A Discussion on Space Quality in Educational Building (Northern Cyprus)

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ABSTRACT

Space quality in places that learning takes place is an ongoing debate. It can impact on the construction of meaning within education and dynamic of learning. It is suggested that there are different learning goals and expectations and consequently a need for different learning environments. However, result in everyday experience is not always responsive. This study contributes to a navigation of the realities of learning space. It recognizes that the literature may be leaving the profession behind and that for many educators the opportunities of design are merely aspirations. The main aim of this thesis is to test the space quality indicators (Space and Proportion, Functional Spaces, Openings (Size, Proportion, shape, direction and visual access), Flexibility and adaptability, Color and texture, Physical Accessibility, Ergonomic) in two different types of educational buildings in North Cyprus as one of the well-known educational destinations. For this reason, two different types of existing educational buildings selected. One in camps university buildings (Girne American University (GAU)) and the other as converted building to university (University of Mediterranean Karpazia (UMK) as cases. Educational spaces in each of the cases is analyzed and compared. The findings reveal that converted spaces to schools and universities are not providing students' needs and expectations in most of space quality indicators. On the other hand, although educational spaces in Campus based are designed and equipped to provide and support educational needs however still there are many criteria that literature implied and in professional world they are neglected.

The result of this case would not be limited to case of Cyprus or selected cases it is kind of precaution to designers, constructors, investors of educational sector and students to advance knowledge regarding this subject and to help them design and build better educational buildings in future.

Keywords: Educational Buildings, Space Quality, Northern Cyprus

ÖZ

Eğitim verilen yerlerdeki alan kalitesi hala devam etmekte olan bir tartışmadır. Farklı eğitim amaçları ve beklentilerinin, ayrıca da farklı eğitim ortamlarına ihtiyaç duyulduğu önerilmektedir. Ancak olağan deneyimlerin sonucu bu kadar hassas olamayabiliyor. Bu çalışma, eğitim alanlarının gerçekliklerine yön vermeye katkıda bulunmaktadır. Çalışma, literatürün mesleği arkada bıraktığını ve tasarım fırsatlarının pek çok eğitimci için yalnızca bir niyetten ibaret olduğunu kabul etmektedir. Bu tezin temel hedefi, en iyi eğitim yerlerinden birisi olarak bilinen Kuzey Kıbrıs'taki iki farklı tür eğitim binasında alan kalitesi göstergelerini test etmektir (alan ve orantı, işlevsel alanlar, açıtlar, boyut, orantı, şekil, istikamet ve görsel erişim, esneklik ve uyum, renk ve doku, fiziksel erişim, ergonomi). Buna bağlı olarak, mevcut eğitim binalarından iki tanesi seçilmiştir. Bir tanesi kampüs üniversite binalarıdır. (Girne Amerikan Üniversitesi, GAÜ). Diğeriyse üniversiteye çevrilmiş binalardır (Akdeniz Karpaz Üniversitesi, AKÜ). Her bir vakadaki eğitim alanları analiz edilmiş ve karşılaştırılmıştır. Bulgular, üniversiteye ve okula çevrilmiş binaların, öğrencilerin ihtiyaçlarını ve beklentilerini, alan kalitesi göstergelerinin pek çoğunda karşılamadığını göstermiştir. Diğer yandan, kampüsteki eğitim alanlarının eğitimsel ihtiyaçları karşılamaya ve desteklemeye yönelik tasarlanmış olmasına rağmen hala literatürün ve profesyonel görüşün belirttiği pek çok kriteri ihmal ettiği görülmüştür. Bu araştırmanın sonuçları seçilen vakalarla ya da Kıbrıs ile sınırlı kalmayacaktır. Bu, tasarımcıların, müteahhitlerin, eğitim sektörü yatırımcılarının ve öğrencilerin bu konudaki bilgilerini ilerletmek ve onlara gelecekte daha iyi binalar tasarlamalarına ve inşa etmelerine yardımcı olacak önlemler niteliğindedir.

Anahtar Kelimeler: Eğitim Binaları, Alan Kalitesi, kuzey Kıbrıs

To My Family

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Chapter 1

INTRODUCTION

1.1 Research Background

In this section, the background that forms a base for thesis is discussed and some terms that are used commonly are defined and explained. The term "quality" is often used to evaluate a product. According to Nelson in 2006, quality is defined by how a product fulfills users' needs or expectations. It should be mentioned that quality is subjective and it varies with the users' priorities (Choy & Burke, 2016).

Space is the basis of architecture. It defines the characteristics of each architectural design (Zevi, 2009). "Space is created by a specific set of natural and artificial things whose architecture is involved in its creation" (Arnheim, 2007). Anything that does not have a space lacks architecture either (Zevi, 2007).

The term "Space Quality" is a combination of good design (Sternberg, 2000), good architecture (Chapman & Kham, 1999), good city form (Lynch, 1984), urban quality (Trip, 2007) and delight (Wootton, 1624). This study focuses on the good design and good architecture in order to evaluate the quality of space in an educational environment.

This thesis uses the definition of Magrab in 1997 as a base: "The totality of the characteristics and performance that can be used to determine whether or not a product or service fulfills its intended application."

Education is defined as "means of cultural transmission from one generation to another in any society" (Daramola, 2003). Buildings that house the education process are called educational buildings.

1.2 Importance of Thesis

Educational buildings as place that their users (students and staffs) are spending around 70 percent of their daily life and having great impact on students' learning are very important. Students are easily distracted in uncomfortable space caused by any inappropriate factors which affected space quality.

This thesis tries to find factors which affect educational spaces quality in educational buildings and to increase particularities will study and evaluate case of Northern Cyprus. This country due to its special geographical place and high level of provided educational services already attracts many students. The number of universities in this country compare to its span is considerable and this provides a reason to test and evaluate the current condition of those under use buildings and get lessons from it. The importance of this research can be fully comprehended when it is mentioned that, slight changes with minimum costs in interior spaces of educational buildings or better design decisions at beginning can cause enormous differences in comfort conditions and the learning process of student's. Furthermore, this study can be more helpful and supportive not only for fresh designers but also to improve current condition of constructed educational buildings.

1.3 Problem Statement

Education is already admitted as the primitive right for all humankinds in a long time; however, the quality of buildings space where education takes place is rarely discussed and evaluated notions (Ward, 2015; Baker, 2012).It seems like there is an unwritten belief that the quality of education is more important than the quality of educational spaces. Although daily population increases in the whole world and the possibility of providing demanded spaces for this population exacerbates the situation, it would be naive to deny the influence of space quality (healthy and comfortable spaces) on users' concentration, productivity, progress and learning attitudes.

Unfortunately, the development of learning environments, especially for adults, has been neglected (Katafygiotou and Serghides, 2014). Educational space quality should be suitably adjusted in terms of functionality, proportion, space arrangement, openings, ergonomics, color and texture and accessibility. Providing these qualities through design-dependent elements such as building's form, orientation, window types and shading devices is easily possible. As consequence of population increment, most of the universities need to cope with the challenge of increasing number of students which is economically beneficial; however, the buildings of these universities are often selected/built either because of their aesthetically pleasant conditions or their location in strategic cities. Therefore, seems still there is a need for researches exploring the qualities of educational buildings both architecturally and from the users' perspectives.

1.4 Objectives of Thesis

The objectives of this study are described as follows:

i. To study and analyze common understanding about space quality and providing list of influential factors on it.

ii. To analyze the space quality in terms of functionality, proportion, space arrangement, openings (Size , shape ,direction ,visual and physical access), ergonomics, color and texture and accessibility

iii. To redefine educational design dependent strategies that designers need to follow and introduce a check list.

1.5 Methodology of the Research

To analyze the impact of educational buildings' space quality and find the opinion of students about current space quality, this study tried to benefit from qualitative methodology. To analyze the effects of design-dependent elements, the selected cases have been studied and analyzed in terms of functionality, proportion, space arrangement, openings, ergonomics, color and texture and accessibility. Finally, in order to determine students' opinion and satisfaction level in terms of space quality some randomly selected students are asked to interview.

Two University buildings in North Cyprus has been selected as case study for this thesis. One of the selected Universities is University of Mediterranean Karpasia (UMK) which is converted building to university. Techno Park Building in Girne American University (GAU) Campus University building. These two different types of building have been selected in different shape, condition (campus based and non-campus building) and space arrangement and etc. To compare with each other.

First the current conditions of the selected cases (functionality, proportion, space arrangement, openings, ergonomics, color and texture and accessibility) are analyzed

through a qualitative method. Each case is investigated separately through interior and exterior photos, measurements of the space and mentioned standards of theory chapter of this study. Then, the interview has been done to find students' opinion about space quality in the chosen cases has been analyzed. The results are initially compared for two cases and then, the author tries to give recommendations and suggestions in order to deal with the named problems and limitations.

1.6 Limitations of Research

This study limits itself to space quality of educational building in North Cyprus. And tries to cover existing type of educational buildings in this part according to the heights, places and used material. Those selected buildings are both university scale and either in campus or individual building in city context. This study is carried out in three main cities of Northern Cyprus (Nicosia and Kyrenia) with maximum number of students.

Related to design quality, these thesis will serve as a base to evaluate the quality of designed educational buildings. Moreover, standards of quality design for educational settings will be discussed. In order to do so, quality is studied in the first step; then, the criteria of evaluating design quality are discussed according to the professionals. Among all the influential criteria this study limits to the functionality, proportion, space arrangement, openings, ergonomics, color and texture and accessibility which are analyzed in detail.

Chapter 2

LITRATURE REVIEW

2.1 Introduction

Space is the basis of architecture. It defines the characteristics of each architectural design (Zevi, 2009). "Space is created by a specific set of natural and artificial things whose architecture is involved in its creation" (Arnheim, 2007). Anything that does not have a space lacks architecture either (Zevi, 2007).

Each space is defined by its elements. According to Gann et al. in 2003, measuring quality of a designed space is not an easy task. Various facts which can be tangible or intangible should be considered. Furthermore, components that define space quality are both objective and subjective (Gann et al., 2003).

The primarily issue is to find the measuring criteria for space quality. According to the existing literatures, these criteria can be divided into three main groups which are: functionality, built quality and impact [Figure 2.1]. This means that, in order to achieve the desired quality in an architectural space, all these criteria should work together (Gann et al., 2003 & Harputlugil and Gultekin, 2009).

This method of measuring design quality began in the UK construction sector with the publication of Rethinking Construction. The main aim was to define a policy for quality assessment of designed spaces (Egan, 1998).

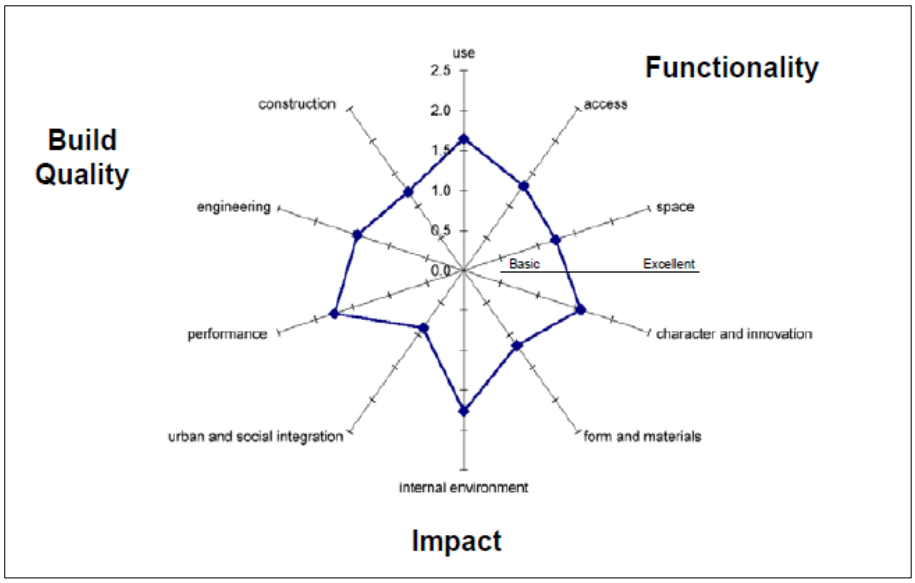


Figure 2.1. Design Quality Assessment (Thomson, 2003)

While the effect of healthy and comfortable educational settings on students' achievements is not a secret today, this thesis studies the quality of designed educational buildings. Educational spaces are mediators which can both enhance the process of learning or cause negative consequences (Report of the Department of Education and Early Childhood Development, 2011).

The main aim of this chapter is to analyze the existing literatures related to design quality. These literatures will serve as a base to evaluate the quality of designed educational buildings. Moreover, standards of quality design for educational settings will be discussed in this chapter. In order to do so, quality is studied in the first step; then, the criteria of evaluating design quality are discussed according to the professionals. Among all the influential criteria, functionality, proportion, space arrangement, openings, ergonomics, color and texture and accessibility are analyzed in detail. The last section gives summary of this chapter.

2.2 Space Quality

The term "quality" is often used to evaluate a product. According to Nelson in 2006, quality is defined by how a product fulfills users' needs or expectations. It should be mentioned that quality is subjective and it varies with the users' priorities (Choy & Burke, 2016).

Quality is the third character (beside cost and time) that determines the selection of a project (Suratkon & Jusoh, 2015). Today, most of the designers' first priorities is construction and maintenance costs. This fact has made most of the designed projects boring with minimum quality (Salimi & Razzaghi, 2014).

In order to evaluate the quality of an architectural project, the first step is to determine its use and how it will affect users (satisfies, harms or empowers the users) in future (Moulaert et al., 2011).

The term "Space Quality" is a combination of good design (Sternberg, 2000), good architecture (Chapman & Kham, 1999), good city form (Lynch, 1984), urban quality (Trip, 2007) and delight (Wootton, 1624). This study focuses on the good design and good architecture in order to evaluate the quality of space in an educational environment.

This thesis uses the definition of Magrab in 1997 as a base: "The totality of the characteristics and performance that can be used to determine whether or not a product or service fulfills its intended application."

Although there are several studies related to architectural space evaluation, only four of them tried to determine criteria out of their studies (Harputlig et al., 2014). As Table2.1 shows, all these three researches are categorizing the criteria under three indicators which are Functionality, Build quality and Impact. They believed that an architectural product meets the required quality if all these criteria work together.

Table 2.1. Researchers Idea about Categorization of Space Quality Factors

	Criteria
Thompson (2003)	***Functionality*:** use, access, space ***Built quality*:** performance, engineering systems, construction ***Impact:*** form and material, internal environment, urban and social integration, character and innovation.
OECD (2006)	***Functionality*:** access to all sections of a building. ***Built quality**:* durability, heating & cooling systems, ventilation. Usage of sustainable materials, structural system. ***Impact*:** The build environment must clearly reveal its identity and character, proper circulation, natural lighting, form and materials should be applied.
Harputlig (2014)	***Functionality:*** Space size and proportions, fit for purpose, privacy, access (local access, interior access, inter-floor access, inter-unit access), flexibility, adaptability ***Built quality**:* Engineering systems, lighting, ventilation, air conditioning, electrical systems automation, security, noise control, construction, durability, detail solutions, structural design, finishing, structural material selection, occupancy performance, energy performance, functional performance. ***Impact:*** Form and materials, color and texture, identity, age, movement, order, character, aesthetics, context, image.

Suratkan & Jusoh (2015)	***Functionality****:* layout, access, space, lighting & natural lighting, natural ventilation ***Build quality*****:** use, engineering system, landscape, security system, sustainability, finishing, structure element, road width, infrastructure, stability, walkway, building maintenance ***Impact:*** color, form and material, comfort, internal environment, external environment, character and innovation, urban and integration social, location, visual effect, security, natural disaster, noise.
	Sitting orientation, accessibility, community privacy, ease of management, clarity of expression, composition, connectivity, space allowance, circulation efficiency, type specific, attributes, adaptability, health and safety, ease of maintenance, integration, innovation, vision, material quality, symbolic fit, user control, finishes, acoustics, natural light, artificial lighting, external form, spatial qualities, landscape, type specific attributes, civic contribution, valuing the user, buildability and structural efficiency, durability and thermal comfort.

Thomson in 2003 has a categorization of these criteria. In this study the criteria are defined as following:

Functionality: use, access, space

Built quality: performance, engineering systems, construction

Impact: form and material, internal environment, urban and social integration, character and innovation.

Another categorization is given by OECD in 2006. All criteria are divided into three categories:

Functionality: access to all sections of a building, either educational or non-educational, should be provided. Building should be adaptable to the changing needs.

Built quality: buildings should be durable and the need for heating and cooling systems and ventilation should be minimized. Sustainable materials should be implemented and structural system must be integrated with other parts of the building.

Impact: the build environment must clearly reveal its identity and character. Proper circulation, natural lighting, form and materials should be applied.

Harputlig et al. in 2014 have found the most important priorities during the pre-design stage and categorized them as follow:

Functionality: Space size and proportions, fit for purpose, relationship with spaces, privacy, access, settlement, local access, interior access, inter-floor access, inter-unit access, use, flexibility, adaptability.

Built quality: Engineering systems, lighting, ventilation, air conditioning, sterilization, electrical systems automation, security, acoustic (noise control), construction, durability, detail solutions, code compliance, structural design, finishing, structural material selection, performance, occupancy performance, energy performance, functional performance

Impact: Form and materials, color and texture, identity, age, movement, order, character, aesthetics, context, image.

According to Suratkan and Jusoh in 2015 in order to measure the quality of a design the following indicators should be analyzed:

Functionality: layout, design, access, space, lighting, service, natural lighting, natural ventilation

*Build quality***:** use, engineering system, landscape security system, energy, green energy and sustainability, finishing, structure element, road width, infrastructure, stability, pedestrian, walkway, building maintenance

Impact: color, form and material, comfort, internal environment, external environment, character and innovation, urban and integration social, location, visual effect, security, natural disaster, noise.

Another categorization is mentioned by Gann et al. in 2003 as follows:

Sitting orientation, accessibility, community privacy, ease of management, clarity of expression, composition, connectivity, space allowance, circulation efficiency, type specific, attributes, adaptability, health and safety, ease of maintenance, integration, innovation, vision, material quality, symbolic fit, user control, finishes, acoustics, natural light, artificial lighting, external form, spatial qualities, landscape, type specific attributes, civic contribution, valuing the user, buildability and structural efficiency, durability and thermal comfort (Figure 2.2).

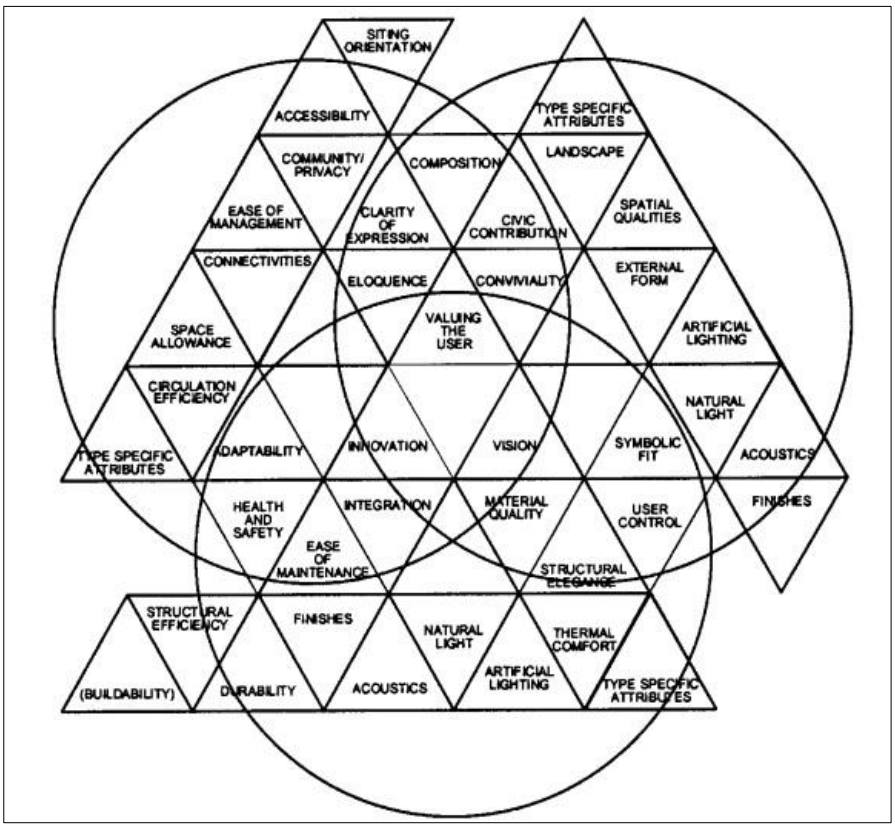


Figure 2.1. Design Quality Indicators (Gann et al., 2003)

Based on what is found in the existing literatures and their categorizations, the indicators of design quality can be divided into the following groups: Space size and proportions, fit for purpose, privacy, access (local access, interior access (access to all sections of a building), inter-floor access, inter-unit access), social integration, flexibility, adaptability, ventilation and air conditioning, functional performance, color and texture, urban and integration, location, noise.

All these factors are studied under five main groups in this thesis which are: Space & proportion, Functional space (space organization and arrangement), openings (size/ proportion/shape/direction/ visual and physical accessibility), and ergonomics (adaptability and flexibility, furniture), Color and texture.

2.2.1 Space and Proportion

A. Space:

Space is the core element of architecture. In order to design an architectural space, that is surrounding us, it is essential to consider the characteristics of its nature and determining messages that are exposed by its built form. In other words, space is a kind of a detection process that helps the architect to enrich and construct her / his understanding of spatial and space skills. These, collected, recorded, reproduced and even described skills are then used as the essential part of her / his spatial data and performance as the activator of the design procedure via leading to decide on the concepts and principles of the space which they prefer (Lawson, 2003).

As Kurtuncu, et al mentioned, knowledge related to space acts as a network intertwined between interrelated concepts such as scale, body, structure, proportion, senses, perception, atmosphere, time, experience, memory, architectonics articulation, materials, context, light, spatial and syntax etc. (Kurtuncu, et al, 2008).

The common approach in architecture is to evaluate and conceive spaces via focusing on their formal characteristic and physical appearance and to categorize them in a specific style of architecture. This approach disrespects those characteristics such as their social implications and man-space relationship that are the main forming elements of architectural space and its identity (Lawson, 2003).

Space is simple even more than the sounding volume around us. Firstly, space has its own physical form with tangible characteristics such as scale, width, length, geometry and color, light and texture. Secondly, space has some complex and abstract characteristics which are even difficult to interpret. These are rules, abstract and cods' parts of space which make that meaningful. (Koch et al, 2009).

B. Proportion

"Since therefore, all things are beautiful and to some measure pleasing; and [since] there is no beauty and pleasure without proportion, and proportion is to be found primarily in numbers; all things must have numerical proportions" (St Bonaventure Itinerarium Mentis in Deum II, 7)

Broadly speaking, proportion is the appropriate harmony between every piece of the space and the rest of the pieces and the entirety of the space. This relation between elements is not solely maintained through magnitude since it is possible for this connection to be established in the form of degree or quantity. Proportion is maintained differently by each individual designer. Sometimes even the material itself becomes the indicator of the nature of this relation (Ching, 2007).

The function of the most of Architectural elements is defined through the structural plan and their manufacturing methods. However, these proportions can be changed by the designer (Ching, 2007).

The extremely big or small spaces have negative influences on users. The main aim of all proportional principles is to establish a harmony and an order between various elements (Figure 2.3). People have different, individual opinions towards proportion. Sometimes these proportions are not immediately comprehensible; however, they are felt and recognized in the long run (Ching, 2007).

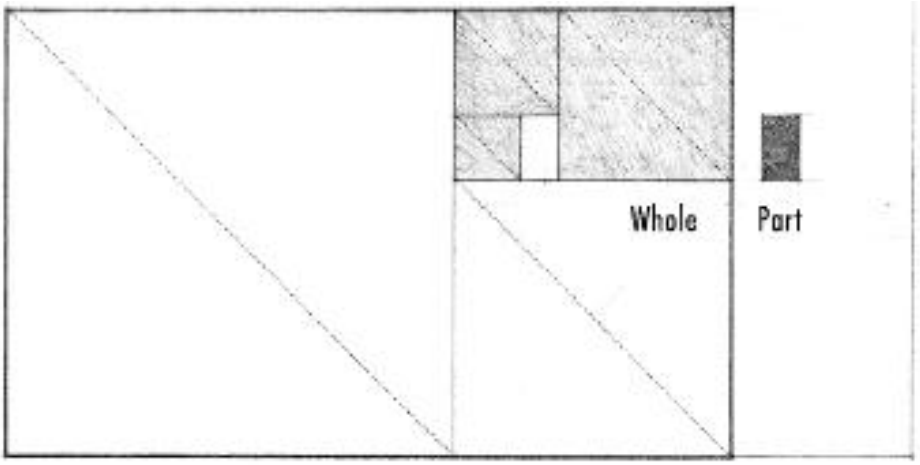


Figure 2.2. Proportion, the relationship between whole and part (Ching, 2007)

Generally, the proportion of an educational space is determined by the number of the students (Figure 2.4). It is possible to say that approximately for each university student 1.4 square meters is required (this amount does not include professional educational spaces). If classrooms are utilizing portable seats this ratio can reach up to 1.85 to 2.32 square meters. If the space is used for seminars or have a distinctive use at least 2.32 to 2.80 metes square per person is required. If the educational space is considered to be media-reach the amount of space required for each student may even reach up to 4.6-meter square. As for the height that is required for such spaces, it is believed that 323 CMs is needed so that the entrance of the unblocked light would be easier. It is worth to mention that bigger classrooms and buildings naturally require greater proportions. Thus the adequate proportions are maintained according to both acoustics and aesthetic rules (Princeton University Report, 2014).

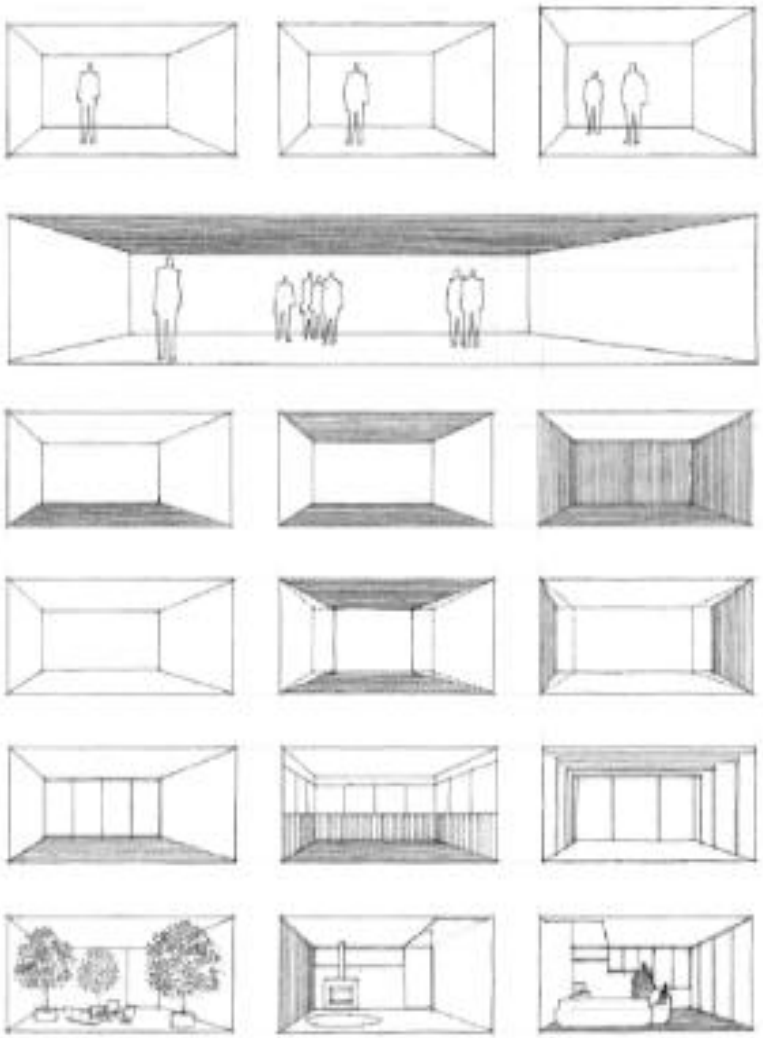


Figure 2.3. Proportion and human scale (Ching, 2007)

The preferred shape for classrooms is square. If the shape is rectangular the 4x3 ratio is the best proportion. The waiting spaces are usable spaces where the students can wait. No certain proportion has been established for them; however, they must certainly be located close to the classrooms and have acceptable proportions. The suitable amount of space per student in the waiting spaces is 0.5 square meters. The extremely narrow or long classrooms and also odd shaped ones are generally to be avoided. The visual connection of students and instructors cannot be blocked by columns and any other building elements. The classrooms that have the capacity of less than 15 students are generally inadequate (Washington University, 2015).

2.2.2 Functional Spaces

Functionality is one of the criteria that influence the process of judgment of a building. It is measured based on the usefulness of space. Three different factors are influential here: Space, Access, and Use. The first step to indicate the functionality of a space is to measure the level of the costumer's satisfaction (Volker, 2010).

In educational settings, functionality is defined as having access to all the available educational or non-educational spaces for all the users. In order to satisfy this need, educational buildings must have the ability to adapt themselves to changes (OCED, 2006).

The design of an educational building should demonstrate the architectural concept supporting the building's character and form as well as the relationship between spaces. There should be a civic structure to illustrate the significance of educational building in the city. All visible elements should be perceived over the design period. Moreover, it is important to consider how will the building look like both during day and at nights (DES, 2007).

The selection of proper scale and proportion, together with prioritizing the spatial quality in an educational building raise students' spirit. Visual elements should be used to express functional spaces and to reduce over-massing. Monotony of forms should be averted and illumination should be considered to enhance the three dimensional forms.

The Designed spaces should be attractive and well-planned to stimulate the desire feeling. Safety and accessibility to all areas and facilities should be ensured for all

adult student categories especially those with special needs or disabilities. A horizontal vista is preferred for classrooms, offices and dormitories to ensure a view of the surrounding environment. To maximize the sunlight penetration, the teaching stage should be minimum 25 cm above the finished floor level. Furthermore, the height of window sills should be 9 cm above the finished floor level (DES, 2007).

Classrooms play a significant role as the core spaces of an educational building to determine the dignity of its design. Therefore, proper and flexible design of classrooms affect educational programs and pedagogical goals. Hence, the main body of educational buildings are created by classrooms. The classrooms' form and size should support the activities which take place in them (Williamson, S, 1997).

The students' comfort in a classroom and the level of interaction are influenced by furniture arrangement (Martin, 2002; Burgess and Kaya, 2007). Comfort is subjective in nature which means different furniture arrangements will arouse different emotions. For instance, in a survey of more than 1000 students, women are reported to feel more at ease in classrooms with desks arranged in rows or clusters (Burgess and Kaya, 2007). Nevertheless, Hasting and Schwieso (1995) stated that clustered arrangements can also lead to more disruptive and off-task behavior. Therefore, Wannarka and Ruhl (2008) suggested that in order to find the optimum desk arrangements; the aims of learning and task demands should be considered.

An object can also motivate or demotivate students depending on the students' background and origin. A study was performed at a local university where female students' feelings while waiting in an office belonging to the male graduate students were analyzed (Burgess and Kaya, 2007).

The analogies were based on the objects in the waiting room. When the waiting room contained objects that did not reaffirm the female students' views and beliefs about women especially those who had prior concerns about gender issues, performed negatively on the analogy. Mendoza-Denton et al. (2009) stated that reassuring women that they would not be judged based on their gender through displaying objects illustrating equally or historical achievements by women should generate more positive results. Cheryan et al (2009) analyzed the impact of masculine objects in the study environment and realized that these objects undermine female students' career aspirations. They, in their analysis of female undergraduates, discovered that these students should express more interest in computer science subject when the objects in the room were less related to computer science (e.g., art, plants, etc.) compared with when the room had objects pertaining to computer science (e.g. computers, projectors, video games, etc.) within a building.

The entrance of each building has a noticeable impact on its functionality and appearance. Entrances signify access and create a central point for all users (residents and staff). They welcome people and guide them inside the buildings (Burgess and Kaya, 2007).

The other important role of an entrance is to visually represent the characteristic of a building. Entrances are symbols of the buildings' designing approach and well-defined entrances positively influence users. If these access points are improperly defined (hardly achieved entrances, heavy doors or narrow entrances), people may feel excluded. Entrances play conflicting roles; they can be used to control access to the building. They may deny the access of some unannounced people. A properly designed entrance should provide the required qualities and make easy access

possible for entitled people. Interior doors also act as barriers for some adjacent spaces. The reason can be privacy, security, decreasing noise, etc. furthermore, these doors should make easy circulation among different spaces, entrances and exits possible for all users (Building for Everyone Report, 2015).

The circulation pattern and circulation strategy should be well laid out and expressed. This is because there will be guests who are not familiar with the building. It is highly important to use both the architectural structure of the building and signage. This is to ensure physical accessibility within the building and its external environment by both frequent and potential users (Building Bulletins No.91 and 94, (1999; 2001)).

The number of entry points to an educational building depends on the type and number of users and security concerns as well. A single entry may be more secure but multiple entrances reduce congestion. The circulation pattern should efficiently utilize available spaces and it should wither overlapping or running alongside or adjacent to the study spaces.

Regarding the security and restriction, the educational building should make it clear as to the people who require and do not require authority to access certain sections and also the particular times when other sections are not accessible (e.g. exam periods). It is preferred to cluster spaces that are frequently used to bolster security and is also advised to have specific routes leading private sections which are seldom used such as examination rooms and consultation centers (Building Bulletin No.95, 2002).

The Building for Everyone (2015) stated that horizontal circulation in a building may comprise access routes through open-plan areas, walkways, corridors and lobbies. The overall arrangement of access routes should be logical, understandable, useable, and as direct as possible in terms of providing access to key facilities. Travel distances should be minimized, although this of course will depend on the nature and size of the building. A well-designed building layout, with clear circulation routes that are easy to follow will benefit everyone. Moreover, it emphasized that changes of level within a story should be avoided if at all possible. Where this is not possible in an existing building, the installation of a ramp, passenger lift or platform lift may need to be considered and designed to be accessible. All circulation routes should be well maintained, free of obstacles and have adequate headroom. Windows should not open into circulation routes in a manner that would cause obstruction or reduce corridor width.

Corridors in buildings should have a recommended clear width of 1.5m – 2m to enable people to move in both directions and pass each other with ease. Passing places should be provided where a corridor is predominantly less than 1.8m wide. Passing places should be at least 2m long and 1.8m wide, and positioned within the sight of another. The passing spaces also serve as turning areas, which are useful at corridor junctions, at the top of ramps and at the end of passageways. They enable wheelchair users and parents with strollers to turn and return along a corridor and generally improve access for all building users (Burgess and Kaya, 2007).

The furniture should ease the process of reconfiguring spaces. This means that the furniture should be light enough to be carried and moved. Fixed furniture unless necessary should be avoided, tables should be accommodating multiple type of

usages and trolleys should also be available to transport resources from one space to another. Adjustable furniture is also necessary. Modifiable chairs and tables can be considered in a situation where adults and children utilize the same space and resources or for special occasions when students need extra support (Building Bulletin 95, 2002).

City Schools' educational specifications encourage the clustering of classrooms as an organizational device. A school can have multiple clusters throughout its building. These clusters can accommodate around 150 students, with smaller clusters for primary schools and larger ones for high schools. Each cluster consists of four to eight classrooms aligned to the number of students designated to share the cluster; the classrooms are designed to support flexibility for students' activities and teaching. Classrooms within a cluster use a shared collaborative learning space, storage as well as teacher planning and resource rooms. The most flexible space is the collaborative learning space in each cluster. Figure 2.2 illustrates the relationship between spaces in a cluster (Baltimore City Board of School Commissioners, 2012).

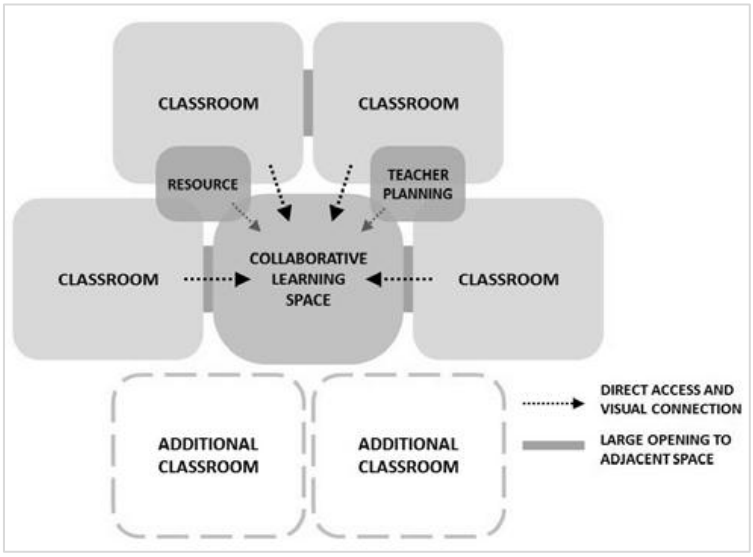


Figure 2.5. Relationship between spaces in a cluster (Baltimore City Board of School Commissioners, 2012)

The relationship between clusters and their shared using area should be investigated. The shared-use areas that are not contained in each cluster should be located on the edge of clusters; thus, they are easily to accessed from different clusters (Figure 2.3) (Baltimore City Board of School Commissioners, 2012).

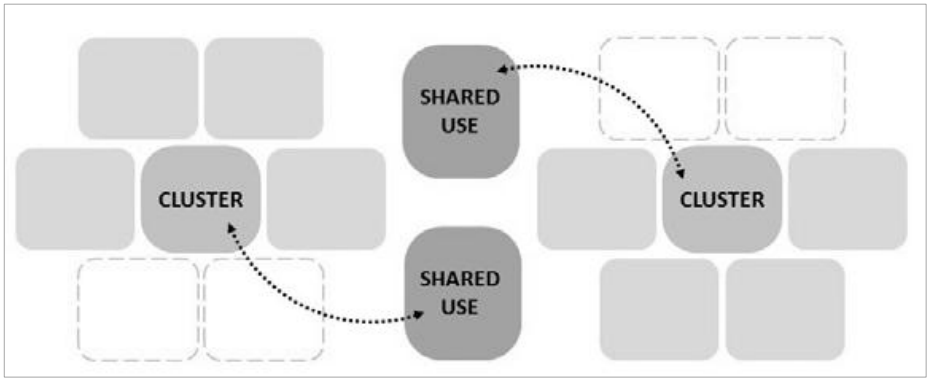


Figure 2.6. The location of shared-use areas and clusters (Baltimore City Board of School Commissioners, 2012)

In order to analyze functionality in educational buildings some of its indicators are discussed in the following sections.

2.2.3 Space Arrangement

Interior educational spaces are divided into four general groups of: learning spaces, meeting spaces, offices and service spaces. Although educational spaces vary based on the number of students and educational level; however, space arrangement for most of these buildings is shown in the following Figure 2.7 (Center of Effective Learning Environments, n.d.).

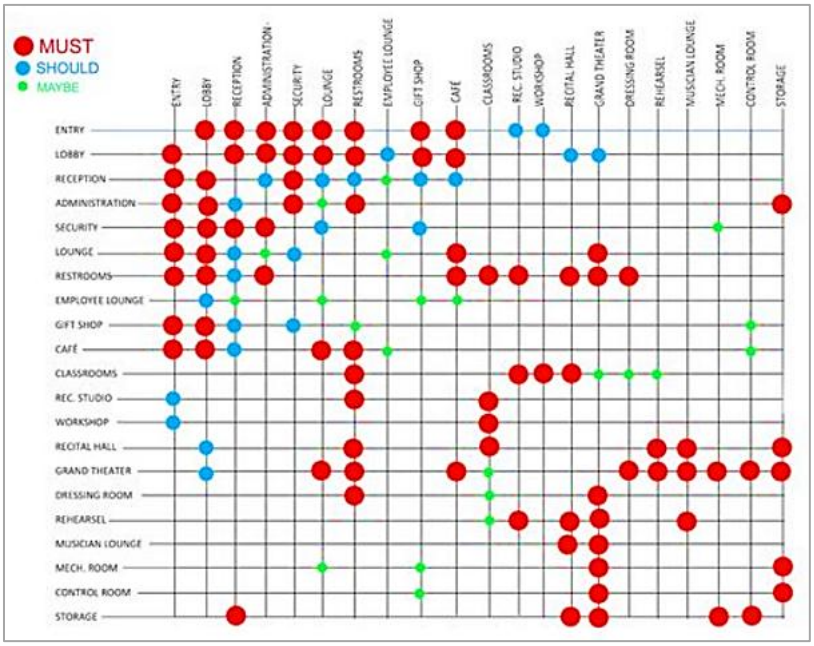


Figure 2.7. Space Arrangement in Educational Buildings (https://tr.pinterest.com/pin/511580838902859521/)

The sub-spaces of an educational space are as follows: entry, lobby, administration, acceptation, security, lounge, restrooms, employee lounge, café, classrooms, studios, workshops, grand theater, control room, storage, media room, computer rooms. The details of these spaces may vary due to the proportions of the building and the number of students (Center of Effective Learning Environments, n.d).

In order to meet functionality in educational environments, is recommended for the classrooms to be located around the common spaces. The connection between different spaces should be maintained through visual means (colors and patterns).Adequate spaces must be established for different activities such as sitting, presenting and meetings (or gatherings). Furthermore, separate, tranquil zones should be considered for studying zones (National Institute of Building Sciences, 2016).

Administrative spaces should not be concentrated in a single spot (the aim is to maintain an adequate connection between the students and the active leadership). Utilizing operable walls to create multipurpose spaces is also suggested. It is recommended for the classrooms to have the ability to change in relation to the number of students and the activities performed in the classrooms. The installation of technology upgrades is also suggested by experts to increase functionality of educational buildings (Burgess and Kaya, 2007).

2.2.4 Openings

In general, opening is a window, door or all fenestration which are created in the building. Windows, skylights, vents, and glazed portions of doors are critical components of a building's envelope (Potak, 2004).

The opening method of a window or door needs to be adapted to both the positioning of the element in the building, and to the way in which users want to use it. This often varies for every building type and depends on the requirements of the user (Potak, 2004).

Therefore, functional and user-friendly opening types are very important requirements that need to be considered in the design phase of the building in terms of size and proportion, shape, direction and, visual and physical access (Ozay, 1998).

2.2.4.1 Size and Proportion

In terms of natural lightning, quality of illumination of space is directly dependent on the overall windows design, such as size of glazing areas, number of considering windows, and shape of windows. Proper size of glazing for each space connect occupants to the outdoor environment which has a positive mental effects on them. Considering glazing part faced to the South and North maximize the natural lightning. Burberry (1997) recommended glazing area/wall area (glazing ratio) of south, east and west is better to be 40%, while for the north side which is not exposed to direct radiation it could be 55%. Considering windows with a small size at the top of the space is proper for air circulation.

Lighting is one of the most critical building elements in an educational facility (Jago and Tanner, 1999). Adequate lighting is necessary to perform regular tasks such as reading. According to Veltri et al. (2006), students are more likely to rest and relax rather than to actively learn in an environment where there is low lighting. Due to the decrease of energy costs over the past several decades, the amount of natural light in educational facilities built after the 1950s has decreased and has been replaced with artificial light. However, in recent years the interest in providing adequate natural light in educational facilities has increased (Schneider, 2002; Veltri et al., 2006).

Natural light produces biological effects that influence our bodies and minds (Higgins et al., 2005; Lyons, 2001) "The University of Georgia's School of Design and Planning Laboratory recommends that at least 20% of classroom walls be devoted to windows" (Creating Connection, 2004).

There have been many empirical studies suggesting that good lighting, both natural and artificial, has a positive impact on students' outcomes (Fisher, 2001; Heschong Mahone Group, 1999; Lyons, 2001). Fisher (2001) stated that even though there has been considerable empirical quantitative research on the relationship between lighting and student outcomes in the United States, studies vary by sample size and level of correlation between building elements and building conditions, requiring further research to validate such findings.

According to Woolner et al, (2007), with the increase in use of personal computers in educational facilities, it is important that educational facilities use glare-free light. Woolner et al, (2007) reviewed the different lighting types and concluded that there is no lighting that is ideal for all educational facilities. Factors such as the building layout, local culture and aesthetics should be considered when deciding what type of lighting to use.

Jago & Tanner, (1999) stated that the Illumination Engineering Society recommends 50-foot candles for regular classwork and 100-foot candles at a chalkboard or marker board, with a minimum of one window for each classroom. Many researchers agree that it is evident that adequate lighting in educational facilities influences students' outcomes (Jago & Tanner, 1999; Woolner et al., 2007).

Color also has influence on learning performance of students specially while combining white light. It is one of the important parameters in interior design as well as physical learning environment owing to support light and enhance the effect of lighting on occupants. It has the ability to make light darker or brighter. Color could be utilized to build an improved learning environment while additions to interior

form, space, light, and texture (Daggett et al., 2008). Students can be motivated to study and learn better by utilizing color designing in educational buildings especially in classrooms. Utilizing different colors in educational buildings decreases passivity and boredom.

Daggett et al. (2008) stated that "schools should incorporate a variety of colors (based on age, gender, and activity) to decrease monotony and visually refresh perception." The right combination of light and color is important to improve students' performance in school. Different colors have different significant impacts on most of people and they have different outcomes. Bellizzi et al. (1983) and Ocvirk et al. (2009) emphasized that more mistakes were happen when workers work in a white room in comparison to painted a one. Babin et al. (2003) found that occupant have various responds to different colors, lights as well as their combinations. They also stated that soft light can reduce the negative effects of some colors.

2.2.4.2 Shape

In general, Windows allow daylight penetration and illuminate the surfaces of a room, offer views to the exterior, establish relationship with adjacent spaces, and provide natural ventilation. Doorways offer entry into a room and influence the pattern of movement and use (Ching 2008) (Figure 2.8).

- Opening lying wholly within the enclosing planes of a space do not weaken the edge definition not the sense of closure of the space.
- Multiple openings may be clustered to form a unified composition with a plane, or be staggered or dispersed to create visual movement along the surface of the plane.

- As an opening within a plane increases in size, it will at some point cease to be a figure within an enclosing field and become instead positive element in itself.
- A horizontal opening that extends across a wall plane begins to visually lift the ceiling plane from the wall planes and give a feeling of lightness
- A window-wall admits more daylight, offer more expansive views, and visually expands the space beyond its physical boundaries
- Openings located along the edges of a space visually weaken the corners of the volume. As these openings increase in number and size, the space loses its sense of enclosure and beings to merge with adjacent spaces.
- Locating a linear skylight along the edge where a wall and ceiling plane meet allows daylight to wash the surface of the wall, illuminate it, and enhance the brightness of the space.
- Combining a window-wall with a large skylight overhead obscures the boundaries between inside and outside.

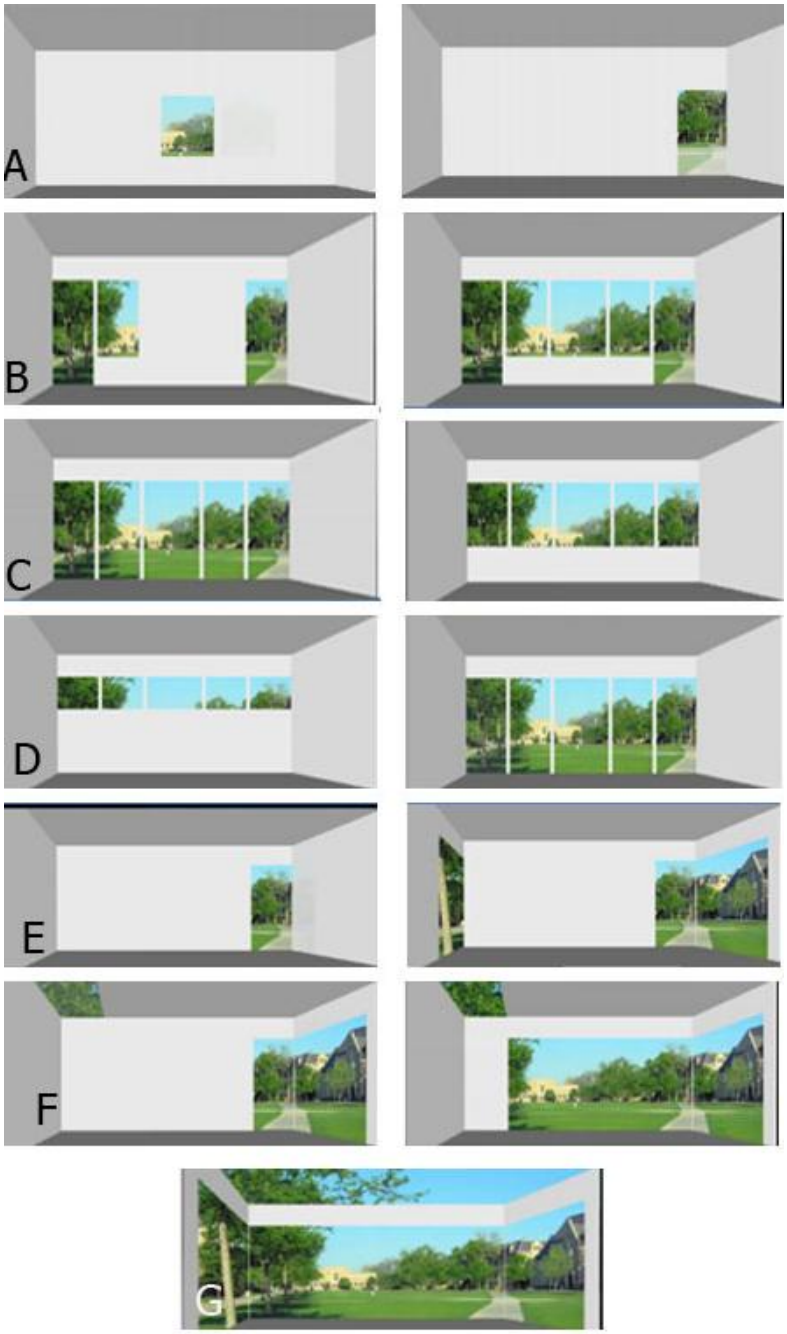


Figure 2.8. Different Shape of Opening in the Space (ching,2007)

2.2.4.3 Direction

In Nordic countries, most of the windows are located on south side to achieve more solar energy meanwhile smaller glazing are used on the other sides of building. Well insulated glazing can be utilized to stop draft resulting from cold air flow to south located windows. Glazing should be designed in a way to decrease heat loss and to

allow solar energy conduction (Goulding et al., 1994). They suggested following items to improve windows solar and thermal performance

- Low emissivity window can be used to reduce heat loss through thermal radiation.
- Using double or triple glazing window can improve insulation however it gently reduces the solar conductivity. Filling with a heavy gas decrease the rate of convective heat loss. In addition, a glazing with a selective surface can increase solar radiation gain when it reflects thermal radiation.
- Reflective glasses might not be appropriate in order to improve solar gains since it reflects considerable solar radiations during summer.
- Some transparent polymer materials can be used to cover window glasses in order to improve solar and thermal performances of windows.

Givoni (1976) stated that heat gain through a glazing is more than a common wall; moreover, residents feel its influence without any delay. This is clearly spotted especially in building which are built by lightweight materials. Windows thermal performance can be optimized by utilizing an efficient combination of glazing and shading as well as glass treatments. Givoni (1976) found that the windows size and thermo physical specification as well as ventilation conditions can greatly affected windows thermal performance. The author investigated an experimental research in Haifa, Israel to find out the impact of shading and ventilation of a room on window orientation performance. It was concluded that shading devices competence and ventilation conditions play a significant role in the impact of window orientation on the indoor air temperature. In ventilated room with efficiently shading devices, the indoor air temperatures are not affected by window orientation. However, in a well-ventilated room with inefficient shading, small variations are observed in the indoor air temperature depending on orientation of windows. Finally, if there is not any

shading or ventilation in a room, the differences in indoor air temperature owing to orientation of window are in the highest rate (Givoni, 1976).

"Generally the easiest, cheapest and effective way to cool your building is to shade it – keep the sun from hitting your windows, walls and roof. Indeed, where summer temperatures average less than 30 ºC, shading might be all you need to stay cool" (Anderson and Wells, 1994).

Kumar et al. (2005) assessed the solar cooling methods performance namely building insulation, air ventilation and shading. They stated that a reduction in the indoor temperature by around 3 ºC to 5 ºC is detected for solar shading. Indoor temperature can be decrease more (5°C to 7°C) if insulation and air ventilation are also considered as well as solar shading. They concluded that solar shading (as a passive cooling system) can be used in building to decrease the indoor air temperature in comparison to a same building without shade.

Appropriate shading methods can markedly decrease building heat gain as well as cooling demands and increase the natural lighting quality inside a building (Figure 2.9). The solar orientation should be considered in shading methods design. For instance, during the summer (with high sun angles), simple fixed overhangs can effectively shade windows in the south side of building. Nevertheless, the same devices are not effective at shading windows located at the west side of building in the summer afternoon (Kamal, 2012).

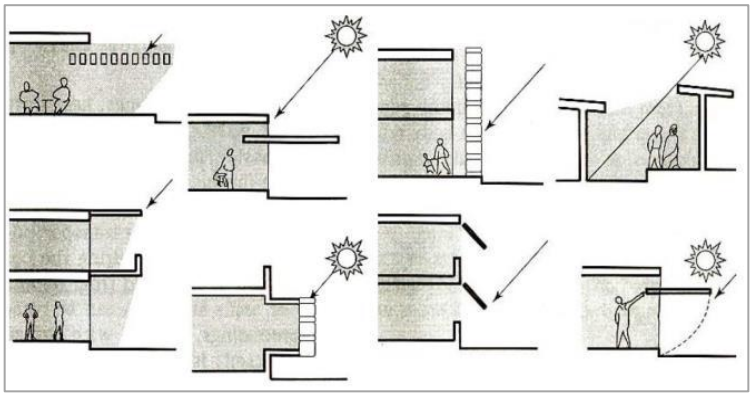


Figure 2.9. Shading Methods (Kamal,2012)

Shading should be able to decrease heat gain in summer period as well as decrease heat loss in winter period. For example, shading well insulated walls is not necessary while poor insulated walls need an appropriate shading to keep out summer heat (Anderson and Wells, 1994). Poor insulated building elements should be shaded in hot climate conditions. Anderson and Wells (1994) found that the shading provided by fixed overhangs coexists with the sun position rather than climate conditions. It means that fixed overhang illustrates best performance in June (specifically 21st June) when the sun is highest in the sky; nevertheless, hottest days are in August (when sun is in the lower position).

Shading windows which are located in west and east side of the building is challenging due to the low position of the sun in winter and summer. Amount of sunlight (which overhangs cannot prevent) in east and west side of the building in summer period is more than winter period. Vertical louvers or extensions can be useful to shade these windows meanwhile horizontal shading devices performance is acceptable for south facing windows. The performance of vertical exterior louver and egg-crate solar shading devices is enough high to block sunlight in east and west directions. Moreover, these shading devices can raise the window insulation

resistance over winter months by acting like a windbreak. The egg-crate shading device is just a combination of both vertical and horizontal elements as illustrated in Figure 2.10 below. Because of its high shading performance, it is commonly utilized in hot climate conditions (Cakir, 2006).

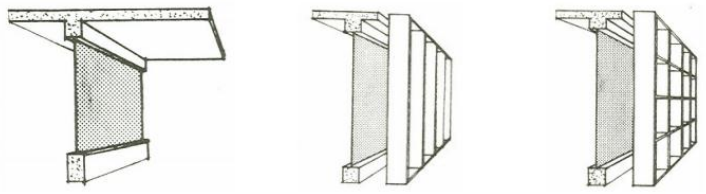


Figure 2.10. Horizontal, Vertical And Egg-Crate Shading Devices (Egan, 1975)

To realize shading impact on building one should be aware of sun's position. Position of the sun could be established by geometric methods respecting to geographic location, season as well as time of day. Position of the sun differs in altitude and azimuth angles in different seasons. The south-north axis in relation to altitude as well as azimuth angles can be utilized to estimate shadow for a specific time at certain latitude (Egan, 1975).

The period of time when the sun is to be prevented or is to be allowed should be considered to design efficient shading deceives. Take 21st of March and 21st of September as an example. Although these days have same sun angles, different shading devices are needed. For example, fixed shading devices can be used efficiently not only in summer but also in winter when solar radiation is needed (Rassam, 2004). Rassam (2004) stated that air temperature is not in relation to sun angle. Daily weather patterns extremely change, particularly in autumn and spring when too cold or too cold days may be happened. Adjustable overhangs (which are

illustrated in Figure 2.11) are appropriate for daily weather patterns as well as seasonal variations. For the purpose of minimizing the heat transfer between shading devices and building, it is better to detach shading devices from the building. Moreover, it increases the natural air ventilation towards the residents in summer (Rassam, 2004).

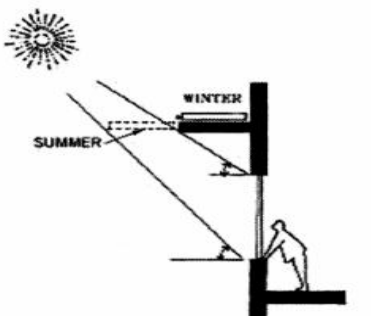


Figure 2.11. Adjustable Overhang for Solar Penetration in winter and summer (Rassam, 2004)

To shade windows located in both west and east side of building, plants can be used. Around 75% of sunlight can be absorbed by leaves. The angles of incident, age as well as density affect the plants shading. Vines can be utilized as suitable shading devices due to their high leaf density, providing filtered dynamic light as well as high rate of growth in comparison to trees. They absorb more than half of the solar radiation. A vertical vine covered trellis can properly shade west and east facades meanwhile a horizontal one can efficiently shade south façade. The main drawback of using plants as shading devices is that naked branches can also block between 30% and 60% of the sunlight in winter. Moreover, they can reduce natural ventilation as they affect air movement (Rassam, 2004).

2.2.4.4 Visual and Physical Access

a. Privacy

The definition of privacy varies in different cultures. According to Hashim and Rahim in 2008, "privacy is a two-way process involving the permeability of boundaries between oneself and the others" (Hashim and Rahim, 2008).

Another definition is given by Abu Gazzah in 1997: "privacy aims to control transactions between persons with the objective of enhancing autonomy and minimize vulnerability" (Abu-Gazzeh, 1997). While according to Altman the "selective control of access to the self" is called privacy (Altman, 1975). All these definitions are emphasizing on the self's ability to control his openness or closeness which also means his boundary (Altman and Chemers, 1984).

Solove in 2008 has divided privacy into six different categories: the right to be let alone, limited access to the self, secrecy, control over personal information, personhood and intimacy (Solove, 2008). In order to analyze privacy in a built environment, this section discusses limited access to the self and studies it from two aspects: visual privacy and physical privacy.

Privacy or restricted access is discussed as an individual's ability to control his realm. This access may be physical or visual or even in form of being subject of attention.

b. Visual Privacy

Visual privacy is one of the important forms of privacy especially in the built environment. It is defined as the probability of being seen by the immediate surrounding. It is essential for a user to be free from visual exposure and have freedom of visual access whenever it is needed (Rahim, 2015).

c. Physical privacy

Physical privacy is defined as a tool of prevention from unlawful entry and trespassing in their various forms. Physical privacy is not limited to unlawful access to information but also the right to control physical interference into one's private affairs (Brey, 2005).

The following principals are defined in order to maximize privacy in a built environment without blocking the entrance of natural light and air.

- Off-setting windows and openings to the adjacent buildings
- Using vertical fins to block view from adjacent balconies
- Using louvers or screen panels
- Using vegetation to block direct view
- Using planter boxes in walls for plant screening
- Using pergolas or proper shading devices to block direct view from upper floors of a building or to the private open spaces (Department of Education and Early Childhood Development, 2011).

2.2.5 Ergonomics

Ergonomics is the science that studies the human abilities and limitations and the way that this science is being utilized in the design of objects and machines and etc. in order to guarantee the comfort and health of the users during their life cycle (Healthy Schools Network, 2012).

Traditionally this science has been used to make the working space more comfortable and all the workers would benefit from the principles of this science to feel more comfortable. However nowadays ergonomics is also used for students and

educational environments in the design of the backpacks, computers, work stations and furniture (Healthy Schools Network, 2012).

The principles of the Ergonomics are beyond the design of comfortable and adjustable seats, in fact all the elements of a built environment and the relation between them and the users must be considered; even the adequate pathways, access to supplies and movable furniture are parts of an ergonomic design. The difference between the human sizes has made the utilization of adjustable and portable seats and tables compulsory.

The design must be in such a way that the instructors and students can easily leave their seats and have an appropriate circulation. The principle law is to avoid injuries, pain and discomfort (Oblinger, 2006).

There exist a series of standards for designing school furniture for example:

- Tables: each student's table has to at least have a width of 30 inches (76.2^{cm}) and also to have an adjustable height of 29 inches (73.66 ^{cm}). The surface of these tables have to be laminated and their legs should be fixed. The color of these seats and tables are determined according to the room or the building design if there is enough space, 2 extra tables for each classroom with the ratio of 18 by 16 inches (45.72 by 40.64 ^{cm}) are required (Washington University, 2015).

Figure 2.12. The arrangement of student tables in a seminar classroom (Washington University, 2015)

- Chairs: chairs must have a flexible back, the existence of fabric seats and backs are vital. The width of each chair must be 20 inches (50 cm), their legs must be easily stackable and have the ability to rotate 90 degrees. The color is chosen according to the design of the building and the classroom. 8-10 percent of the chairs are to be designed for left-handed users at least two extra seats for the guests are required.

Figure 2.13. Chair arrangement in a classroom (Washington University, 2015)

- The space between each row of tables is preferred to be 26 inches (66cm) but the minimum ratio is 30 inches (76cm). The distance between the Instructor's table and the first raw of students should be more than 48 inches (120cm) (for the comfortable movement of the instructor). The distance between the last row of seats and the wall is recommended to be 42 inches (100cm). At least 36 inches (90cm) of distance between the wall and the raw which is located besides it is vital (Washington University, 2015).

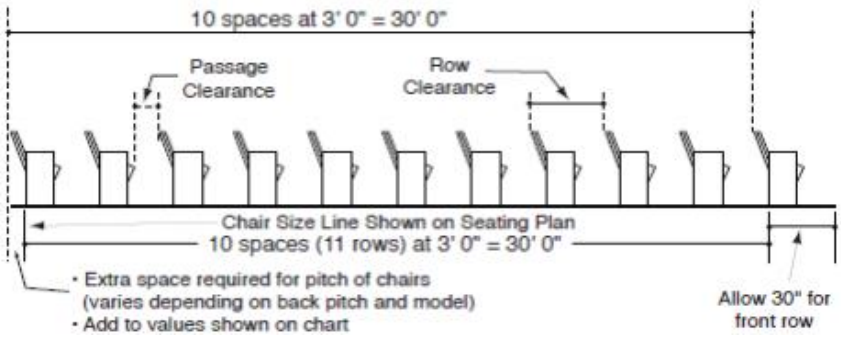


Figure 2. 14. Chair arrangement in a classroom (Washington University, 2015)

- The teaching desk: must meet the aesthetic needs, the larger tables are preferred but if there is not enough space, smaller desks are used (Figure 2.15). The size of the large desks is 82 by 30 by 32 inches (200cm by 76cm by 81cm). If the number of the students is high the height of the desk should reach 35 inches (90cm). Two cabinets for the required tools are needed. Drawers can be utilized in an optional manner. If small desks are to be used their size must be 60 by 30 by 32 inches (150 by 76 by 81 cm). One cabinet for the required tools

Figure 2.15. a: Large teacher desk b:Small teacher desk (Washington University, 2015)

- Computer accessories: ergonomic keyboards, mouse and monitors are required. The placement of the monitor must be such that the user can use it comfortably. The mobility of the pieces should also be considered.
- Libraries: The existence of spaces for height standing and seating is vital. In the reading area the existence of an adequate lighting is necessary (Preferably LED). Shelving must be adjustable and fixed in place.
- Labs: the seating type is decided according to the performed activities.
- Lounges: the furniture used in the lounges are designed according to the needs (Washington University, 2015).

2.2.6 Flexibility and Adaptability

One of the objectives of Architecture is to design for change. This is a kind of response of the buildings to the changes that it has to face during its life cycle. This strategy that is utilized by the designer to make the building adapt to the changes is chosen according to the building's performance. In the past decades the flexibility and adaptability have been playing a huge role in architectural projects.

There exist many different definitions of adaptability in architecture. However, there is no connecting link between the said definitions. One of these definitions is utilizing principles to absorb and adapt to changes (Indrawan et al., 2012).

Many different words have been used to describe this quality. Each of which predicates a certain level of adaptability. For example, in the year 2006, Dekker used the term “interactivity”. While in the same year Edler has used the term “Dynamic Architecture” to describe it which means a structure that is able to satisfy all the needs that are ever-changing or even the designers' demands. In the year 1997, Kroner used the term “intelligent Architecture” which means buildings that their integrated parts are able to respond to all different types of phenomena. These phenomena have the ability to impact the residents or building’s performance (Ade, 2014).

In this study the term adaptable is used to describe any form of architecture that can be changed in accordance to external elements (These elements can be environmental or the user’s needs). One of the problems that are very common on educational settings is that the exact number of students is impossible to be predicted. However, the number of students is not the only problem faced by the designers of such spaces.

Usually the taught subjects and the methods of teaching change in time; while, the educational spaces remain unchanged. Thus, the educational buildings must possess the ability to adapt themselves to the changes; be it pedagogical or technological and at the same time be independent of both of them. Thus, the building must be flexible to provide the possibility of technological and educational changes and be adaptable

at the same time in order to be able to absorb the changes in enrolments (Lelieveld et al., n.d.).

There are a series of strategies that can be applied in order to make space adaptable.

- The first one is to design the classrooms in a polyvalent fashion and for working areas to be placed in them in an integrated manner.
- The second one is constructing the load-bearing parts of the building in a way that they are separated from the finishes. This method makes the displacement of walls possible.
- The third strategy is to design the technical installations in such a way that makes them easy to access and also makes it possible for further additions in shaft to be installed at a later date.
- The fourth way is to place the meeting spaces in such a way that they can be accessible outside the class times.
- The fifth way is to utilize furniture in order to define spaces instead of the excessive use of infrastructure.
- The sixth way is to make possible the utilization of connecting spaces and access (such as corridors). Thus, the useful spaces are separated from the fire escape and can be used for presentations, group learning and exhibitions.
- The seventh way is to reduce the amount of specialized spaces as much as possible (Barrett & Zhang, 2009).

2.2.7 Color and Texture

It is now proven that color has a big impact on the Psychological and Physiological state of human beings. Colors have symbolic and visual impacts in every environment. Texture is dependent on the nature of the material. Color and texture

together are the most basic elements of designing. For example, the utilization of soft and hard textures next to each other is the symbol of indoor and landscape environments (Barrett & Zhang, 2009).

a. Color

When the matter of color in educational spaces is presented, usually the problems are beyond just aesthetic considerations. The colors are used in a functional manner to attract attention or to decrease eye fatigue. Beauty is not the most important matter here; but it is a tangible evidence that matters. Color psychology studies the impact of the colors on human brain. Colors can affect the blood pressure and human behavior (Educational Facility Manual, 2010).

The utilization of adequate colors impacts the eye sight, enhance the health of the users (both psychologically and physically), and make studying easier. The negative impact of lighting and color have such impacts as reluctance towards learning and nervousness. The colors that are used within or without the building have much influence on the level of comprehension of the users; thus, people's reaction to these buildings is different (Mandez, 2016).

A color may be adequate for the façade; however, not applicable inside the building. Moreover, a color may not be suitable for spaces that have a different functionality. Thus, it is necessary to follow the principles below:

- Appearance: Color has a direct influence on the comprehension of size, distances and temperature. It must be considered that the lack of color causes under-stimulation. The other impacts of the non-existence of colors is the lack of complexity. By using colors, one can increase the sense of unity.

- Rooms: Choosing a color for the rooms is dependent on the activities which are meant to be performed in them. If the increment of concentration is intended, the combination of different colors is preferred. Moreover, the utilization of the colors that psychologically stimulate people is recommended (Fielding, 2006).

Many designers act very cautiously when it comes to choosing a color for the façade. It is obvious that strong colors cause immediate reactions. However, this reaction is not continuous. For example, the first reaction when faced with the color red is the increment of the blood pressure; however, this impact is not continuous and the body returns to normal conditions within a short period. On the contrary cool colors increase the ability to concentrate because they do not attract attention thus side walls are often painted with tan and beige colors (Educational Facility Manual, 2010).

- Classrooms: The experts believe that the color of walls which are situated behind the instructors should be different. Pile and Brewbaker introduced this idea in the years 1997 and 1998 respectively. Blue or green tones are often preferred for these walls. The objective of this contrast between the colors is for there to be a contrast when the students start looking at the instructor instead of their tasks. Moreover, the contrast with the other elements such as chalk boards is preferred, this color contrast increases interest.
- Libraries: Light colors such as light green are preferable for the libraries; since they increase concentration and quietness.
- Corridors: For the corridors and hallways there exists a possibility to use various colors. Usually it is preferred to use live colors which attract the users' attention. Even in multi-story buildings it is possible to use different

colors for each corridor. The mitigation of complimentary colors attracts interest; for example, using light orange corridors with blue doors.

- Office: Since concentration is necessary in the offices, light cool or warm tones are utilized. For example, pale green, blue-green, pale gold or soft yellow are suggested.
- Cafeteria: Bright colors are used; however, it should be noted that aggressive or intense colors must not be chosen, the proper choices are warm yellow, apricot, pale green and pale red-orange. These colors must not be strong. The surface of the tables which are laminated can be wooden or colors which excite hunger such as red, yellow, orange or green. For stimulating the sense of tidiness, the floors should not have very dark colors (Mendez, 2016).

b. Texture

According the Nasar (1984), two types of environments are comprehended by human beings. One of them is soft; such as grass, plants, flowers and the other type are the hard environments such as busy traffic and intense buildings. Humans naturally have a positive reaction towards texture. Texture can simultaneously cause unity, complexity and diversity (Barrett & Zhang, 2009). Texture is divided between the range of coarse to fine and can change from rough to smooth in a juxtaposition manner.

Studies have shown that life in educational establishments which have a campus is better. These changes are both aesthetically appealing and also make an environmental diversity in various seasons. The other positive influences of the existence of a campus are the increment of interest in learning, the increment of

imagination and the sense of empathy. The external covered spaces are the connection link between the interior and exterior. Studies show that these spaces are always preferred by the students (Barrett & Zhang, 2009).

The utilization of texture diversity has always been beneficial. When there is no diversity, concentration is reduced; however, the balance between unity and complexity is important (Barrett & Zhang, 2009).

2.2.8 Accessibility

"Accessibility means firstly that everybody should have access to the built environment". The term is often used to maximize equalization and provide easy access to all facilities for users. "Accessibility refers to provision of flexibility to accommodate each user's needs and preference" (Report of United Nations Secretariat (DESA), 2013).

All users (regardless of their age and disability), should have the ability to access social and health services, transportation, housing, physical and cultural environments, cultural and social life, work opportunities and educational buildings (Report of United Nations Secretariat (DESA), 2013).

There exist various building codes and standards regarding the design of accessible public buildings. Some of these standards are discussed in this section.

Access routes: easy access to facilities through pedestrian and walkways should be provided.

Cafeterias and Restaurants: maneuvering spaces should be provided. All tables should be accessible and vending machines and payment locations should be placed properly.

*Computer Rooms***:** all users should be able to access computers and the circulation among desks should be designed properly.

Doors and Thresholds: all main entrances should be easily accessible for users with mobility aides. The proper width of entrances makes maneuvering of users with wheelchairs possible.

Drinking Fountains: easy access to all drinking fountains must be provided. The height of water spout should be considered in such a way that most of the students can easily use them.

Elevators: the width of entrance to elevators must be suitable for wheelchair users. The internal space of elevators should be design in a way that all students can use them and the location of elevators must be considered properly.

Entrances: the navigation of entrances must be easily done by all users (including users with visual impairment or who have cognition problems.

Handrails: size, placement and design characteristics of the handrails should be considered in a way that make easy access possible for users.

*Fire Safety***:** the fire procedure for all users, including users with disability or who need assistance, must be possible.

Libraries: all libraries should be easily accessible, maneuver among the shelves must be considered and information in various formats must be provided.

Training Rooms: proper seating for users with mobility aides should be provided. Enough lighting and information in various formats are necessary. Access aisled must be considered.

Parking: the design and location of parking must be such a way that it is easily accessible for all users.

Ramps: minimum slope must be considered for all ramps. Entrances and exits of these ramps should be easily accessible.

Stairs: the location, size, width and height of stairs should be selected properly. Various warning indicators must be provided whenever they are needed. Windows and doors must be situated accordingly (Report of the Department of Economic and Social Affair, 2013).

2.3 Education and Educational Buildings

Public education is one of the major responsibilities of a developed society. Buildings that house this significant duty not only shape the way we teach, but also afford symbols for the values we hold. Perchance, this context has situated educational buildings directly in a position of innovation since our nation began, and they continue to be the subject of careful study nowadays.

Educational buildings are influenced by modern technologies, social and political movements, the rising knowledge of what makes us learn better and therefore our belief in what makes a great school is continually reforming to new notions (Hugh

Ward, 2015; Lindsay Baker, 2012). Yet, we are still surrounded by the educational buildings that match the theories of over hundred years ago, when our understanding of education is fairly different, we had not been listening much to the students' needs (Lindsay Baker, 2012).

Most of the schools which are in use today were designed and built during the 1960s and throughout 1970s to meet the increasing population growth of those times. According to Earthman (2000), the schools that are built in the 1950s and 1960s were constructed rapidly and made of inferior materials because the quality building materials and modern technology were not readily available during those decades.

Earthman (2002) notes that many of the building features that were essential for appropriate learning environments were operating in new educational buildings; however, there were absent in older ones. The building's age is considered in many studies as an effective item on students' achievements. Researches leading to various findings has explained student achievements; however, all found the school buildings' age to account for a percentage of the students' learning variance (McGuffey and Brown, 1978; Chan, 1979).

As a result, in a large majority of schools, as students enter today's classrooms, they are taking a step backwards in time due to the outdated building conditions that exist in school districts (U. S. Department of Education, NCES, 1999). Educational buildings were just a part of the educational reform puzzle; however, this might be a more significant part than educators may tend to embrace due to the funding inadequacies (TACIR, 1999).

Educational buildings count as important places in which broad range of people spend most of their time after their houses. Even during school days, more than 70% of time is spent in indoor environment of educational places (Birob, et.al. 2011).

Many parameters directly or indirectly influence the quality of education in general or particular. Physical environment is one of those parameters which play an important role in education by the way it influences the mental process (Altman, 1991; Heft, 2001).

The National Clearinghouse for Educational Facilities (NCEF) (2002) suggests that there are physical characteristics of schools that have direct and indirect impact on the educational environments. For instance, buildings' external and internal physical characteristics (buildings' structure, roof and HVAC systems), physical characteristics of classrooms (lighting, acoustics and temperature control) and psychological characteristics (color, broken windows and restrooms' conditions) (NCEF, 2002).

Furthermore, many scholars already named furniture, colors and lighting, visual and auditory factors, temperature, humidity, acoustics, air motion and ventilation as influential factors in the quality of education process (White.S, 1972; Givoni Baruch, 1998; Earthman, 2002; Schneider, 2002; Lindsay Baker, 2012; Ronald B., Lumpkin, 2013). If schools are not equipped with these adequate building conditions, there may be detrimental effects on concentration, mood, well-being, attendance, and ultimately, attainment (Higgins et al., 2005).

Therefore, a school facility must be more than just a shelter for its occupants (Weinstein, 2001). It must be viewed as a structural envelope capable of supporting, stimulating, and strengthening a wide variety of learning experiences for the students of today as well as for generations yet unborn (Castaldi, 1997).

2.4 Summary of Chapter

The objective of this chapter was to study the available literature on the subject of the quality of educational buildings and the standards of their design. For this reason, the indicators of quality assessment were considered in the early parts of this chapter.

Chapter 3

ANALYSIS OF SELECTED EDUCATIONAL BUILDING IN NORTH CYPRUS

3.1 Method of Analysis

This chapter firstly introduces the selected cases which are one campus-based educational building which was built to give service for the same purpose and a converted office building to a university. This selection provides opportunity of a comparative study thorough controlling the findings in theory section and test the real life effect of those differences. Cyprus due to its golden geographical place and high educational level turned to an educational destination for many students. Number of buildings which are need to serve for education are increasing exponentially. This creates opportunity to work on Northern Cyprus as a case.

The results of each case will be discussed according to the determined space quality indicators like Space & proportion, Functional space (space organization and arrangement), openings (size, proportion, shape, direction, visual and physical accessibility, and ergonomic (adaptability and flexibility, furniture), Color and texture. Then in each indicator the findings will be accompanied by user's responses to the relevant questions (an interview was done in 30 students in each case) to find out if there is any consistency or inconsistencies.as the limit of study only classrooms and corridors would be put under scrutiny. Summary of the findings would be tabulated individually and in comparatively.

3.2 Analysis of the Case Studies

In this part firstly brief information about each case would be given and then found result would be presented .The campus based university case which is (GAU) first will be studied and then building university case (UMK) would be analyzed.

3.2.1 Campus-Based Case: Techno Park Building in Girne American University

Girne American University (GAU) campus has fourteen buildings such as Rector's Building, Faculty of Health and Science, Faculty of Architecture and Fine Arts, the Techno Park Building and many more. Techno Park building in this campus is a two story building which gives service to three faculties: Faculty of Engineering, Faculty of Business and Economies, Faculty of Health Sciences, and three schools named as Vocational, Nursing and Sports School plus multilateral center. Moreover, students' affair office and a cafeteria are other active spaces in this building. This variety of educational functions and activities provides homogeneity among selected cases and support the comparison result.

The Techno Park building in this campus has a linear form on the North-West / South-East axis and it was built in 2013 to give service as an educational space (Figure 3.1).

Figure 3.1. Techno Park Building in Girne American University campus

As Figures 3.2 and 3.3 indicate, the interior spaces are arranged around two rectangular shaped atriums which are covered with a space frame structure and curved glass roof. Structural material of this building is concrete and covered by double glazed tiles and aluminum composite sheets.

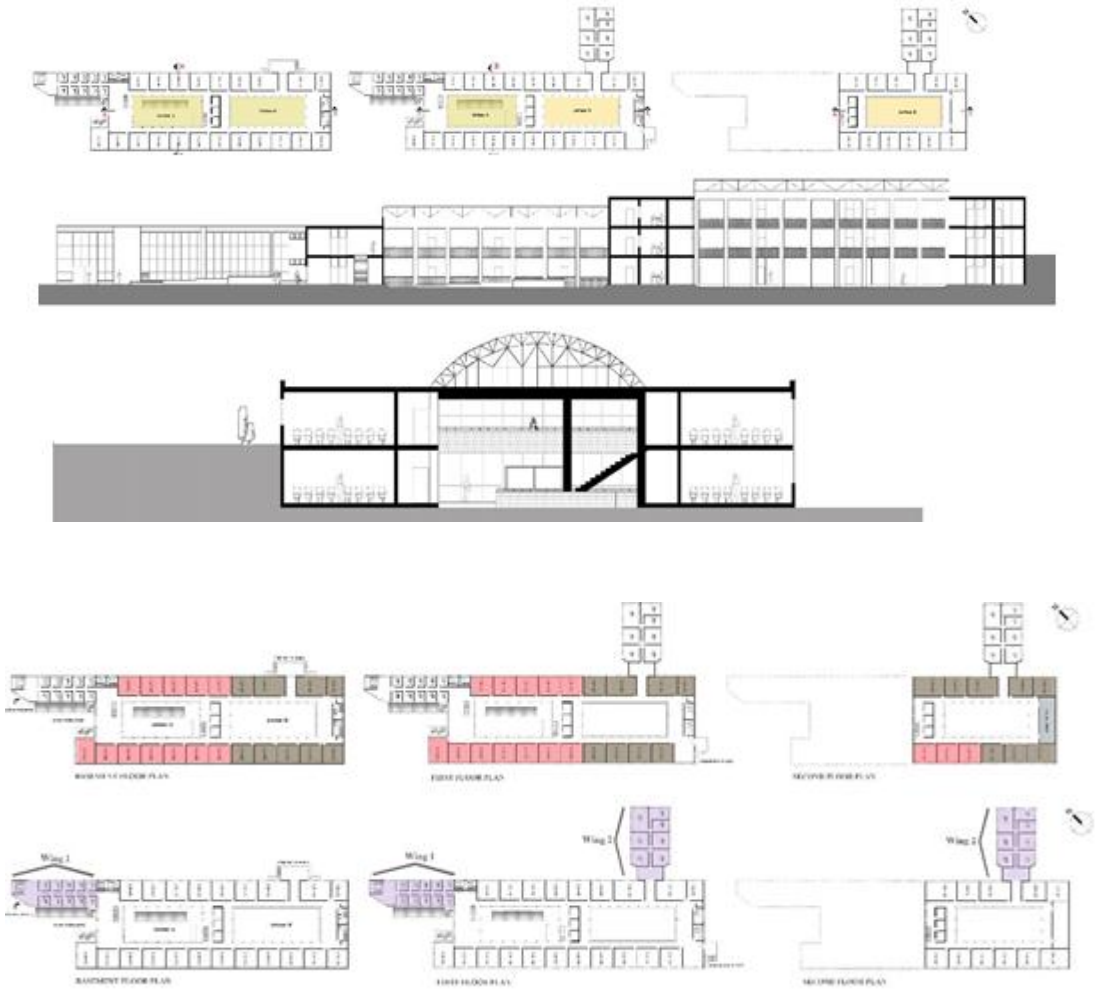


Figure 3.2. Class room and Office Zone in Techno Park Building

The obtained result from aforementioned case would be presented according to space quality indicators discussed in theory section.

3.2.1.1 Space and Proportion

As discussed in literature, proportion is the proper harmony between every piece of the space and the rest of the pieces and the entirety of the space. Techno Park building has a large volume with the area 3600 m^2 which huge area of this building is belong to the two atriums (area of atrium-A is 336 m^2 and atrium-B is 360 m^2 (total area of atriums are 696)) Atriums are surrounded by 2 meters width corridors that which connects functional spaces such as classrooms and labs (Figure 3.3). According to the observation and measurement data:

- General infrastructure of building without office areas is = 7086
- General infrastructure of atriums is = 1752 (25%)
- General infrastructure of classrooms is = 2670 (38%)

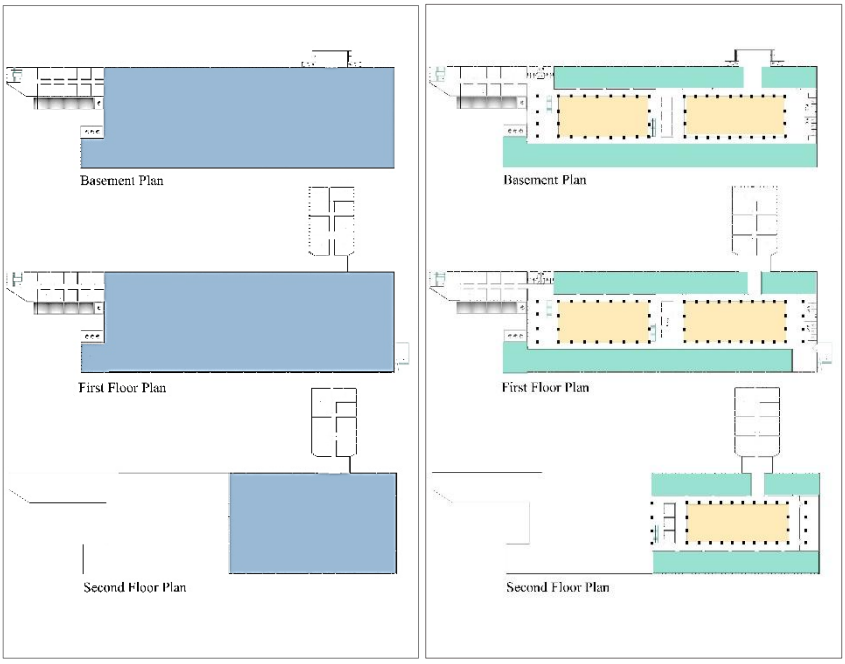


Figure 3.3. Ratio of Atriums to the Classrooms

Now it can be conclude the ratio which is considered for classrooms and labs in more than the ratio of atriums while considered area for each classroom it may not proper.

There are two types of classrooms in this case in terms of area. The big classrooms have 700*900 cm (63 m^2 area) rectangular shape and 300 cm height. And furnished by 50 portable chairs. According to the literature proportion of classrooms is determined by the number of the students, which is mentioned considering 1.85 to 2.32 square meters area for each students in classrooms with portable chair due to easy circulation of students and instructor and also comfort of students in necessary. Therefore, according to the available data:

Minimum: 1.85*50 = 92.5 m^2

And

Maximum: 2.32*50= 116 m^2

} areas is necessary for 50 students in each classrooms.

While the biggest classroom with the capacity of 50 students has a 63 m^2 area which is smaller than mentioned standards, that the extremely small spaces have negative influences on users. In this case student's responses to the question "How do you feel in terms of class room size?" were almost similar. They mentioned about compact management of equipment inside. They believed this class size is not suitable for the assigned number of students. They believed more classrooms they need to have. One student commented "*compact arrangement of chairs make the circulation hard between the tows and also lack of space for each students caused discomfort during lesson hours."*

The small classrooms have 600*700 cm (42 m^2 area) rectangular shape with 300 cm height. And furnished by 18 chairs and 9 tables, and also 8 portable chairs that are arranged in the last row of the classrooms. According to the standard (chapter 2) approximately for each university student 1.4 square meters area is required in the

classroom with normal chair and table. Required area according to the standards for 18 normal chairs is (1.4 *18=25.2) and for 8 portable chairs (is between 14.8 -18.56), which the total appropriate area calculated between 40-44. That can be concluded the area of small classrooms according to the standard is approximately appropriate.

The mentioned standard for height of classroom due to entrance of the unblocked light through opening is 323cm from finished floor up to the floors which in this building considered height for the classrooms is less than standard (300 cm).

3.2.1.2 Functional Spaces

Techno Park Building separated to the different clusters, which represent independent pedagogical units. As obvious in the plan (Figure 3.4) all the laboratories in all three floors are located in the of same part, classrooms are designed in the one cluster and for office zone two separate wings have been considered. 25 students out of 30 in response to the question related to functional distribution logic and difficulty or simplicity of finding places; directly pointed that "*the class room, labs and etc ate all grouped in a way from the early days we learned them and didn't get lost* ." As Figure 3.5 indicate, central atriums (yellow color) in the basement floor and buffer space (light green color) in the first and second floors are considered for the movement from the private to the public areas and also between the clusters.

In this facility, atriums further unifying element that connects up with all the pedagogical units, have a key psychological role for students because enable them to identify themselves in a group, gradually transiting towards the rest of the building. Most of the students mentioned to the condition of Atrium -A. *We can use this space*

during our break times and we are also satisfied with the location of the cafeteria within this atrium. While the number of sofas for this function are not enough, we have to stand in this place when sofas are full. But in general, atrium A with water fountain can be helpful for reducing our stress and for leisure time of us.

Furthermore, the independent volumes are linked by these general gathering place, defined the public character of the building.

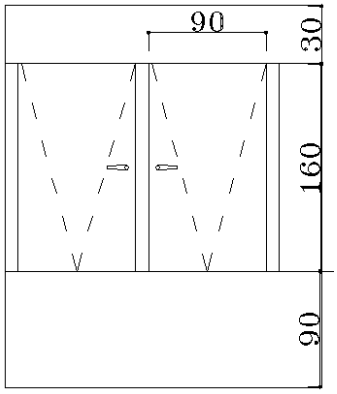
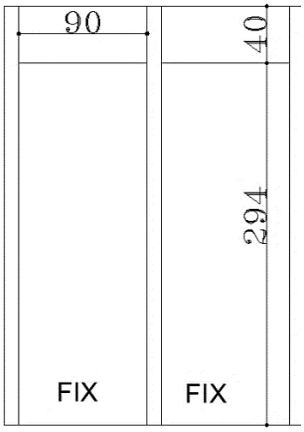
Figure 3.4. Different Clusters in the Techno Park Building

3.2.1.3 Openings (Size, Proportion, Shape, Direction, Visual and Physical Access)

As mentioned in the literature considering proper glazing size, shape and direction due to connection between occupants and outdoor space and also take advantage of natural lighting has a positive mental effects on them. Researchers believe, considering opening with the proper size faced to the South and North maximize the natural lightning.

Two types of window design was observed in the classrooms of Techno Park Building. Both types have rectangular shape but in different size, sill and direction (Table 3.1).

Table 3.1. Different Types of the Window in Techno Park Building

Window Types	Type 1	Type 2
		

As Figure 3.5 Indicate windows of the classrooms Type-A have 90 centimeters sills above the finished floor level, 160 centimeters height and 40 centimeters distance from the window's head up to the ceiling. According to the literature, the ideal window size for teaching parts of an educational building in order to maximize the

daylight penetration is 240 centimeters from the finished floor level above the window's head (Including 90 centimeters sill high consideration),which it means 150 cm height should be considered for each window. The bottom of these windows should not exceed the seated height level to provide proper view to the outside for students. Now it is possible to conclude the considered size, sills and shape for classrooms type-A is proper.

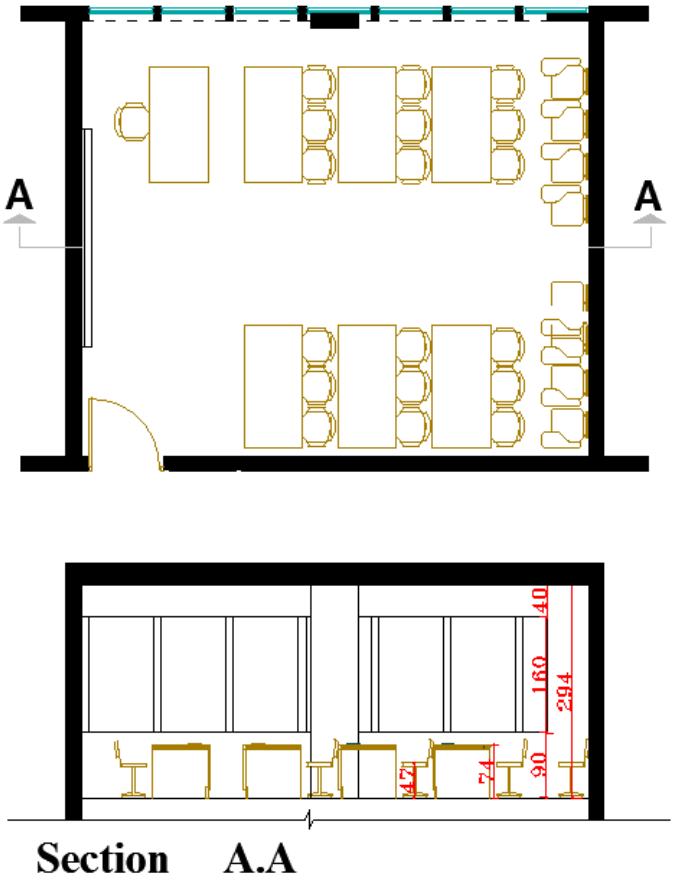


Figure 3.5. Classroom Type-A Opening

In the ground and first floor of Techno Park Building 4 classrooms Type-A located in the North-East Part and 5 classrooms are located in the South-West part, also in the second floor 3 classrooms Type-A in this side is obvious. From total area of

classrooms' (Type-A) walls (60.26 m^2) 9.52 m^2 of them covered via windows (24%) and 2.14 m^2 of the walls is dedicated to the door.

As researchers referred glazing area/wall area (glazing ratio) of south and west side is better to be 40% while because this parts of the building exposed to the direct sun radiation during the day. Furthermore, they believed as North part is not exposed to direct radiation it could be 55%. As mentioned before, the size and shape of the windows is proper according to the standards while, glazing ratio to the wall area of classroom type-A is 24% in all direction which is less than mentioned ratio.

As Figure 3.6 Indicate windows of the classrooms type-B and type-C don't have any sills with 254 centimeters height and 40 centimeters distance from the window's head up to the ceiling. According to the literature considering 90-120 cm sills for all the opening while, these two types of classrooms does not have any sills and students chairs are located beside the windows without proper distance; as referred in the literature due to safety and concentration of students considering sill for classrooms window and arrangement of chair via proper distance from windows is necessary.

In classroom Type-B from total area of walls (94.08 m^2) 47.08 m^2 of that is covered via windows (50%) and 2.14 m^2 of the walls is dedicated to the door. As researchers mentioned in the west side of the building the ratio of the window to wall due to sun penetration it should be 40% while, glazing ratio to the wall area of classroom type-B is 50% which is higher than mentioned ratio. In classroom Type-C from total area of walls (94.08 m^2) 67.62 m^2 of that is covered via windows (72%) and 2.14 m^2 of the walls is dedicated to the door. As researchers mentioned in the west side of the building the ratio of the window to wall due to sun penetration it should be 40%

while, glazing ratio to the wall area of classroom type-C is 72% which is higher than mentioned ratio.

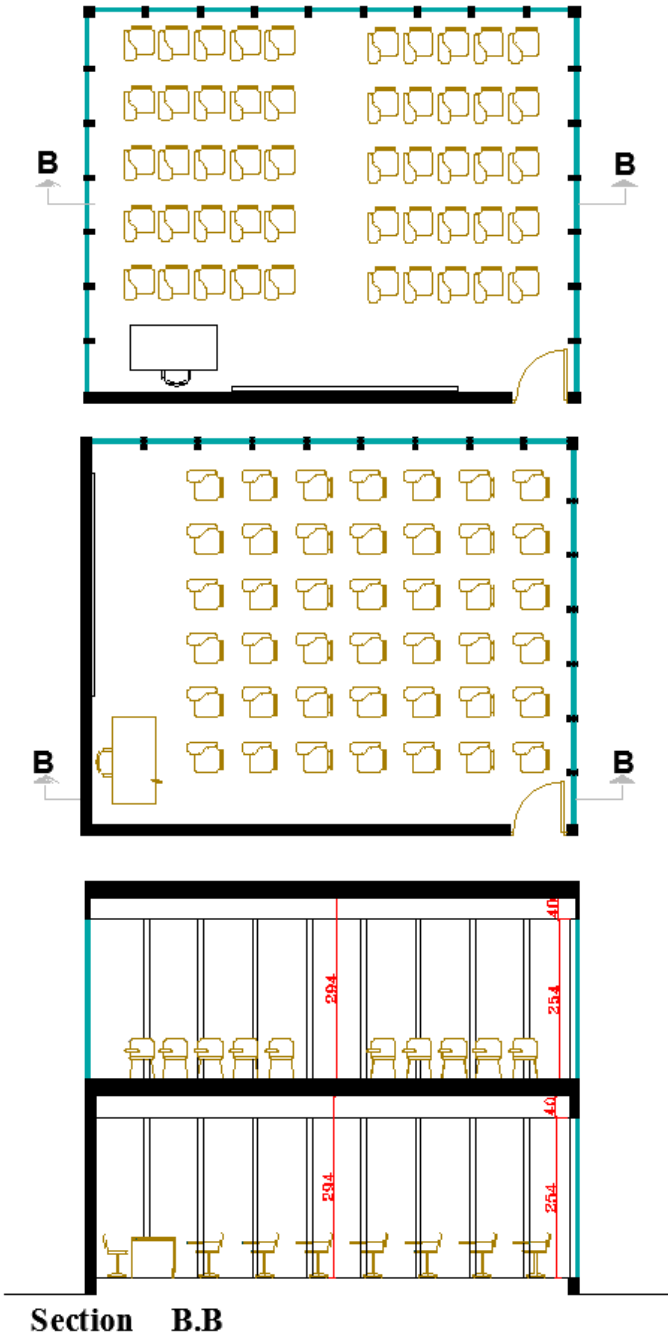


Figure 3.6. Classroom Type-B and C Opening

According to the results can conclude opening of classrooms type-A in compare with the two other types of classrooms have a proper size and shape which is near to the

mentioned standards. While the opening ratio to the wall of classroom types B and C are larger than the standard, and as these two classrooms are located in the west side over glaring and overheating would provide an improper condition for students during lesson hours. *Students have explained that, the windows that are considered for classrooms are too large. They have pointed out that, the problem is not tolerable. Direct radiations in these ateliers cause visual problems for them*, they have to keep the shadin*g devices closed to prevent the penetration of sun radiations into the classrooms and over glare. In such circumstances, using artificial lighting becomes necessary.* It is possible to conclude that, replacing these shading devices with more proper ones which are adjustable can make it easier to take advantage of natural lighting during lesson hours.

3.2.1.4 Flexibility and Adaptability

One of the problems that are very common on educational settings is that the exact number of students is impossible to be predicted. Thus, the educational buildings must possess the ability to adapt themselves to the changes; be it pedagogical or technological and at the same time be independent of both of them. Thus, the building must be flexible to provide the possibility of technological and educational changes and be adaptable at the same time in order to be able to absorb the changes in enrolments (Lelieveld et al., n.d.).

As figure 3.8 Indicate, location of columns around the atriums created boundary for the space which make the future changes impossible in the classrooms of this building.

Also classrooms are too small and they are not design in polyvalent fashion and the do not have extra areas for working in an integrated manner.

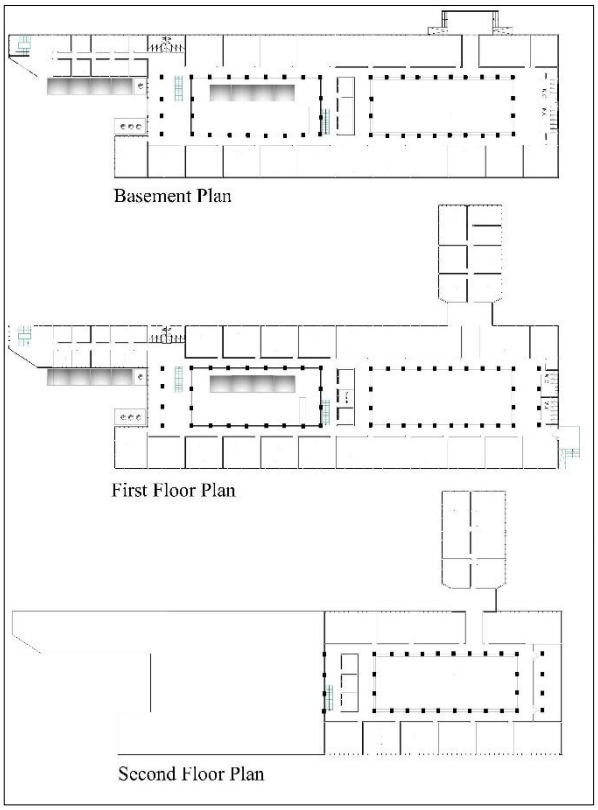


Figure 3.7. Location of the columns in Techno Park Building

3.2.1.5 Color and Texture

As it is indicated in Figure 3.8, all the classrooms walls are colored in the white color and gray tiles on the floor, while according to the literature lack of color and contrast in the classrooms increase eye fatigue and have such impacts as reluctance towards learning and nervousness. Students shared similar problems in response to the question about used colors in the class rooms. One student commented *that everything is white in our class rooms. Everybody knows color effects our emotions and this will affect our learning level and concentration I think."*

The key to create a conducive educational environment for learning in a classroom is to not over-stimulate learners by using large amounts of bright colors.

Figure 3.8. Classrooms Type A Situation in Terms of Color and Texture

Calmness, relaxation, happiness and comfort are feelings elicited by colors such as green and blue.

While it is best to have a calming and neutral color on the walls, furniture can add a splash of color to an otherwise dull classroom. As Figure 3.9 indicates in B type classrooms by small quantity usage of colors in terms of furniture responded to also attention demand of classes and attract learners' attention to detail and engaging in the activities.

Figure 3.9. Classrooms Type B Situation in Terms of Color and Texture

In terms of texture, in educational spaces only soft textures could be offered to students and in this case visual accesses to the greeneries in the campus are very well covering this demand.

3.2.1.6 Physical Accessibility

According to the literature accessibility in general defined as the easy and proper access to the main building and also accesses to different parts of the building easily.

In general, a large area of Techno Park space is dedicated to two central atriums which are covered by space frame structures. Atriums are acting as the heart of this building and other spaces such as corridors, entrances, seminar rooms, laboratories, lecture halls, classrooms and offices are arranged around it.

This building generally has three entrances and one emergency exit which provide access for user from outside. Entrances on different sides of the building provide easy access for students through pedestrian and walkways to perform various activities.

The main entrance which is clearly visible from campus has an access to the ground floor and is located on the North-West side of Techno Park Building, this entrance does not have any ramp for users with disability (Figure 3.10 A). This entrance guides the students through a pathway from campus to the North-West side atrium (Atrium-A). Atrium-A is located in front of the main entrance and it has 280-Meters length, 120-Meters width and 9 Meters height. In addition to the basement floor this atrium has another floor above it. Cafeteria, as an academic facility, gives service to students in atrium-A. This atrium has a dynamic fountain in blue color to create a harmony with the blue color of sky. Floors are covered by dark grey ceramic tiles and walls are colored with white plaster color. Eight red sofas are arranged around the atrium to providing seating elements for students' break time (Figure 3.10 A). The used colors in this section crate a contrast which attract students' attention and

has proper physiology effect on students during break hours, while just the number of sofa according to the students number and large area of atrium-A are not enough.

Students who enter the building from main entrance for academic activities can access to the classrooms through the left side and right side corridors or reach the first floor through staircase which is visible from the main entrance. Other visitors who enter this space without academic aims (to visit their friends or other activities) can directly enter the atrium-A zone without passing the classrooms. The other entrance which is located on the West corner of the North wing, guides the users and staffs to the official part, this entrance has a 20 ^{cm} distance from ground level and does not have any ramp for disable person (Figure 3.10 B). This access is useful for staffs if they do not want to pass the classrooms, and guides them directly to the office zone. Entering the office part is possible for students and staffs through inside of this building as well.

The third entrance has been considered in the middle of the building and on the East side. This entrance leads the users to the South-East atrium (Atrium-B) and eases the access to temporary exhibitions zone (Figure 3.10 C). Atrium-B has a 300-meters length, 120-meters width and 12-meters heights. This place is expected to serve as exhibition and thematic ceremonies. This entrance provides easy access for visitors who enter the exhibition and also connects it to the South-East part's classrooms. Entry for disable person is possible thought ramp from this entrance as well.

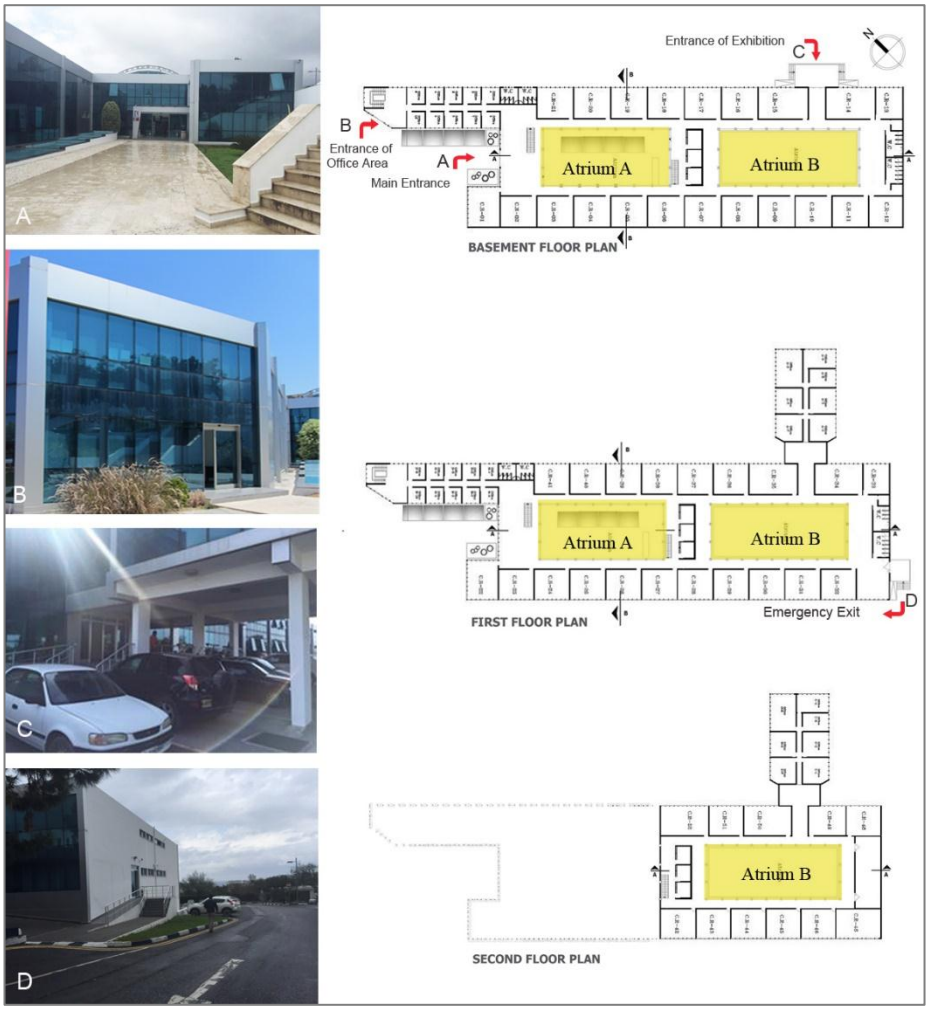


Figure 3.10. The Entrances and Emergency Exit of Techno Park Building

The main emergency exit, with access to the first floor and with 180cm distance from ground level, is located on the South side of Techno Park building (Figure 3.10 D). This access guides the students from South–East part to the outside of the building and also leads the students to the South-East side's classrooms and labs. Intended ramp for this part does not have a proper slope .Minimum slope must be considered for all ramps. Entrances and exits of these ramps should be easily accessible.

As Figure 3.11 Indicates, inside the building accessibility separated to the two types: vertical access the staircases and horizontal access (corridors).

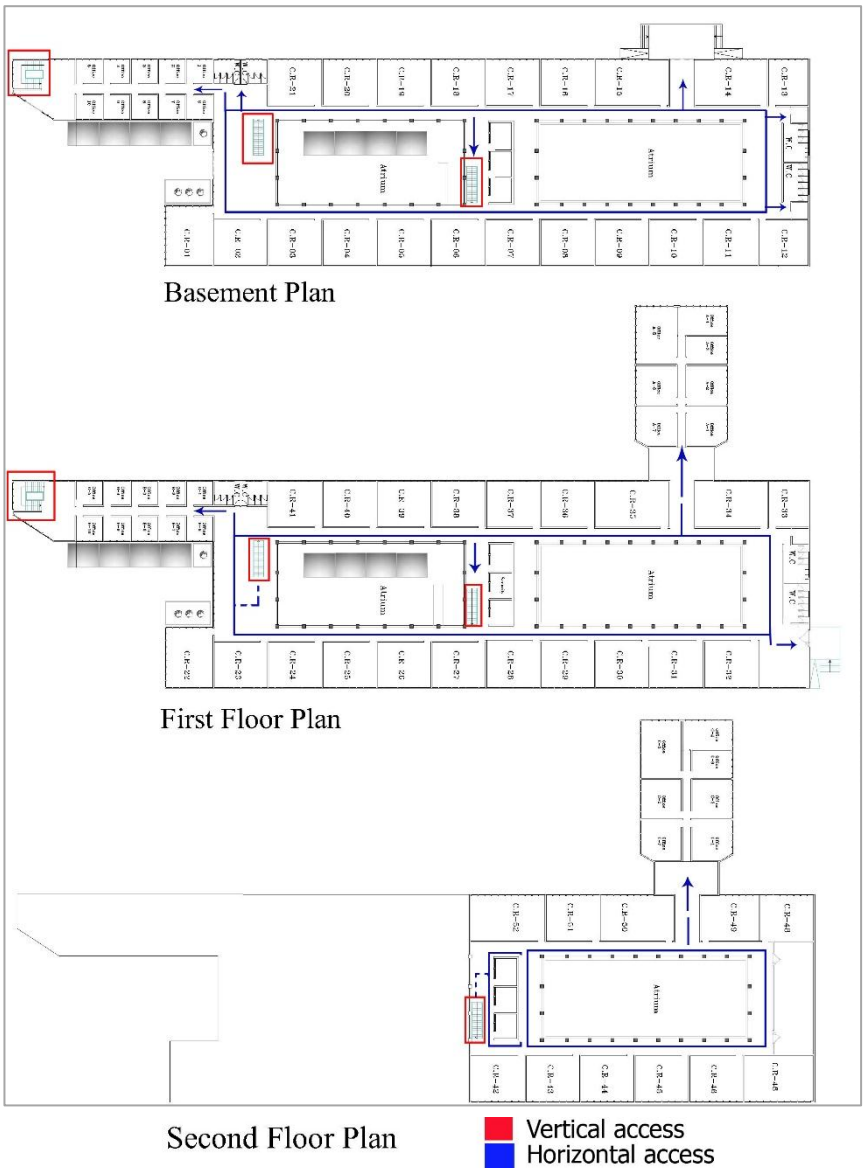


Figure 3.11. Vertical and Horizontal Access in Techno Park Building

Staircases provide the vertical access to the other floors which are located on three different parts of the building. One of them is placed in the North-West wing for the official zone; and makes the access to upper floors easy for the staff. In addition, the other two staircases are situated in the entrance and the other one is located between atrium A and B to ease the access to different functional spaces. However, this building does not have any elevator. Therefore, disabled users are not able to reach the upper floors.

Corridors provide a horizontal access for the users, as obvious in the Figure 3.11 atriums are surrounded by 2 meters corridors which make the horizontal access easy for the students to the different spaces such as office parts, classrooms labs, restrooms, cafeteria and etc.

3.2.1.7 Ergonomics

As Figure 3.12 indicate 3 types of classrooms are designed in Techno Park building which each types of classroom has a different furniture arrangement. The access to laboratories, official parts and lecture halls were not possible for the author and they are not investigated.

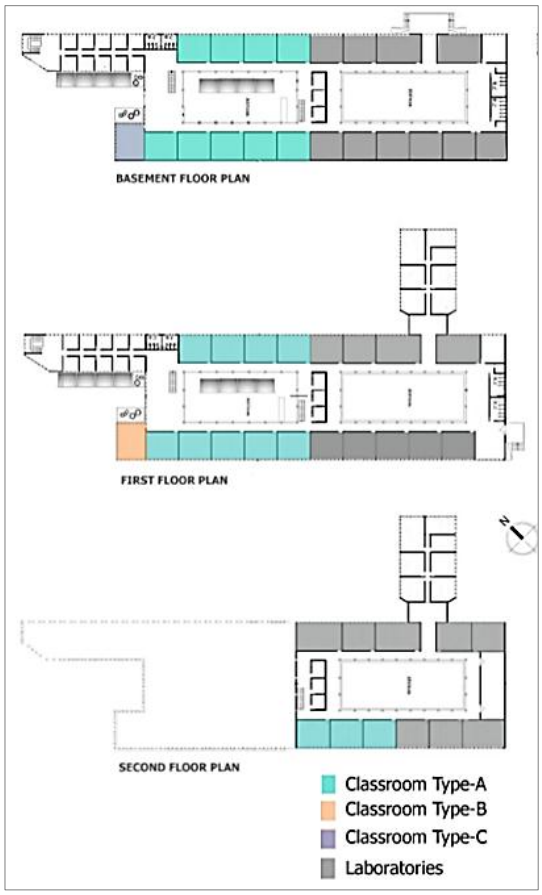


Figure 3.12. Different Types of Classroom in Techno Park Building

Classrooms type-A (Figure 3.13) have a rectangular shape whit 700*600cm. This classrooms has a 26 chairs and 9 tables. 8 of the chairs has not a separate tables and table is connected to the chairs.

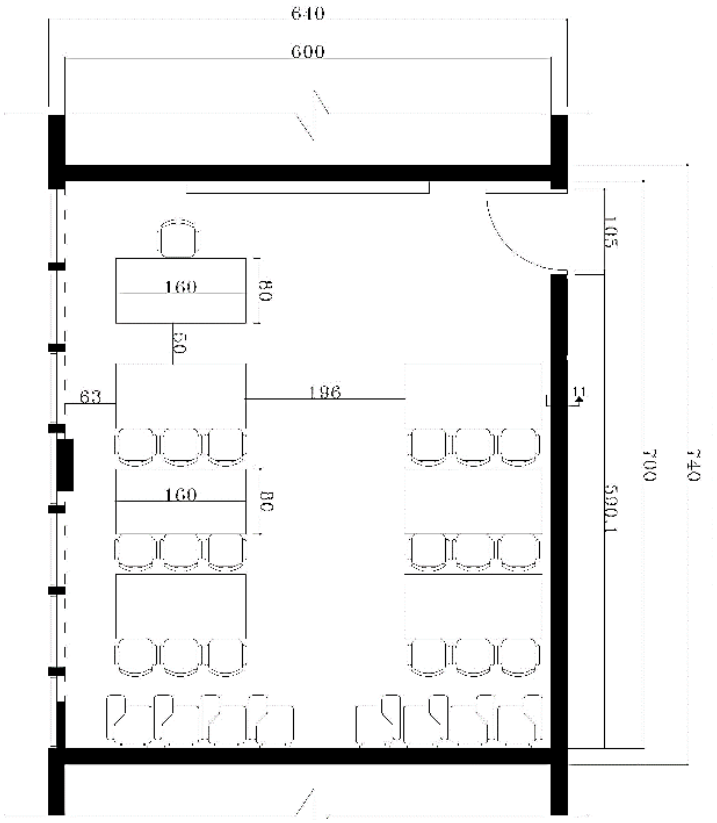


Figure 3.13. Classrooms Type-A Interior Furniture Arrangement in the Techno Park Building

Classrooms type-B (Figure 3.14) have a rectangular shape whit 900*700cm. This classrooms has a 50 portable chairs which the tables is connected to the chairs. These chairs are arranged in 6 columns and 7 rows.

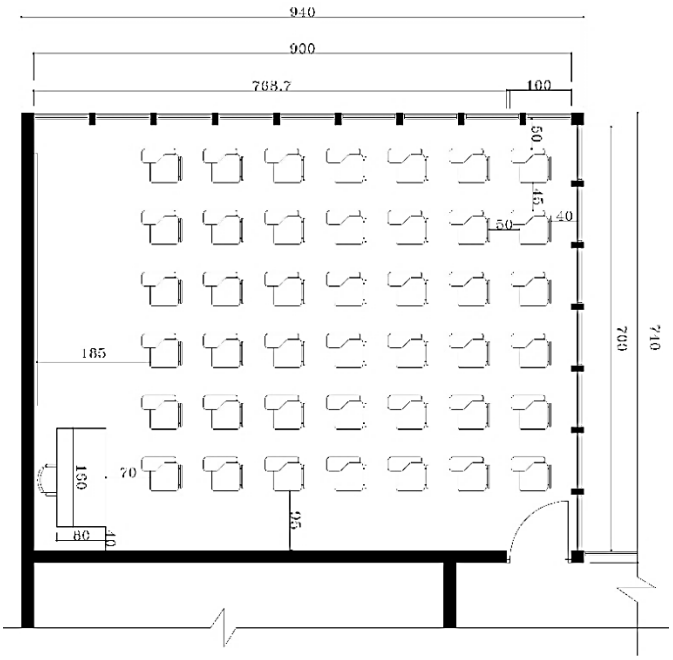


Figure 3.14. Classrooms Type-B Interior Furniture Arrangement in the Techno Park Building

Classrooms type-C (Figure 3.15) have a rectangular shape whit 900*700cm. This classrooms has a 50 portable chairs which the tables is connected to the chairs. These chairs are arranged in 10 columns and 5 rows.

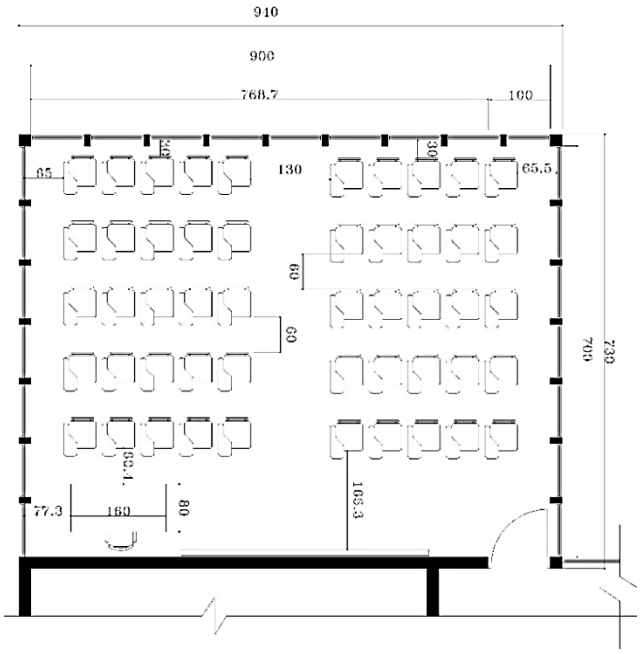


Figure 3.15. Classrooms Type-C Interior Furniture Arrangement in the Techno Park Building

Table 3.2. Different Types of Furniture Arrangement in Techno Park Building

	Indicators	Standard	Classroom Type B	Classroom Type B	Classroom Type C
Classrooms Data	Table width for each students	76.2cm	53	35	35
	Table width for instructor	200*81	**160*80**	**160*80**	**160*80**
	Chair width for each student	50cm	**50cm**	**50cm**	**50cm**
	Distance between each row of tables	66cm	196 and 0	50 and 45	**130 and 60**
	Distance between instructor tables and first row of tables	120cm	50cm	70cm	60cm
	Distance between the last row of seats and wall or windows	100cm	0	40	To window 30cm
	Distance between the row of seats and beside wall or windows	90cm	To windows:63 To wall:11	To windows:50 **To wall:95**	To window: Right row:65.5 Left row: 65

According to the schematic plans of classrooms and Table 3.2 it is now easy to conclude:

- In 3 types of classroom the area of tables for each students is not proper and is less than standard.
- Table width for instructor is proper in all the 3 classroom types, while observation indicates drawer or cabinet is not considered for the teacher which due to according to the literature at list two cabinet or drawer for the required tools is needed.
- The chair width for each student in 3 types of classroom is match to the standards.
- The proper distance between each row of tables due to easy circulation of students and instructors is obvious in classroom types-C.

- Distance between instructor tables and first row of tables is less than mentioned standard, while considering proper distance according to the standard due to comfort of instructor and easy circulation of users is necessary.
- Distance between the last row of seats and wall or windows is less than standards in all three types of classrooms.
- The proper distance between the row of seats and beside wall is just obvious in the classroom type-B. While the other rows beside the windows and walls does not have proper distance which is less than standards.

3.2.2 Building University Case: University of Mediterranean Karpasia

The University of Mediterranean Karpasia (UMK) is a private university which is constructed within the urban region of Nicosia in 2014. This university building has a rectangular plan shape with 15-Meters width and 17-Meters length on East-West axis orientation. It is a high-rise building with nine floors and hosts different faculties such as Business Administration, Tourism and Hospitality Management and Law (Figure 3.16). The ground floor of this building encompasses the register's office and a cafeteria. The other two floors contain administrative offices and a restroom. There is a classroom on each floor (from the fourth floor up to the eighth floor). The main used structural system is concrete and large parts of the envelope is covered with double glazed windows and aluminum composite sheets.

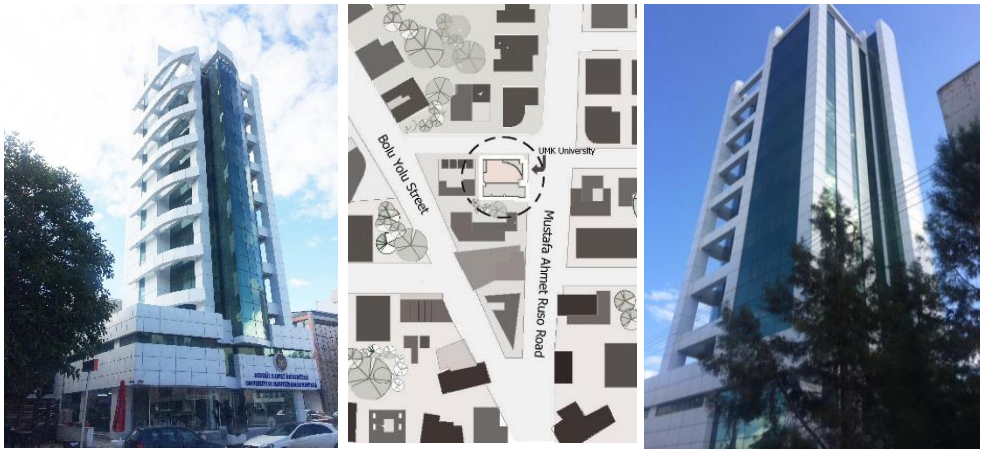


Figure 3.16. The University of Mediterranean Karpasia

The obtained result from aforementioned case would be presented according to space quality indicators discussed in theory section.

3.2.2.1 Space and Proportion

As discussed in literature, proportion is the proper harmony between every piece of the space and the rest of the pieces and the entirety of the space.

4^{th} floor to 8^{th} floor of UMK building which classrooms are located has total a 500 m^2 infrastructure (each floor 100 m^2 infrastructure). Large area of this building in each floor is belong to the classroom with 80m^2 area each floor (Figure 3.17). According to the available data:

- Total infrastructure of UMK floors which classrooms are located:100*5= 500 m^2
- Total infrastructure of classrooms: 80*5 =400 m^2 (80%)
- Elevator from basement floor to ninth floor: 1.2*9= 10.8 m^2 (2.16%)
- Staircase from basement floor to ninth floor: 12*9= 108 m^2 (21.6%)
- Corridor from basement floor to ninth floor: 7*9= 49 m^2 (9.8%)

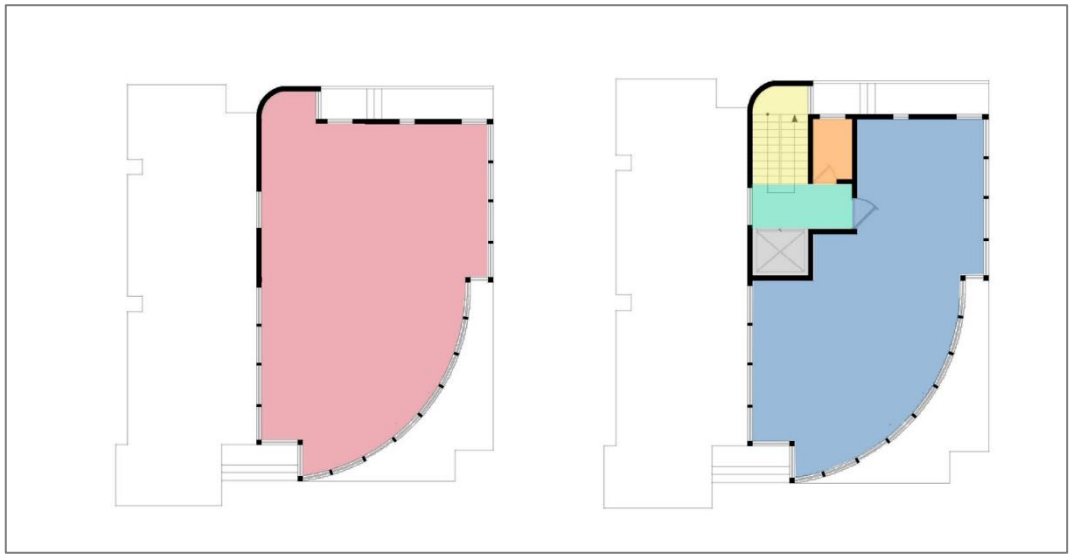


Figure 3.17. Ratio of Classrooms to the other space

Can be conclude from the results a high ratio of this building is belongs to the classrooms while the ratio of elevator, corridor and stair case is not proper due to ratio of the classrooms. Ten students are mentioned to this point during interviewing and they responses to the question "How do you feel in terms of different spaces size?" similar. *The elevator does not work properly sometimes and the considered size for elevator is not proper because for example in the morning (as all the classrooms are started approximately in the same times) we have to wait for the elevator because it does not have enough space also the waiting area in front of the elevator is small which we faced with problem .Therefore, we are forced to use the staircase and walk up to reach the upper floors and this is not easy.*

There is just one type of classroom in this case with multi-dimensional shape (80 m^2 area) and 320 cm height. As green color is indicated in Figure 3.18 from the total area of the classrooms only 50 square meters is furnished by 24 chairs and 12 tables. According to the standard (chapter 2) approximately for each university student 1.4

square meters area is required in the classroom with normal chair and table. Required area according to the standards and the available data:

1.4 * 24 = 33.6 } areas is necessary for 24 students in each classrooms.

That can be concluded the area of classrooms according to the standard is appropriate.

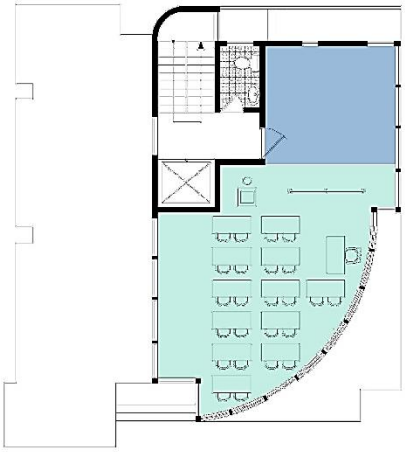


Figure 3.18. Useless and Used Space in the classrooms of UMK Building

3.2.2.2 Functional Space

As mentioned before UMK is not campus based and it is an individual high rise building within the urban region of Nicosia. The building is connected to the East side's main street by two entrances; one of which takes the user directly to the cafeteria; while the other one acts as the building's main entrance (Figure 3.19).

The only space which is considered for the leisure time of students and staffs is cafeteria which is located on the ground floor facing the South side of the building (Figure 3.19). Cafeteria has a 52 square meter area with 320 centimeters height; the floor is covered by light gray ceramic tiles, the walls are colored by white plaster color and finally furnished by rectangular shaped tables and black, purple and green

chairs. Visitors entering the building are guided directly to the cafeteria zone; which also acts as a lobby and transitional space. While cafeteria area is not enough for this dual function, considering an antechamber after the main entrance that acts as a separator between the public and private areas and works as a buffer zone between internal and external spaces; makes it much important.

Figure 3.19. The Location of Cafeteria and Registration Area

Furthermore, 28 students out of 30 in response to the question related to functional distribution logic and difficulty or simplicity of finding places; directly pointed to the similar fact. *Students have mentioned that they are not happy about studying in high-rise buildings. 28 of students mentioned about lack of outdoor space and pointed out the lack of green spaces and outdoor spaces. We think easy access to green spaces during break times is necessary to free our mind or to do team activities.* According to these explanations, green spaces which act as an intermediate between urban region and the educational space in order to decrease traffic reverberation, purification of air pollution, and providing a proper view from the classrooms' windows in order to reduce stress and to provide comfort is necessary.

In addition, cafeteria zone is linked to the registration area (Figure While these two spaces have separate entrances, crowded cafeteria during students' break times may disturb the staff throughout working hours. Furthermore, three different functions (lobby, Cafeteria and Registration area) are met on the ground floor; as it is obvious from Figure 3.20, only one restroom is considered with 3.5-m^2 area. Considering separate restrooms for different genders, students and staffs is essential in educational spaces. In addition, some other facilities such as lavatories and drinking fountains, for both male and female students, must be considered.

An elevator is situated in the middle of the building in order to ease the access to the upper floors with six people as carrying capacity. The waiting area for this elevator is 7 square meters. Considering the main function of the waiting area (connecting the cafeteria to the registration space), this space is too small. A staircase is also located on the west part of the building and gives service to the students. While the staircase and the elevator should be visible and adjacent to the main entrance of the building which are not easily observed in this case.

First, second and third floors of UMK are under administrative use and were not accessible for observation, study and plan analysis. Therefore, these three floors are excluded from this study. Starting from the fourth to the eighth floors, the classrooms are giving service to the students (Figure 3.20).

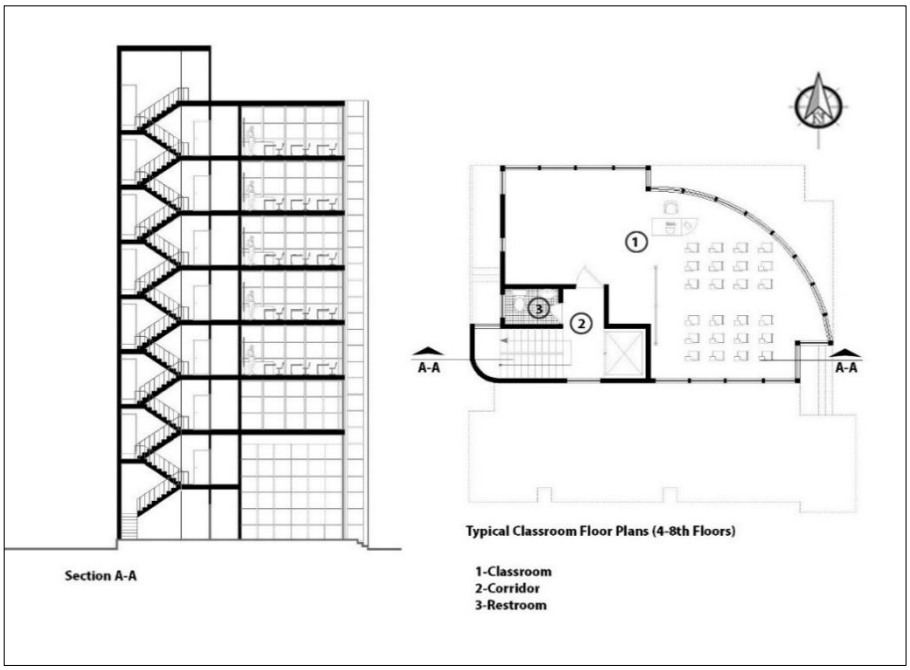


Figure 3.20. Schematic Section and Typical Classroom Plans (4-8th floors)–UMK

Only one restroom is placed beside the classrooms' entrances for the students' welfare on each floor. As mentioned before, a separate restroom for each gender is necessary; furthermore, other facilities such as lavatories and basin should give service to the students in the restroom area which are not provided in this case.

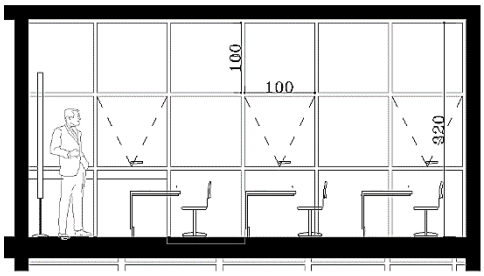
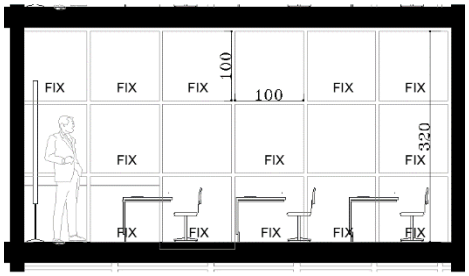
3.2.2.3 Openings (Size, Proportion, Shape, Direction, Visual and Physical Access)

The main effective factors on visual and lighting comfort are glare and the natural lighting level. A high quality lighting of an educational space plays an important role in students' biological processes and psychology.

Natural lighting of the UMK classrooms is provided by the glazing parts of external walls. Glazing covers 98 m^2 (70%) of the total curtains' (140 m^2) area (Figure 3.21). This glazing consists two general window types; one of which is fixed type and the other is top-hung. These two window types are designed in 100*100 centimeters

dimension per panel. Fixed window panels have been used in combination with functional windows to take more advantage of the outside view and to let in more natural light (Table 3.3).

Table 3.3. Different Types of the Window in UMK Building

Window Types	Type 1	Type 2
	 Top-hung	 Fix

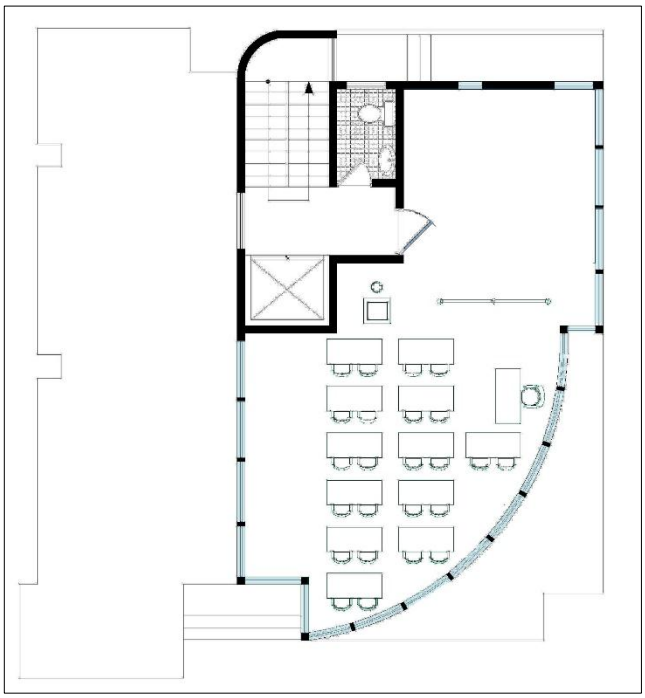


Figure 3.21. Glazing Area in the UMK Building classrooms

The curved form of this building prevents free furniture arrangement in classrooms. As it is obvious from Figure 3.21, %40 of students are forced to seat beside windows. These windows have no sills. As it is mentioned in the literature review, an embedded sill with a height of 90-120 centimeters from the finished floor level is essential for classrooms. Lack of these sills may cause intimidation; especially on upper floors. On the other hand, direct solar radiation at different times of a day may also cause discomfort.

Windows are relatively large for the only purpose of providing daylight and view in classrooms. *In order to find the reason of students' dissatisfaction, they are asked to explain the reason. Students declared that natural lighting during fall and winter from 4:00 PM and especially during cloudy days is not proper and using artificial lighting is necessary. Furthermore, visual discomfort is tangible during sunny days due to White-Boards' and desks' surface glare. In addition, as students mentioned, classroom spaces are bright and natural lighting level is not uniform during normal days for using the video projectors.*

Therefore, providing proper shading devices for these windows to prevent sunray penetration and provide good view is critical. South and North elevations of UMK building are designed by horizontal overhangs (Figure 3.22) which act as a shading system. This kinds of overhangs are effective to prevent direct radiation of South facing facades and to reduce sun glare in the classrooms. As mentioned before, North side is sunless and shading this side of the building is not essential to take advantage of natural lighting.

Figure 3.22. Shading Devices and Glazing on the UMK's North and South façades

Furthermore, the East façade of the UMK building (3.23) is facing morning sun and the West side is exposed to the evening sun, as almost all the East facing surfaces are covered by glazing, considering proper shading to manage solar glare especially for the East façade is vital.

Figure 3.23. Glazing Area of the East and West Facades of UMK Building

3.2.2.4 Flexibility and adaptability

As Figure 3.24 indicates location of the columns in the building structure, especial form of the building and glazing part, location of the elevator and stair case make the later changes impossible for this building. While classrooms are designed in polyvalent fashion and each classroom is included two parts which one part of that is useless. This part is proper for different educational activity according to each faculty.

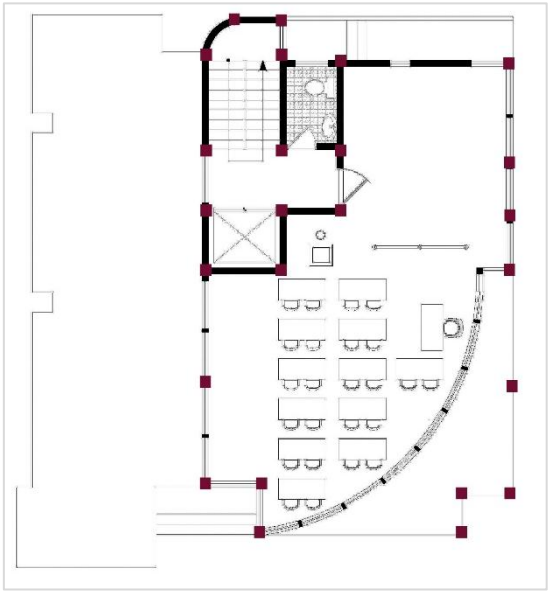


Figure 3.24. Location of the Columns in UMK Building

3.2.2.5 Color and texture

As it is indicated in Figure 3.25, all the classrooms walls are colored in the white color, %70 of the total area of walls are covered by glass panels and light gray tiles on the floor. Finally, all classrooms are furnished by movable wooden desks and blue chairs. The blue color of objects in this classroom create a contrast in this environment. That this contrast responded to attention demand of classes and attract learners' attention to detail and engaging in the activities.

Figure 3.25. Glazing Area of the East and West Facades of UMK Building

Furthermore, students have a view to the environment with a hard texture (traffic and intense buildings) from the large glazing area of the classrooms. Therefore, this texture has a negative influence on students. According to the literature students are preferred to studying in campus base educational building due to its positive influences such as the increment of interest in learning, the increment of imagination and the sense of empathy. Students shared similar problems in response to the question about visible texture to the outside in the class rooms. Most of the students are commented *heavy traffic of street especially during crowded time of the day has a negative disadvantage in our concentration. We prefer to have view on greeneries area instead of busy traffic.*

3.2.2.6 Physical Accessibility

In terms of physical accessibility this building can separate to the three types:

a) Main access from the outside to the building and visa-versa.

This access is shaped through main entrance of the building which is located in the east side of the building and emergency exit which is located in the south side of the building (Figure 3.26).

Figure 3.26. a. Main Entrance b. Emergency Exit

b) Horizontal access which is shaped through buffer zone

As Figure 3.27 indicates in UMK building two corridors in typical size have been connected the different spaces to each other which the width of corridors is 120 cm while according to the literature minimum width for corridor should be at list 200 cm.

Figure 3.27. Corridors in UMK Building

c) Vertical access in UMK building.

Figure 3.28. Stairs and Elevator in UMK Building

As mentioned before and obvious in Figure 3.28 the vertical accessibility in UMK building is shaped through both staircase and elevator. While the author observation

has been indicated that the width of staircase is not proper for ninth floor building especially during the emergency situations and natural disaster.

Furthermore ,as mentioned before author observation and students response have been indicated that the area of elevator in not proper for educational building and even the 1meter door which is considered for the elevator is not proper for people with disability while they are using wheel chair.

3.2.2.7 Ergonomics

From the total area of the classrooms only 50 square meters is useful. In order to conserve the general form of the building, classrooms (which are located on the East side of the building), are gussied up by a curved wall. This form of the plan makes furniture arrangement difficult.

This classrooms has a 24 chairs and 12 tables. As Figure 3.29 indicates they are arranged in the row shape.

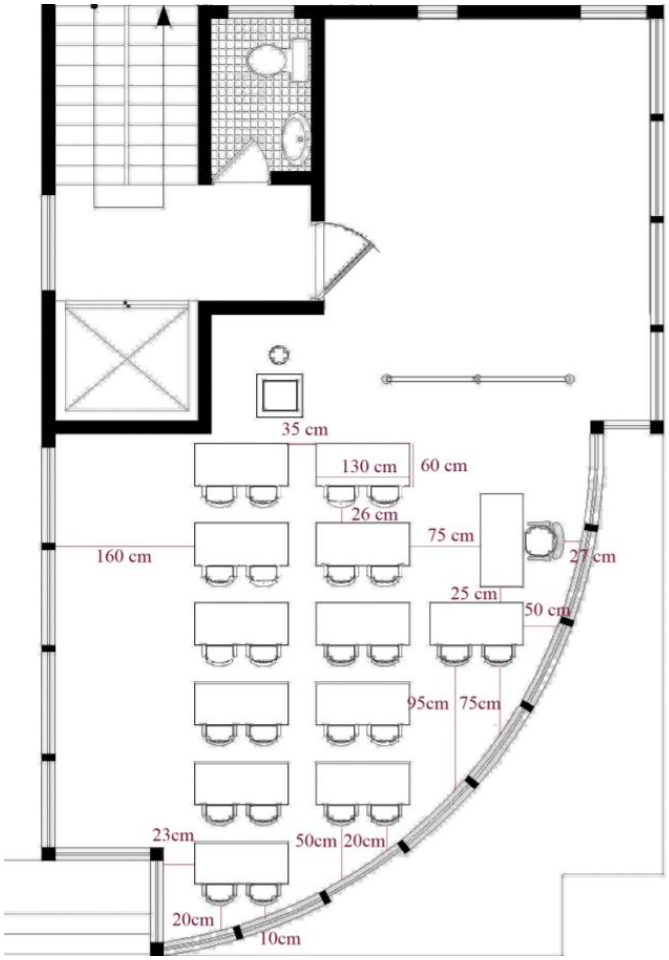


Figure 3.29. Furniture Arrangement in the UMK Building

Table 3.4. Different Types of the Window in UMK Building

	Indicators	Standard	UMK Classrooms
Classrooms Data	Table width for each students	76.2cm	65 cm
	Table width for instructor	200*81	130*50 cm
	Chair width for each student	50cm	50cm
	Distance between each row of tables	66cm	26 and 35 cm
	Distance between instructor tables and first row of tables	120cm	25 and 75
	Distance between the last row of seats and wall or windows	100cm	Minmum:10 cm Maximum:95 cm
	Distance between the row of seats and beside wall or windows	90cm	Minimum: 23cm Maximum:160cm

According to the schematic plans of classrooms and Table 3.4 It's now easy to conclude:

- In classroom the area of tables for each students is not proper and is less than standard.
- Table width for instructor is not proper in classrooms, while observation indicates drawer or cabinet is not considered for the teacher which according to the literature at list two cabinet or drawer for the required tools is needed.
- The chair width for each student is match to the standards.
- The distance between each row of tables due to easy circulation of students and instructors is not obvious in classroom.
- Distance between instructor tables and first row of tables is less than mentioned standard, while considering proper distance according to the standard due to comfort of instructor and easy circulation of users is necessary.
- Distance between the last row of seats and wall or windows is less than standards.
- The proper distance between the row of seats and beside wall is just obvious in one side of the classroom with 160 cm distance.

According to the results can conclude that, the area of classrooms is proper for considered furniture while the shape of classroom is created limitation for proper arrangement of the furniture which the distance between the furniture rows and wall and window is not respected to the standard. *Ten students are mentioned to this fact : as our point of view the area of tables is not proper for each students and also we*

don't have any area to put our objects ,also the less distance between each rows make the circulation hard for us and we are not comfortable during lesson ours.

Chapter 4

COUNCLUTION

4.1 Conclusion

The main aim of this study was to find the indicators of space quality, and evaluate campus based and building universities in North Cyprus as case study. Found space quality indicators of educational buildings are widely divided into space and proportion, functional spaces, accessibility, adaptability and flexibility, space arrangement, openings, ergonomics, and color and texture.

Campus based case selected to see the success of architectural attempt in designing educational spaces compare to building universities which are normally transferred spaces into educational building and not planned and designed according to the needs and standards.

As table 4.1 indicates; in terms of openings, UMK case as almost 70 percent coverage of glass on walls and window sill in not considered at all.

All types of openings (windows, doors, fenestrations), influence the way we conceive a space. While lighting is an important aspect in designing educational spaces, the size, number, shape and direction of these openings become important. Furthermore, besides providing proper lighting, visual and physical privacy must be considered. The implementation of proper adjustable shading devices can be helpful

to provide proper lighting in educational buildings specially classrooms. In case of GAU 24% of the classrooms class rooms are placed and designed based on standard and 72 percent in close to standard. Usage of shading devices in both cases seems arbitrary and according to design principles rather than preparing the comfort expected from inside.

In terms of color and texture, both cases are successful in usage of color in furniture while wall color is not used as an opportunity in both cases. Considering the visible view fro, windows as texture, GAU as a campus based case found more successful. Distance from the street, natural greeneries, and having proportionally suitable neighbors is strength only campus based universities can benefit from. Functional space relation in UMK case found very much vertical and distinct while in GAU case it is more clustered and readable.

These types of design decisions are part of basic strategies that simply might be lost in converted building. In terms of space proportion, converted buildings as the case studied in this thesis, are put under usage due to availability of them and having physical changes in them mostly found difficult. As in UMK case the ratio of under usage of education is not proportional and based on standard compare to GAU. However it should not be forgotten that exponential increase in student number after few years would create kind of unbalance between required spaces and standard with available area.

In terms of vertical access, all educational buildings should be designed based on life safety rules and regulation and universal design principles. Having proper ramp size

and slope and elevators with proper loads of people to carry in another issue which usually would be left unregarded in both cases.

The other factor to be considered is Ergonomic. Students, tutors and Staffs are spending most of their daily life at schools and universities , however since students presence in school are floating, ergonomic issues are minimally considered for them. Various standards for ergonomic design in educational facilities are mentioned in this study. Moreover, as a result of constant change of pedagogy, curriculum and number of students, all educational buildings should have flexibility and adaptability.

Table 4.1. Comparative study of Findings in UMK and GAU cases

Indicators		**UMK**	**GAU**
Openings	**Size** **Shape**	70% of the classrooms walls are covered by glazing. Windows do not have any sills. Openings in this building do not have proper shading devices.	24% of the classrooms in type A covered by window. Dedicated window for these type of classroom as according to the standard. 72% of classroom types B and C dedicated to windows. That is more than mentioned standard, and considered windows do not have any sills. Improper shading devices in both cases.
Color & texture	**Color**	White color and 70% glass on walls. Usage of color in furniture.	White colors on walls. Usage of color in furniture.
	texture	Hard texture is available	Soft texture is available
Functional space	**space organization**	Vertical arrangement	Clustered
Space & proportion		Elevator, staircase, café, restroom do not designed in a proper proportion according to the large area of classrooms and number of building floors.	Size of the classrooms in compare with the atriums and also large volume of building in small

Physical accessibility		Two entrance in the east and an emergency exit in south side. Vertical access shaped through elevator and staircase.	Three entrances in different part of the building. Vertical access through stair case. Horizontal access through 2meter width corridors.
Flexibility and adaptability		Location of columns and especial shape of the building created limitation for future changes.	Location of the columns around the atriums created limitation in this building for later changes.
Ergonomic	**Furniture arrangement**	Furniture is arranged in rows with little distance which make the circulation hard in classrooms.	Furniture are arranged in the row with improper distance which make the circulation of students hard in the classroom.

Some suggestions to enhance flexibility such as using public spaces and corridors, separating spaces with furniture instead of walls and using movable walls; are discussed in the second chapter of this thesis.

As Table 2.4 reveals most of the indicators are not provided while the selected campus based case in better situation. However surprisingly, These space quality indicators are not completely and positively achieved in most of the cases. This proves that everyday experience is not always responsive. This study contributes to a navigation of the realities of learning space. It recognizes that the literature may be leaving the profession behind and that for many educators the opportunities of design are merely aspirations.

Table 4.2 Space Quality Indicator Condition in Selected Cases

Indicators	UMK	GAU
Space & Proportion	Inadequately	Partially
Functional Space	Inadequately	Completely
Openings	Inadequately	Partially
Physical Access	Inadequately	Completely
Flexibility & Adaptability	Inadequately	Inadequately
Color & Texture	Partially / Inadequately	Partially / Completely
Ergonomic	Partially	Partially

4.2 Future work

This study examines the current situation of two universities in North Cyprus based on found space quality indicators. In continuation of this path future studies might be done on development of set of solutions for both cases in all terms space quality, simulate the changes effect in internal organization and external look and appereance of the building.

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APPENDIX

Appendix A: Students Interviewing Questions

1. How do you feel in terms of named space size in this building?

- Classroom
- Elevator
- Staircase
- Corridors
- Campus
- Café

2. How do you feel in terms of space arraignment? (Is finding the space which you need is easy or space are arranged far from each other and they are not visible?) *Please explained and write the name of space which dos not located proper according to your need.

3.Do you prefer to study in the university with campus of in the city context? (Please explain your answer)

4. How do you feel in the non-campus/campus based university?

- Does the campus have any advantage on your learning, concentration, tiredness, stress and etc.?

5. Which kind lighting has been used in your class room? (Natural lighting through windows /artificial lighting through electric equipment)

6. How do you feel in terms of winnows size and location in your classroom?

7. How do you feel in terms of outside view from the classroom?

8. Does outside view from the classrooms window have any advantage or disadvantage on your learning, concentration, vision and etc.?

9. How do you feel in terms of used color in the classroom? (Please explain)

10. How do you feel in terms of classroom furniture; and explained are you satisfied with the arrangement of furniture?

11. How do you feel in terms of furniture arrangement and circulation in the classroom?

12. How do you feel about over all condition of the building?