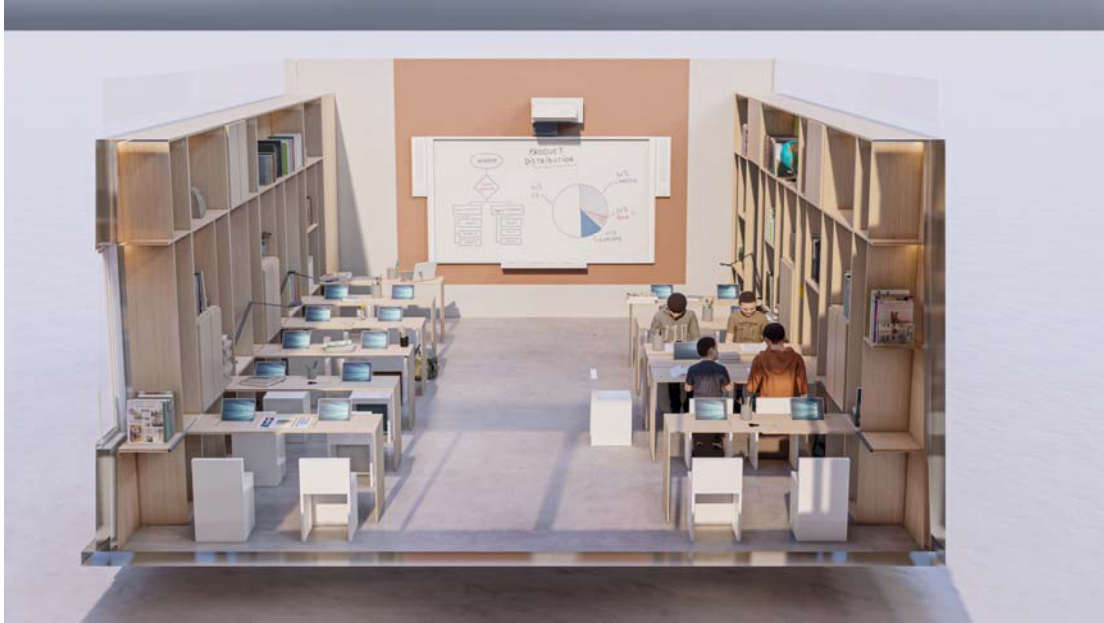
Perspectives L & M demonstrate sections of the physical environment of the conceptualized classroom; the section above shows the façade of the wall unit as a whole, depicting the grid, the material, the colors, and the unfolded tables and seating. The render also shows how natural daylight enters the room and full illuminates it. The second render focuses on the front façade of the room in order to demonstrate the focal brown wall and how it blend with the room's atmosphere and biophilic mood. Additionally, it focuses on showing the seating and desks arrangement in traditional rows, as well as the implementation of ICT tools such as the smart board and the tablets.

Perspectives N & O *show the East and West sections of the classroom. Both renders demonstrate the wall unit on each side wall of the room; the first wall unit asides the hall way, the second wall unit asides the outside environment, which allowed implementing openings such as windows into the wall unit for natural lighting and ventilation.*

6.3 Approach Constraints and Future Studies

Actualizing the proposed conceptual approach can be feasible and executed in the renovated or future-built Lebanese public schools since it is a practical, flexible and reasonably innovative approach.

However, (re) creating such conducive classrooms in Lebanese public schools may come across difficulties, notably in the financial aspect (budget wise) since designing the optimum classroom includes the implementation of innovative features and technological tools (smart-boards, tablets), which could be considered costly by the government, especially nowadays with the burst of the economic bubble in the country and its monetary collapse. Yet, donations and contributions for learning and education coming from NGOs, the UN, UNESCO, the World

Bank, and the donations received (locally and internationally) for the reconstruction and renovation of the damaged and affected schools by the explosion on August 4th, 2020, can contribute in accomplishing such classroom environment design.

Furthermore, what about the students enrolled in private sectors and their views of their classroom's physical environment?

Future studies can thus use the qualitative methodologies to research and study the extent to which they find the rooms' physical factors enhance their learning experience and academic performances. Such studies can possibly lead to 'image restoration' of the Lebanese schools and its advanced educational systems and environments. Moreover, this thesis' methodological process did not allow further measurements as 'out-of-hand' limitations were encountered during the study. Hence, future studies could focus on experimental components and focus groups that include both students of public and private sectors that could prompt deeper and further insights, in order to compare the students' perceptions of their educational setting since they could possibly interact and exchange opinions in different ways when they are presented with changing opinions on the matter issue.

In addition, this could be done to develop and improve future projects, innovate their structure and meet the precise needs of both scholars and instructors in question, which also may enhance educational experiences and academic outcomes. This could possibly increase the effectiveness of the room's setting and efficiency of the resources and supplies invested in the school infrastructure developments, and could lead to a more fruitful cooperation between designers, specialists and (interior) architects involved in school and classroom development. Also, according to Wolff, Jarodzka & van den Bogert (2016), the effectiveness of the education

system across the globe is based on the support that the secondary education gets from the government and other interest groups.

To conclude, the overarching aim of this research study was to collect the current findings and the evidence on the impact of the classroom's environment, and how it can affect their learning outcomes. It was revealed that the followings have a particularly strong impact on classroom management and design planning for a progressive learning experience. Also, the evidences highlighted the effect of an adequate 'fit' between school spaces and pedagogy. Moreover, as the physical environment, from a classroom perspective, is defined as the physical characteristics necessary for any classroom to be effective, it is indicated throughout this study that where there is a favorable physical classroom environment, the performance of the students improves as this is considered as a catalyst towards reporting high student's performances. In some of the successful learning institutions, the comfort of the students is necessary and this is essential in improving the quality of learning in such an institution.

This thesis further revealed that there is a significant relationship between the physical classroom environment and the high school student's learning. Also, it has disclosed the significance of the following related matters of educational purpose, quality, student engagement, and having a cooperative, flexible and interactive environment, as well as the importance of modern interior elements, technology and their implementation within the curriculum. As such, it will be interesting – in the future – to see those working on instructive and educational infrastructure funding to reap and actualize all of the advantages and benefits that advanced quality schools and classrooms can offer to maximize student performance, increase academic achievement, improve learning experience and school community satisfaction.

Appendix A: IRB Form 1

Application Form
(Based on the *IRB Guidebook*[3])

Title of the Study	The Impact of the Class Environment on High School Students' Learning in Public Schools in Beirut, Lebanon.
Sponsored by	Notre Dame University Louaize (NDU).
Purpose	Completion of thesis II for a Master degree in Arts and Design.
Concise Summary of Project [200 words]	Outline the importance of the class environment in improving the satisfaction level of the students as low students performances have been attributed to the negative effect of the classroom's physical environment in public Lebanese high schools that have limited classroom resources (as also this has an impact on the student's achievement in the long-run).
Profile of the Research Subjects	High school students enrolled in grade 10, 11 and 12 that are attending Lebanese public schools located in Keserwan, Lebanon.
Recruitment Methods and Consenting Process	Data collection methods: Online questionnaire of 14 questions, distributed to the students of grade 10, 11 and 12 that are enrolled in Lebanese public schools located in Kerserwan, Lebanon. **NB**: Due to the limitations met throughout the study (outbreak of the pandemic Covid-19 and the Lebanese revolution), "on-ground" observation was alternated to an online research of case studies locally and internationally. Consenting process: Study participants are to read and sign the IRB approved consent form prior to study participation, as also confidentiality and anonymity of the respondents as there are ethical implications associated with this form of relationship between the participants and the researcher. The respondents will be advised not to write their names on the survey paper while the researcher will ensure that the transcript does not contain the names of the respondents.

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[3] The *IRB Guidebook*: http://www.hhs.gov/ohrp/archive/irb/irb_guidebook.htm

Potential Risks (such as discomfort, inconveniences expected)	Embarrassment of (the student) labeling his/her own school in an inferior and negative way.
Potential Benefits (solution to social/environmental problems, advance of knowledge, treatment of any kind, etc.)	Finding a more adaptable and comforting physical environmental solution in classrooms, also understanding the effect and impact of outdated classrooms in order to advance it and improve a student's achievement. Such study contains several potential benefits: physical environmental benefits, pedagogical benefits, learning benefits, general benefits for proper school environment and its students, teachers and staff.
Subject Safety and Data Monitoring	No adverse event (AE) can possibly happen as ensuring data collection is virtual and online due to the current events occurring in Lebanon (Pandemic outbreak, Revolution, political and economical crisis, Lockdown…). Hence, study participants are completing the questionnaire through an online link from home.
Procedures to Maintain Confidentiality	Confidentiality and anonymity of the respondents as there are ethical implications associated with this form of relationship between the participants and the researcher. The respondents will be advised not to write their names on the survey paper while the researcher will ensure that the transcript does not contain the names of the respondents.

Appendix B: IRB Form 2

Application Form
(Based on the *IRB Guidebook*[4])

Title of the Study	The Impact of the Class Environment on High School Students' Learning in Public Schools in Beirut, Lebanon.
Sponsored by	Notre Dame University Louaize.
Purpose	Completion of thesis II for a Master degree in Arts and Design.
Concise Summary of Project [200 words]	Outline the importance of the class environment in improving the satisfaction level of the students as low students performances have been attributed to the negative effect of the classroom's physical environment in public Lebanese high schools that have limited

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[4] The *IRB Guidebook*: http://www.hhs.gov/ohrp/archive/irb/irb_guidebook.htm

	classroom resources (as also this has an impact on the student's achievement in the long-run).
Profile of the Research Subjects	High school students enrolled in grade 10, 11, 12 in Lebanese public schools located in Keserwan, Lebanon.
Recruitment Methods and Consenting Process	Data collection methods: Short questionnaire distributed to the students, an interview, and on ground date collection procedure.
Potential Risks (such as discomfort, inconveniences expected)	Due to Lebanon's current situation and the presence of a pandemic, inconveniences such as collecting accurate and on ground date could be an obstacle as physical interaction and being present for class observation is challenging.
Potential Benefits (solution to social/environmental problems, advance of knowledge, treatment of any kind, etc.)	Finding a more adaptable and comforting physical environmental solution in classrooms, also understanding the effect and impact of outdated classrooms in order to advance it and improve a student's achievement.
Subject Safety and Data Monitoring	Observation will take place in classes throughout the course with no interruption, two/three days a week, for an hour and thirty minutes each session.

Informed Consent Form
(Based on IRB Guidebook)

GENERAL INFORMATION

Title of Research	The Impact of the Class Environment on High School Students' Learning in Public Schools in Beirut, Lebanon.
Funding Agency/Sponsor, if any:	None
Names of the Leading Researcher and Those Individuals Who will Obtain Consent	Tina Roy Farhat (the researcher) under the supervision of Ms. Dinna Baroud.
Contact Person Phone Office Hours	Dina N. Baroud 03/ 976310 Monday- Friday, 1:30-2:30 PM

RESEARCH STUDIES: MATERIALS & METHODS

Statement About the Research Studies	Proposing improved and new notions as The study findings will be used in providing key recommendations for improving the physical classroom environment.
Purpose(s) of the Research	Investigating the physical elements present in a classroom and the notions of their impact on a student's focus, motivation and learning outcomes in order to understand

	the effect and the impact of the class environment on students' learning in schools
Expected Duration of the Subject's Participation	10 to 15 minutes for the completion of the questionnaire.
Description of the Procedures to be Followed	Sampling design and procedures, data collection schedule, definition of important term and concepts, and data analysis procedures.
Detailed Experimental Procedures	70% of the sampled population will be provided with questionnaires to fill and on ground classroom observation. However, due to current complications happening in Lebanon, virtual contact might be an alternative.
Approximate Number of Subjects Involved in the Study	7 to 9 public schools are to be visited, asking at least 3 students of each grade (grade 10,11,12).
Profile of the Research Subjects	High school students of grade 10-11-12 enrolled in Lebanese public schools located in Keserwan, Lebanon.
Circumstances Under Which the Subject's Participation May be Terminated by the Leading Researcher Without Regard to the Subject's Consent	Discomfort or a feel of invasion of privacy, being biased.

RISKS & BENEFITS

Foreseeable Risks or Discomforts to the Subject	Invasion of privacy, the feel of being subjective towards his/her school physical environment since it is a public school, the feel of underestimation due to social classes present in Lebanon's social system.
Benefits Expected from the Research	Obtaining key findings that would help improving a classroom's physical setting for a better educational achievement and comfort.
Disclosure	Most of the Lebanese public schools are outdated in their physical environment.
Confidentiality Statement	Confidentiality and anonymity of the respondents as there are ethical implications associated with this form of relationship between the participants and the researcher. The respondents will be advised not to write their names on the survey paper while the researcher will ensure that the transcript does not contain the names of the respondents. The notes from the interview will not be

	taken to the work environment to prevent access to the information by the third party.
Medium to High Risks	Low risks.
Subject's Compensation to be expected (if any)	None

Consent Statement (Based on *IRB Guidebook*)

Being informed that any particular treatment or procedure may involve risks which are currently unforeseeable; I, [Tina Farhat], state hereby that my participation in the research study is voluntary. Any refusal to participate will involve no penalty or loss of benefits to which I am entitled. I may as well discontinue participation at any time without penalty or loss of benefits to which I am entitled.

_____,   _____,
Signature(s) of the participant(s)   Signature of the Leading Researcher (LR) or guardian

_____,
Signatures of the witnesses (where appropriate)

Appendix C: List of Lebanese Public Schools

List of Public Schools located in Keserwen:
1. Elias Abou Chabake Public School
2. George Frem Public School
3. Al Safra Public School
4. Public High School – Jounieh
5. Haret Sakher Public School
6. Ghazir Public School
7. Sarba Public School
8. Zouk Mosbeh Public School
9. Iskandar Rizk Public School
10. Kfour Public School
11. Mairouba Public School
12. Daraoun Public School
13. Yahshoush Public School

Appendix D: Questionnaire

The following questionnaire is a quantitative methodological process that assesses the physical environment of classrooms, in order to extract and inspect specific notions and parameters; such as purposeful furniture, class management, walls and windows, artificial/natural lightings and every other physical element that affects the focus and learning outcomes of the students. Thus, this questionnaire is an anonymous survey only defining the age, grade and the public school's name. It also includes 14 close-ended questions (yes-no questions) that the researcher will be asking on high school students enrolled in Lebanese public schools, as they are more attentive and aware of their surroundings. Furthermore, the questionnaire ends with 2 open questions, where students are allowed to subjectively explain and elaborate more about the positive or negative aspects of the classroom for a better understanding of the hypothesis suggested.

Students enrolled in Lebanese public schools of Keserwan city, in grades 10, 11 and 12 are asked about their classroom's environment.

Findings emerging from data analysis will be formulated at later stages in order to affirm the following hypothesis "There is a significant relationship between the physical classroom environment and the high school student's learning".

"*The physical elements of the classroom and their effect on high school students' focus and learning outcomes*" Questionnaire

Date:

_____
_____

Public School Name:

_____

Class of / Grade:

_____

Age:

_____
_____

As a high school student enrolled in a Lebanese public school and spends most of his school hours in a classroom, in your opinion

1. Do you think the desks in this classroom are comfortable and spacious enough - when it comes to writing and taking notes?

   Yes _____
   No _____

   -When it comes to the seats when sitting?

   Yes _____
   No _____

2. Do you think this classroom is large enough for the number of students (enrolled) in this classroom?

   Yes _____
   No _____

3. Do you think the arrangement of seats and desks in this classroom is appropriate and adequate?

   Yes _____
   No _____

4. Is there disturbing noise coming from outside of the classroom in this class?

   Yes _____
   No _____

   If yes, do you think this noise condition is often a problem in this class and affects your focus and learning outcomes?

   Yes _____
   No _____

5. Is the lighting condition in this classroom - natural and artificial - adequate during lecture, audio/visual presentations?

   Yes _____

No _____

6. Are you often distracted by other visual items or physical elements in this classroom?

Yes _____
No _____

-If yes, define the item:

_____
_____

7. Are the classroom's walls functional and have a purposeful usage?

Yes _____
No _____

8. Is the classroom's size adequate?

Yes _____
No _____

9. Does the classroom have enough openings and windows for efficient ventilation?

Yes _____
No _____

10. Are the classroom's ceiling and floor in good condition?

Yes _____
No _____

11. Is the furniture (the desks) place management helping in improving interaction with other students?

Yes _____
No _____

And does it affect you positively or negatively when it comes to your learning outcomes?

Positively _____
Negatively _____

12. Given nowadays classrooms are equipped with innovative tools such as computers, smart boards, and projectors… Do you think this classroom is lacking or outdated regarding these contemporary learning methods?

Yes _____
No _____

13. Regarding the previous question, do you think access to these technological aspects would enhance your learning outcomes?

Yes _____
No _____

14. Overall, are you pleased with your classroom physical condition?

Yes _____
No _____

15. When it comes to your educational learning,

What are some necessary elements in the classroom you think should be improved?

_____
_____

_____
_____

What are some necessary elements in the classroom you think should be added?

_____
_____

_____
_____

What are some necessary elements in the classroom you think should be removed?

_____
_____

_____
_____

16. What is a main architectural element in class you think is affecting your focus and
distracting you during the course?

_____
_____

_____

Appendix E: Coding Frame

Furniture	Technology	Spatiality	Finishing
Desks and seating*	**Use of technology systems***	Interior Design	**Lighting (natural and artificial)***
Desk management and organization	**Learning tools (tablets, E-board, E-books and computers)***	**Spacious room (adequate size for student number)***	Ventilation (heating/cooling systems)
Board		Interactive walls	Tiles and ceiling

Furniture	Spatiality	Technology	Finishing
New and comfortable desks*	Wider space for equipment	**Technological learning tools and devices***	**Light and warms colors for a mood***

Couches or benches*	Desk and room layout	Tablets, projectors, speakers, computers*	Cooling systems, AC, Ventilation*
Curtains and a clock to check the time	**Corner for interactive white boards***	Higher tech and screens	**Heating systems or a heater***
Management of chairs and tables/desks*	Posters, pictures and displays about school subjects on the walls	Whiteboards and digital boards	**Lighting (natural and artificial), LEDs and table lamps***
Lockers	**Wall units to arrange books and belongings***	Music	Acoustics, sound proof walls
Wider and bigger tables	**Flexible layout for collaboration, diversity and navigation***	School applications (E-learning, Blackboard, Moodle).	

Physical elements that should be removed from the classroom	
Broken and outdated chairs and desks	Desk hierarchy
Chalkboards	Plain walls
Ceiling/wall fans	Damaged tiles and ceiling
Yellows artificial lighting	Overcrowded classroom

Key physical element within the classroom causing distraction during course hours		
Creaks of old desks and chairs	Humidity of wrong window positioning	Nothing stimulates attention and concentration
Size of classroom compared to the number of students	Sunlight/ daylight does not enter	The shape of the room/ Classroom layout
Bad lighting/ Flickering lights	Chalkboard/ board not straight	Tight spaces between desk rows
Plain walls/ bright white walls	All of the room, the mood and design	Room organization and desk management
Cracks on walls and ceiling (feels unsafe)	Uncomfortable chairs and small desks	Large windows/ the exterior

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