



**PREVAILING FACTORS OF SUCCESSFUL DESIGN IN  
LIBRARY SPACES:  
A COMPARATIVE ANALYSIS BETWEEN TWO LIBRARIES OF  
ÇANKAYA UNIVERSITY IN ANKARA**

**SHAHRYAR BAGHERY SATTARY**

**AUGUST 2015**

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**A THESIS SUBMITTED TO  
THE GRADUATE SCHOOL OF NATURAL AND APPLIED  
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**BY  
SHAHRİYAR BAGHERY SATTARY**

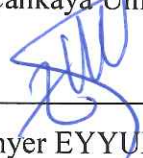
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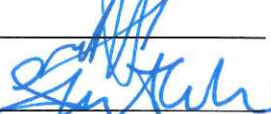
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## **ABSTRACT**

### **PREVAILING FACTORS OF SUCCESSFUL DESIGN IN LIBRARY SPACES: A COMPARATIVE ANALYSIS BETWEEN TWO LIBRARIES OF ÇANKAYA UNIVERSITY IN ANKARA.**

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Supervisor: Dr. Saadet AKBAY YENİGÜL

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The purpose of this thesis is to discuss and outline the functional suggestions on the important factors that need to be considered while designing interior libraries. These important factors can affect considerably to interior environment and designing of libraries. These important factors include lighting, color and materials. Each factors could change designing of interior library easily. In this thesis, all these factors are investigated in separate sections, and there are standards of interior libraries which are explained in each section. Moreover, the history of university library in Turkey is explained and the role of the libraries in society and history of library are investigated. Furthermore, there are different kind of libraries which are explained in separate parts. Consequently, a case studies have been studied under the headlines of this thesis, which are located in Çankaya University in Ankara.

Keywords: Library, interior, design, environment.

## ÖZ

### KÜTÜPHANE ALANLARINDA BAŞARILI TASARIMIN, GALİP FAKTÖRLERİ: ANKARA, ÇANKAYA ÜNİVERSİTESİ’NİN İKİ KÜTÜPHANESİ ARASINDAKİ KARŞILAŞTIRILMALI ANALİZİ

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Bu araştırmanın amacı kütüphanelerin iç mekan tasarımı yapılırken en önemli işlevsel etkenlerin üzerinde tartışmaktır. Bu faktörlerin kütüphanelerin iç mekan tasarımında çok önemli etkisi vardır. Bu önemli faktörler ışık, renk ve malzemeleri içerir. Her bir faktör bir kütüphanenin iç mekan tasarımını çok basitçe değiştirebilir. Bu araştırmada bahsedilen etkenler ayrı ayrı incelenip bu faktörlerin standartları doğrultusunda incelenmiştir. Ayrıca okul kütüphanesinin tarihçesi ve sosyal hayattaki önemi incelenmiştir. Ayrıca kütüphanenin çeşitleri incelenmiştir. Sonuç olarak Çankaya Üniversitesi’nde yer alan örnek mekanlar bu faktörler ve standartlar üzerinden incelenmiştir.

**Anahtar Kelimeler:** Kütüphane, iç, tasarım, çevre.

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## TABLE OF CONTENTS

|                                  |      |
|----------------------------------|------|
| STATEMENT OF NON PLAGIARISM..... | iii  |
| ABSTRACT.....                    | iv   |
| ÖZ.....                          | v    |
| ACKNOWLEDGEMENT.....             | vi   |
| TABLE OF CONTENT.....            | vii  |
| LIST OF TABLES .....             | viii |
| LIST OF FIGURES.....             | x    |
| LIST OF ABBREVIATIONS.....       | xi   |

### CHAPTERS:

|                                                       |    |
|-------------------------------------------------------|----|
| 1. INTRODUCTION.....                                  | 1  |
| 1.1. Aim of Study .....                               | 2  |
| 1.2. Structure of Study.....                          | 2  |
| 2. GENESIS OF LIBRARY.....                            | 4  |
| 2.1. The History of Library.....                      | 4  |
| 2.2. The Role of Libraries in Society.....            | 6  |
| 2.3. Types of Library.....                            | 7  |
| 2.3.1. Public Library .....                           | 8  |
| 2.3.2. Academic Library.....                          | 8  |
| 2.3.2.1. School Library.....                          | 9  |
| 2.3.2.2. College Library.....                         | 9  |
| 2.3.2.3. University Library.....                      | 10 |
| 2.3.3. Special Library.....                           | 11 |
| 2.3.4. National Library.....                          | 12 |
| 2.4. Role of the library in University Education..... | 12 |

|                                                                             |    |
|-----------------------------------------------------------------------------|----|
| 3. FACTORS AFFECTING LIBRARY DESIGN.....                                    | 14 |
| 3.1. Interior.....                                                          | 15 |
| 3.1.1. Lighting.....                                                        | 16 |
| 3.1.1.1. Artificial lighting.....                                           | 17 |
| 3.1.1.2. Daylighting.....                                                   | 23 |
| 3.1.2. Color.....                                                           | 25 |
| 3.1.2.1. Effect of Color on Time.....                                       | 29 |
| 3.1.2.2. Selecting Color.....                                               | 29 |
| 3.1.3. Selecting Materials.....                                             | 33 |
| 3.1.3.1. Floor .....                                                        | 33 |
| 3.1.3.2. Ceiling.....                                                       | 39 |
| 3.1.3.3. Shelving.....                                                      | 41 |
| 3.1.3.4. Wall.....                                                          | 46 |
| 3.1.3.5. Window Treatments.....                                             | 47 |
| 4. A COMPARATIVE ANALYSIS BETWEEN TOW LIBRARIES of ÇANKAYA UNIVERSITY ..... | 49 |
| 4.1. Description of Case Study.....                                         | 49 |
| 4.2. University Libraries in Turkey.....                                    | 50 |
| 4.3. Methodology .....                                                      | 51 |
| 4.4. Çankaya University.....                                                | 52 |
| 4.4.1. Balgat Campus.....                                                   | 52 |
| 4.4.2. Turkuaz Campus.....                                                  | 53 |
| 4.5. Analysis of Two Libraries.....                                         | 53 |
| 4.5.1. Lighting Design.....                                                 | 53 |
| 4.5.1.1. Balgat campus.....                                                 | 54 |
| 4.5.1.2. Turkuaz Campus.....                                                | 63 |
| 4.5.2. Color Design.....                                                    | 74 |
| 4.5.2.1. Balgat Campus.....                                                 | 75 |

|                                             |    |
|---------------------------------------------|----|
| 4.5.2.2. Turkuaz Campus.....                | 78 |
| 4.5.3. Materials.....                       | 80 |
| 4.5.3.1. Balgat Campus.....                 | 80 |
| 4.5.3.2. Turkuaz Campus.....                | 82 |
| 4.6. Comparison Between two Libraries ..... | 83 |
| 4.6.1. Lighting.....                        | 84 |
| 4.6.2. Color.....                           | 87 |
| 4.6.3. Materials.....                       | 88 |
| 5. CONCLUSION.....                          | 89 |
| REFERENCES.....                             | R1 |

## LIST OF FIGURES

### FIGURE

|                  |                                                              |    |
|------------------|--------------------------------------------------------------|----|
| <b>Figure 1</b>  | Color Temprature.....                                        | 18 |
| <b>Figure 2</b>  | General surround, Visual task, Immediate Surround.....       | 24 |
| <b>Figure 3</b>  | Wheel Color.....                                             | 27 |
| <b>Figure 4</b>  | Tufted structure (Right) and woven structure (left).....     | 35 |
| <b>Figure 5</b>  | Left part is lightest and wright part is darkness stone..... | 36 |
| <b>Figure 6</b>  | Inestalling of Suspended Acoustic Tile.....                  | 39 |
| <b>Figure 7</b>  | Acoustic Wood Slat.....                                      | 40 |
| <b>Figure 8</b>  | Glass Fiber Reinforced Gypsum, (GRS).....                    | 40 |
| <b>Figure 9</b>  | Double-faced steel cantilever-style shelving unit.....       | 44 |
| <b>Figure 10</b> | Case-style shelve.....                                       | 45 |
| <b>Figure 11</b> | Lighting Bookshelves for BALGAT Library .....                | 55 |
| <b>Figure 12</b> | Lighting Bookshelves for BALGAT Library .....                | 55 |
| <b>Figure 13</b> | Lighting Bookshelves for BALGAT Library .....                | 56 |
| <b>Figure 14</b> | Lighting Bookshelves for BALGAT Library .....                | 56 |
| <b>Figure 15</b> | Lighting bookshelves for BALGAT Library .....                | 57 |
| <b>Figure 16</b> | Lighting Bookshelves for BALGAT Library.....                 | 58 |
| <b>Figure 17</b> | Lighting Bookshelves for BALGAT Library .....                | 58 |

|                  |                                                     |    |
|------------------|-----------------------------------------------------|----|
| <b>Figure 18</b> | Reading area lighting for Balgat Library .....      | 59 |
| <b>Figure 19</b> | Librarian desk lighting for Balgat Library.....     | 59 |
| <b>Figure 20</b> | Stairs lighting for Balgat Campus Library.....      | 60 |
| <b>Figure 21</b> | Users' desk lighting for Balgat Campus Library..... | 60 |
| <b>Figure 22</b> | Daylighting in Balgat Library.....                  | 62 |
| <b>Figure 23</b> | Daylighting in Balgat Library.....                  | 62 |
| <b>Figure 24</b> | Bookshelves lighting Turkuaz Library.....           | 64 |
| <b>Figure 25</b> | Bookshelves lighting Turkuaz Library.....           | 64 |
| <b>Figure 26</b> | Bookshelves lighting Turkuaz Library.....           | 65 |
| <b>Figure 27</b> | Bookshelves lighting Turkuaz Library.....           | 65 |
| <b>Figure 28</b> | Bookshelves lighting Turkuaz Library.....           | 66 |
| <b>Figure 29</b> | Librarian desk lighting Turkuaz Library.....        | 67 |
| <b>Figure 30</b> | Librarian desk lighting Turkuaz Library.....        | 67 |
| <b>Figure 31</b> | Stairs lighting In Turkuaz Library.....             | 68 |
| <b>Figure 32</b> | Private desks lighting in Turkuaz Library.....      | 68 |
| <b>Figure 33</b> | Private desks lighting in Turkuaz Library.....      | 69 |
| <b>Figure 34</b> | Private desks lighting in Turkuaz Library.....      | 69 |
| <b>Figure 35</b> | Group desks lighting in Turkuaz Library.....        | 70 |
| <b>Figure 36</b> | Group desks lighting in Turkuaz Library.....        | 70 |
| <b>Figure 37</b> | Group desks lighting in Turkuaz Library.....        | 71 |

|                  |                                                   |    |
|------------------|---------------------------------------------------|----|
| <b>Figure 38</b> | Multi work desk lighting for Turkuaz Library..... | 71 |
| <b>Figure 39</b> | Multi work desk lighting for Turkuaz Library..... | 72 |
| <b>Figure 40</b> | Daylight in Turkuaz Library.....                  | 74 |
| <b>Figure 41</b> | Wall colors in Balgat Library.....                | 76 |
| <b>Figure 42</b> | Floor color in Balgat Library .....               | 77 |
| <b>Figure 43</b> | Floor Finishes in Turkuaz Campus Library.....     | 82 |
| <b>Figure 44</b> | Floor Finishes in Turkuaz Library.....            | 82 |

## LIST OF TABLES

### TABLES

|                |                                                               |    |
|----------------|---------------------------------------------------------------|----|
| <b>Table 1</b> | Standard of lighting in Different Part of Library.....        | 21 |
| <b>Table 2</b> | Standard of Daylighting in Library.....                       | 23 |
| <b>Table 3</b> | standards of capacity of Cantilever-style Steel Shelving..... | 41 |
| <b>Table 4</b> | Suggestion Shelving Height for Different Types.....           | 42 |
| <b>Table 5</b> | Lighting Measure in Balgat Campus Library.....                | 61 |
| <b>Table 6</b> | Lighting Measure in Turkuaz Campus Library.....               | 71 |
| <b>Table 7</b> | Color for Balgat Campus Library.....                          | 74 |
| <b>Table 8</b> | Color for Turkuaz Campus Library.....                         | 78 |
| <b>Table 9</b> | Comparison Lighting Between Balgat and Turluaz Libraries..... | 84 |

## LIST OF ABBREVIATIONS

|      |                                                                          |    |
|------|--------------------------------------------------------------------------|----|
| CCT  | correlated color temperature.....                                        | 18 |
| CRI  | color rendering index.....                                               | 18 |
| UV   | Ultraviolet.....                                                         | 19 |
| HID  | High-intensity discharge lamp.....                                       | 19 |
| Lux  | SI unit of luminance and luminous emittance, luminous flux per unit area | 21 |
| IES  | illuminating Engineering Society.....                                    | 23 |
| GCCC | Gold Coast City Council.....                                             | 25 |
| VCT  | vinyl composition tiles.....                                             | 37 |
| NRC  | noise reduction coefficient.....                                         | 39 |
| GRS  | Glass Fiber Reinforced Gypsum.....                                       | 40 |

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Aim of Study**

Interior architecture is complex of knowledge, technology and art such as form, color, texture, lighting, and material, whereby tries to optimize spaces and performance and achieve optimal function with the meaning of beauty and concepts [1]. Interior architect involve wide range of elements such as form, light, color, texture, floor, roof, walls, decorative and functional elements and furniture [2]. These elements are tools of the designers to work from all of them and also must be aligned and arranged in a pattern. Interior design is process that simultaneously should consider aesthetic and functional aspects. Interior design of a building is the story that its main character is human. Human presence in space could provide the features and principles such as: understand the light, know the form, feel the space, touch the texture [3].

The environmental conditions that surrounds the library, directly affect the library activity. Library and interior library environment are repeatedly in a complex exchange of messages, action and interaction. This interaction has a wide range by formal and informal ways, individuals and groups and technologies involved. In such circumstances, any sensitive organization, it must have responsibility to the needs, opportunities and environmental constraints [3]. Moreover, Libraries should seek to create a favorable, impressive and interesting environment, the place where the same sense of joy and favorable in the park is to be transferred to the users. In addition, Suitable environment is inspiring place where people can be free from unwanted

psychological pressures grows in it. The quality of the interior space may direct impact on the activities of the employees and the attitude and spirit of the users affected [4].

Interior architecture can create comfortable space in libraries effectively. The purpose of the interior architecture of the library, improve physical and mental performance for comfortable of space in its activities. Tools, elements, equipment, colors, textures and all other factors that can be seen at work in the library are an integral part of Interior architecture [5].

For the result of library interior design aesthetically pleasant and satisfying, it must be accompanied by architectural elements of the building harmonious and complementary [6].

One of the most important aspects for designing a library is to consider the physical interior environments which comprises of interior space planning, and interior ambience such as selection of lighting, color, furniture, materials and finishes [7].

The aim of this study is to provide designer with the basic point to create more suitable and standard space, and improve physical and mental performance for users of library. Moreover, this study can help to readers of this thesis and also people who use library to choose the more comfortable and standard library for their study. From this point of view, this investigation focuses on the basic elements of interior library and considering as a designer about interior library and discusses the specialties and subspecialties. Furthermore, this study provide key issues of designing interior library which are presented in this study and also solutions of problems to create this important space for designers. This overview will help the researcher in future study to investigate on the interaction between library users and physical environment.

The purpose of this study is to define ideal and standard library for designers and also for readers and students to find out an appropriate library for their research and study.

## **1.2 Structure of Study**

The second chapter, describe the history of the library and also history of the library in the west to point out the role of libraries to the Communities and according to this point, value of libraries to communities. In addition more information about kinds of library and sections are investigated in this chapter.

The third chapter continues through the definition of factors that affect an interior library design. Essentially technical factors are analyzed in order to take provisions according to basic condition that happen in the library such as, interior factors, include of lighting, color and, material such as, wall, floor, ceiling, bookshelf and window treatment.

The forth chapter is include of case studies. This chapter investigated according to daily observation by author and taking pictures from main elements of interior libraries such as, measure lighting for important sections of interior library, for example, desks lighting standards, reading area, bookshelves stairs, moreover, observation from colors which used in interior libraries and also materials which used for these libraries.

Based on what is mentioned above, two libraries from Çankaya University in Ankara (Balgat Campus) and (Turkuaz Campus) are selected and analyzed about interior factors such as, lighting, color and materials.

## **CHAPTER 2**

### **GENESIS OF LIBRARY**

Prior to starting subspecialties explanation about factors of library and analyzing the basic elements of library , In this chapter, in order to research about main purpose of study which is standard library environment, for more understanding about library environment, this chapter include of history of library and role of the library to communication and role of the library to educational environment and types of library according to definition, objective and also function, are investigated.

#### **2.1 The history of library**

Justus Lipsius provided the first known history about the Libraries, it is called a brief outline of the history of libraries. Today this text is known as the beginning of historiography about the library [8].

According to Cotta-Schönberg (2013), some people have even believed that thought, that the Greeks called Logos, established the world so that they it might be thought. But this is in the realm of religion so we leave that to the theologians of Popess Benedicta the 18<sup>th</sup>'s Holiness. Important fact is that thoughts will not only be said and heard, but they will be written and read, too [9].

They had to invent something to write with, and something to write on, so that what was written could be read by others, either directly, or through versions or copies kept in libraries [9].

The collection of written knowledge in some sort of repository is a practice as old as civilization itself. About 30,000 clay tablets found in ancient Mesopotamia date back

more than 5,000 years. Archaeologists in excavations in Amarna and Thebes, cities of the ancient Egyptian, have discovered papyrus scrolls from 1300-1200bc and thousands of clay tablets in the castle of Assyrian ruler, King Sennacherib from 704-681bc, at his capital, Nineveh. More evidence gained with the discovery of the personal collection of King Ashurbanipal, Sennacherib's grandson [10].

In ancient times, people wrote on wet clay tablets and then them to put in front of the sun to stable and the first known library was Ashurbanipal's Royal Library, in Nineveh. Since then, people using materials that were easily available according their culture, have used different materials for writing and storing texts. Slowly and among thousand years they even used the skin of cows [9].

In Assyria in the 20th century to the printed books, literature was a rare and expensive product, especially in the 20th century.

This shortage, problems related to the organization of available books revealed the solution to this problem is what is today called the library, the building where books are stored and where people can come to read books, and recently, to borrow them for home-reading. Libraries as a solution to the shortage were so efficient and quickly spread to other countries. According to results of the excavations there were libraries in ancient cities: Alexandria, Ephesus, and Rome [9].

### **The Earliest Systematically Collected Library as Distinct from an Archive 668 BCE– 627 BCE**

King of Assyria, Ashurbanipal, in order to collect all sciences, during many years at Nineveh collected a library, of 20,000–30,000 clay tablets written in cuneiform script. The library was discovered at Nineveh by Famous archaeologist, Austen Henry Layard in 1849, and is known the oldest systematically collected library, as specially from a government archive. It is thought that more of the books and the library survived to the present because the clay tablets were baked and became stable in fires set during the Median sack of Nineveh in 612 CE [9].

The Royal Library of Alexandria: The Largest Library in which Collection of Recorded Information and documents in the Ancient World circa 300 BCE

The Royal Library of Alexandria is founded under the reign of Ptolemy I. The number of papyrus rolls preserved at Alexandria's library is unknown but it is estimated that the Alexandrian library may have preserved about 400,000 to 700,000 papyrus rolls at its peak (means the largest collection of recorded information and documents in the ancient world). Though the number of papyrus rolls (scrolls) at the library was immense, especially relative to other contemporaneous libraries, probably each papyrus roll contained a text about the length of one book of Homer [9]. Alexandria library had catalog which was divided into ten main subject areas such as, Poetry, The Drama, Laws, Philosophy, History, Oratory, Medicine, Mathematical Medicine Science, Natural Science, Miscellanea [10].

In the past, libraries were made mainly in monasteries. But with the development the printing industry and printed books, libraries are everywhere such as schools, universities and even shopping centers. Even the governments built the libraries as National Library at the site specific [9].

University of Paris in 1250 was earliest known university library in Europe, the library was created by an endowment from Robert de Sorbon who gave his own personal library. Over 1,000 titles by 1289 arranged into 10 major subject categories. Ultimately there was a reference collection chained to the shelves and a collection of copies for circulation [9].

## **2.2 The Role of Libraries in Society**

Library and information services are important factors to preparing the necessary resources for economic and cultural advance. Library and information services contribute efficiently to flourish and gain mental liberty, and to protect of civil rights in public levels. Such things have validity in society, and would bring effects to people without considering the age, gender and economy or the statue of jobs, education or

techniques which one knows, and to cut a long story short in cultural religious and political thoughts of a man or venereal tendencies and the powers of their minds or bodies [11].

At the early years of 20<sup>th</sup> century, libraries played important role in the awakening part of nations which brought cognition as one changing factor in the society. Major libraries flourished their equipment's and servers at this time, so there was an especial attention to gain marginalized sorts of people. Later, libraries played important roles in education gatherings, like in Thailand. Back in the 80s more flexible and proactive facilities, which had names like source database, which starts to change and to start connections to the civil community. Such centers started to find connections with the users, the educated culture, to help the community to develop and to keep the native knowledge [12].

According to study of, German Bertelsmann Stiftung, it is obvious that the libraries in the first class countries like England, America and so are samples of good development. They have shown themselves as one independent part in national knowledge and information gathering strategy along with the laws and good funds. They are crossbred libraries that show that propose conventional media and have trends to have online access to the information. So they are very popular to almost 75-90% of the crowd [13].

Currently, libraries have important role in society, they role is now changing all around the world. They are known as the source of information and their importance during the life chances and their focus on service, notice what users require and the communication solutions [13].

### **2.3 Types of library**

Library is a social institution with storage, preservation and dissemination of the history written, audiovisual and electronic services, help to improve the education and development of political, economic, Social, scientific and cultural [14].

Primeval libraries were to hold books or simply having them, hence they were the book container and keeper of them. Such terms made countries to make social institutions to make them [15].

Libraries are classified based on their functions and according to this classification, there are four types of library, i. public library, ii. Academic library, iii. Special library and iv. National library.

### **2.3.1 Public Library**

Based on UNESCO (United Nations Educational, Scientific and Cultural Organization), Is one native region to keep important information which has all kinds of science and yet users could easily reach them [16].

According to Rooney-Browne (2009), she refers to all public library zones which is an important part of library and it should be alive space, welcoming destinations, exploiting new revenue streams, the space should encourage people to study, trying to establish spaces in virtual communities.

Anyone could utilized the libraries unlike other types of libraries. New libraries often are prepared their books like bookstores, and also libraries use lighting for encourage the users to study, the libraries now are places to interface, and yet to meet each other, seminar rooms, whilom performing places and artistic zones. The aforesaid tasks makes them one favorable place to make and to satisfy their needs [17].

The main goals of public library is, provide up-to-date and reliable information on all subjects for all users, provide useful time to users, To provide services free of cost for all people, and also, responsible for preservation and development of cultural and heritage of the community [16].

### **2.3.2 Academic Library**

An Academic Library has been defined as:

“A library which is associated or attached with any educational institution to support its educational programmers” [15].

One special academic library usually is placed on colleges and universities to aid the students and the academic organizations. Their best task is bring sources and to support the organizations of their educational goals.

Academic libraries also have three sub-categories which are; i. school library, ii. College library, and iii. University library [18].

#### **2.3.2.1 School Library**

The school library is central to learning and plays a key role as a place for encouraging innovation, curiosity, to make problems disappear. School libraries make progress in children minds and findings to protect teaching and learning methods. Such libraries are important parts of school society and inverts and welcomes such society [19].

School libraries have many objectives such as, provide targeted teaching for pupils and inset for staff, provide a wide range of resources, to provide opportunities to browse and discover, provide an environment suitable for group and independent research, to stimulate independent learning, to collaborate with teaching colleagues to embed information literacy across the curriculum [20].

Moreover school libraries have many functions such as, they contain books and other types of text reading or handy documents, books with pictures with large fonts to form children's affection to read, also there are book with trends of easy learning like how to

use computers, to raise the student's skills, it also have source books, dictionaries, encyclopedias, travel books, hence student and teachers aid others with such books [21].

#### **2.3.2.2 College Library**

This Library with today style include providing access to set of digital and print books, papers and documents by best quality so that its space designing to allow for Attractive learning, also study, search and research [22].

College library has many objectives such as, users can find any instructional programmers from college library, it helps the more understanding of children to many subjects, users of college library can have entertainment material, It makes the students as an intelligent, aware, educational and open-minded person to become a responsible citizen, It apprise the teachers with latest up-dates in their subject area [15].

Also college library encourage student to reading and studying not just focus to university project and exams, also it provide for students to research project apart from university programmers [16].

#### **2.3.2.3 University Library**

Jubb and Green (2007) observe that academic libraries such as, university library, have for long time played critically important roles in supporting research in all subjects and disciplines in universities [15].

Oyesiku and Oduwale (2004) assert that in academic communities, libraries are necessary.

University library known as heart of university, and also has directly relationship with students, teachers, administrative staff, researchers [15].

According to Dr. Kumar a university library is the Inseparable section of a university complex. So, today it is there to serve the objectives of its original managers. Normally, each library program should be a subset of university's whole program. In addition, it must aim to advance and development the actions of its parent university. The Library should be a good representative of the university personality [15].

Also Dr. Krishan Kumar, said, differences between university library and college library is university library lays emphasis mainly upon research.

Therefore, the main goal of university of library based on research, and searching new knowledge [16].

Use of the libraries promotes attractive learning, and helps to understand the lessons and creation the study culture. A university environment without a library is like a person without a brain [23].

According to above paragraphs, university library is one of the basic and important place in university, and, it has many objectives such as, it helps to main goals of university with considerations of learning, research and teaching according to aims of university, To arrange the material acquired in such a way that it not only permits but actively stimulates the use of the materials, it provides, up to date resources and services to be an accessible for students to contribute to the integration of both International information and National resources in the University [21].

Moreover, university library includes of some functions for example, it collects and arranges the books, journal's, newspapers, in different subjects to makes new idea and knowledge, it provides documents by classifications, and suitable shelf arrangements, to help users for easy access to books, In order to arrange big collection of documents it keeps them in different sections, like text book section, reference section, thesis section etc.it preparers for students healthy entertainment by using of some magazine, short story, internet facility, some modern university libraries provides network connections to give easy access to e-sources and data for users [15].

### **2.3.3 Special Library**

Special Collections are found within public libraries, in corporate entities, government agencies, historical societies, archives, academic institutions, professional organizations, and social societies [24].

To the first point it can be said that normally there is subject limitation in most special library situations. This is true, especially, for librarians doing the total job of information analysis from library sources. A degree of subject specialization is an inherent requirement of such service [25].

According to Bureau of Labor Statistics describes Special Librarians, librarians work in settings not similar other libraries such as college or public libraries. They are often known information professionals. Today, according to the specialized libraries such as law firms, universities, businesses, cities, museums, government's libraries, they have special librarians. The original aim of these libraries is to serve the information of the organization. Therefore, the librarians collect and regulate books and documents focused on those subjects [25].

There are many values of special library for instance, professional expertise, Equal treatment of customers, Innovativeness, constant improvement of activity and know-how, service-orientation and openness, cooperation and mutual respect [25].

The main aim of special library are such as, it provides desired information to its users on demand and mostly in anticipation, It gives pinpointed information promptly, It disseminates updated and significant information in the concerned field, The users also get new ideas and inspiration to initiate new projects [15].

### **2.3.4 National Library**

National libraries, by definition, are limited in number, this is, perhaps, the only thing that can positively be said about them as a collective term. The national libraries of the world exhibit considerable diversity in their size, funding, structure and functions [27].

A national library keeps all documents and about a nation under some legal provision and thus represents publications of and about the whole nation [15].

Many national libraries, whilst exhibiting some of the outward characteristics of the genus, perform very few of the functions normally associated with it. In addition to this confusion between status and function, there are considerable differences when the word national is used, particularly in nations with a federal structure the concept of nation is differently viewed from without and within [27].

It must be acknowledged that national libraries have few basic characteristics in common such as, funded mostly from public funds, open to the public, act as the major archive of printed material produced within the country or region concerned [27].

A National Library has many objective such as, It coordinates with the other libraries in a country to develop a national library system, It works as a national referral and bibliographic exchange center, It works as a depository house for the said heritage by preserving it, It procures nation's all literary output under legal provision as well the foreign literature about that nation [15].

### **2.4 Role of the library in University Education**

According to earlier descriptions about education and library, education cannot exist without library, and library does not exist without education [16].

In other words Education and Library are the two vital concepts, as their existence basically relates to one another. So they can't be separated from each other. None of which ends in another one. The two are in an end at final stage [28].

The library help very usefully for learning how to inquire. It is general for all disciplines and a place where meaning isn't transmitted but rather made through the interaction with primary material and with other people's interpretations [28].

Large numbers of authors stated that the Academic Libraries should gain a change and so their roles and responsibilities. For instance, the Osburn case in 1979 remarks the essential need in library searches, since the patterns are changed in the American science environment, so the reign of science in universities and the demand of state agencies for relevant researches. He pointed that the expert research libraries should react more with academic agenda and two present more services to the recent developments [29].

The library task is to gain satisfaction for an environment that will absorb the student focus in pair learning. The traditional role of library is to reinforce the reading and studying spaces While the new ways of library schemes are about to change (about the learning rate of students and study areas), we should study the effect of such change on the student tendency and their properties on studying spaces in universities [30].

Moreover, the library is thought to be an extended version of a classroom [29]. Its role makes an environment as a learning area. The studying models could be varied like a café, and spaces whom will face each other [30]. Traditionally, the library is known as the heart of university which will aid the academic community to learn better. However, Grimes says that such conceit is used little and has less evidence that shows the facts in an institutional. The library will aid a person to gain Spiritual, inspirational, and recreational activities besides reading, hence giving the chance of interfacing the society and gaining the knowledge [31]. The library might've been considered as create of the knowledge.

Finally, it is clear, each kind of libraries, such as, public library, academics libraries, national libraries, and also special libraries, play important character in university and increase the knowledge of people about all subject, and all their questions. According to this, it has effect to improve the culture of people in every country. Also, libraries learn to us, not just studying and reading the books and articles, they learn to way of research and how research, and these days, users can study in the groups and study together and share their knowledge's.

## **CHAPTER 3**

### **FACTORS AFFECTING LIBRARY DESIGN**

According to Rooney-Browne (2009), she points out that the library spaces should transform into vibrant, welcoming destinations; exploiting new revenue streams attempting to establish spaces in virtual communities [7].

Physical interior environment are one of the important subject that have been constantly argued and discussed in order to create standard design and comfortable space and also attraction design for users. McCabe & Kennedy (2003), mention that, a library building must be attractive and aesthetically pleasing to the eye. Internally, it must be functional and current in the use of technology supporting services to its users. Architectural design features provide for the physical appearance. The descriptions that follow will appear to meld issues of attractiveness and effectiveness, because sometimes they are inseparable [7].

The physical environment includes architectural elements such as physical layout, furniture, and equipment and visual sensory elements such as color, texture, and lighting. These two aspects, in combination with ambient factors, create the interior environment. [33]. Moreover, there are modern libraries which have a lot of open space, nice and comfortable furniture like sofas and armchairs, coffee-tables and many computerized places or workspaces for users to work with their laptops. Most of the libraries have free Wi-Fi Internet access, electronic catalogues and other technical equipment to make library functions more available for a greater range of users. It all matters when we look at latest trends in library interior and design. [34].

According to the references in the Guidelines and the bibliography (including texts and websites) in Ayub Khan's recent book on planning a new library building better by Design (2009) gives an indication of the wealth of information available to the novice library planner. Like any literature review it is the sorting out of the wheat from the chaff that is important and in library planning it is often best to tackle different areas as required, moving from general information on the planning process to specific detail on topics such as lighting, furniture, IT requirements [35].

Besides, the libraries need to have all technological equipment to make working in the library as easy as possible. Users need to have approach to printers, scanners and electronic catalogues. Also the planning of the space in the library is very important so that users would not feel lost. The best approach is to plan all in the same way. There should be different zones for different purposes, reading, web browsing, group works, references and recreation. There are many interesting ways how to make library building more comfortable and cozy [34].

Furthermore, according to these literatures, main aim of this chapter is, factors which has influence to interior library such as, lighting, color, and, furniture's, bookshelves, and materials of library.

### **3.1 Interior**

Academic training in interior design usually includes a course on the basic elements and principles of design. For the interior design of libraries, the principles of design are used to create library spaces that are both functional and aesthetically pleasing [36].

The biggest challenge is to gain more teenagers and young adults to the physical library. The library needs to become cool and comfortable so that teenagers could consider it as a good place for meetings and hanging out together. Young people prefer comfortable workplaces and more freedom to move around and explore the space, they need a place to use their laptops and different zones to work. Many young people prefer to work in

open space workplace together with others but still some of them want to work in silent rooms. There is also a big need of silent rooms in the library [34].

Therefore, Interior library design can provide suitable and comfortable environment by using many factors, such as, lighting, color, material of wall, roof, ceiling, floor, and shelves, desks. According to these factors the library might become a very good place for exhibiting art and at the same time it could create a special atmosphere and make the library more dynamic [37].

Finally, in this part of thesis, according to standards of library design, interior elements of library such as, lighting, color, and materials of library, are investigated.

### **3.1.1 Lighting**

Light is kind of energy like the electromagnetic radiation. The ranges of waves varies from short wavelength gamma and spectrum, to long term waves on the others [38].

Lighting can control how the library feels and also looks. Good lighting is necessary for study, but intimate lighting may be great for reflective areas [7]. According to David Malman (2004) who architectural Lighting Design, and provided through the library Design Project, “Quality lighting is an influential tool than can greatly impact and enhance an architectural and interior design project” [39].

Library has many tasks, Reading is the most essential task in libraries. Suitable lighting is very important factor in a library total success. Good condition of light in library building happens as a result of technical abilities and designer. Such matter is true to some sorts, where ocular functions happen diversely and the technology inserts new sorts of lighting requirements [39].

On the whole, it is possible to sort the light sources, which could be used in library, under two main title, artificial lighting and natural lighting (daylighting).

Also, there are 3 kinds of artificial lighting, according to these: Fluorescent Lamps, Incandescent Lamps, High-Intensity Discharge (HID) Lamps, also in each of three main source of artificial lighting, there are many kinds of lamps, according to their efficiency, construction, wattage, luminous and also from price, and color properties.

#### **3.1.1.1 Artificial lighting**

The three artificial light sources currently use in libraries, are incandescent and fluorescent lamps and high intensity any light fixture's performance highly depends on the source of light like bulbs. Any bulb could bring different sorts of lights and varies types according to their performance. You should pick efficient bulbs to provide best types of light you need [40].

Library designer and also librarians should know about all characteristics of each sources, and use each sources for specially parts of library.

#### **Fluorescent Lamps**

The introduction of fluorescent lighting fixtures to modern architecture occurred about twenty-five years ago [41].

The fluorescent lamp is a low pressure mercury electric discharge lamp that consists of a glass tube filled with a mixture of argon gas and mercury vapor at low pressure, Lower energy cost typically offsets the higher initial cost of the lamp. The lamp is more costly because it requires a ballast to regulate the flow of current through the lamp [2]. And also fluorescent are have very long life. Fluorescent lamps use 25–35% of the energy used by incandescent lamps to provide the same amount of illumination (efficacy of 30–110 lumens per watt). They also last about 10 times longer (7,000–24,000 hours).

As for the investigation in the past, there is no noise problem with this type of light source. Fluorescent lamps are saving energy by working without vibration. They are suitable because of giving homogenous light. It is more suitable for creating atmosphere when using together with incandescent lamps [42].

Fluorescent light sources are good at illuminating large areas and according to previous page, have longer life than others. Moreover, it is possible to change the lamps easily and it offers the dimming property but that is expensive.

### Lamp Color

According to the David Malman, , he, investigated about standard lighting for library and gave many main issue about lighting in to the library, in this point of view, and according to his investigate: Fluorescent lamps are available in warm (3000°), medium (3500°), and cool (4100°) color temperatures. The appropriate lamp color for every project must be selected based on viewing a mock-up of interior finish samples lit with the three lamp options. Some libraries use 3500° lamps that produce a neutral color light (not too pink, not too blue) that blends well with daylight. Many librarians prefer 3000° lamps that have a pinkish-yellow light that resembles the warm glow of incandescent lamps. This warm color is especially appropriate in historic buildings. 4100°K Illustration fluorescent lamps have generally been replaced by narrow T8 lamps, which are more efficient and have an improved color of light [39].

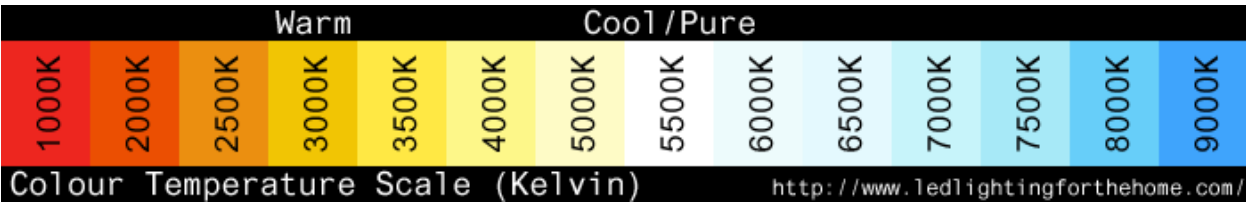


Figure 1 Color Temperature [73]

Therefore, two key factors must be considered when specifying the color of a fluorescent tube, the correlated color temperature (CCT) and the color rendering index (CRI) (lamp tech, 2014).

The color temperature according to many researches and previous paragraph is largely important for users.

Out of what color is chosen, the spectrum of lights from standard fluorescent lights might bring efficient lights from color to spectrum to the libraries. The Color Rendering Index (CRI) is one technical scale to, measure Color rendering characteristics of a lamp,

and differs from the color temperature discussed above. The standard lamp T8 which has CRI of 75, some other designers use T8 with CRI of 82, which have wealthier colors but is little bit more expensive. All the T5 fluorescents have CRI of 82 [39].

### **Incandescent Lamps**

Another types of artificial lighting sources is incandescent lamps which is use for commercial after the carbon arc lamp. Incandescent lamps are one of the most used lamps in these years after the fluorescents lamps [43].

Usual incandescent lamps produce light when an electric current is passed through a tungsten filament, heating it to about 2700 degrees Celsius. Incandescent lamps convert only a small percentage of this electricity into light; the rest becomes heat. Conventional incandescent lamps emit very little ultraviolet light and do not require UV filtering [42]. The enclosing glass bulb contains either a vacuum or an inert gas to prevent oxidation of the hot filament.

Its interesting design for most designers to use many small incandescent lamps in some space such as, lobby and lounge to make the library feel less formal place [39].

Therefore, in this type of source lighting, there are some advantage such as, appropriate for small spaces lighting, it has not nay toxic materials, suitable color rendering: CRI of 100 which is the best possible, Inexpensive to produce, Is simply used in dimming circuits or strobe and there are some disadvantage, for example, Old-style incandescent light bulbs are not suitable for lighting huge spaces. It takes many to light a huge space where as only one HID lamp can light a big open space. Halogen incandescent is suitable for this target but, some designers prefer to use fluorescent lamps, and also, it has not energy efficient (90% of energy goes to heat, 10% makes visible light) [43].

### **High-Intensity Discharge (HID) Lamps**

High intensity discharge (HID) lamps has made a vapor inside a glass lamp covered with a fluorescent powder, but they are much stronger than normal fluorescents. There are

two types. Mercury or metal halide HID lamps should not be used, since they have a dangerously strong UV output and filtering can be difficult [44].

High-intensity discharge (HID) lamps are similar to fluorescents lamps. The arc in a HID source is shorter, yet it generates much more light, heat, and pressure within the arc tube [44].

One of the problem of high-pressure sodium is color, improved-color metal halide lamps are now accessible. These lamps, called "ceramic-arc-tube lamps" have very decent color that is very similar to incandescent light. As these lamps become available in a wider range of sizes and wattages, they are becoming very popular for interior libraries [39].

When HID lighting is considered; mercury, metal halide and high pressure sodium sources can be stated. They are more or less similar to fluorescent lamps in operation and efficiency, and to incandescent lamps in shape and size [45].

Moreover, like another types of artificial lighting, there are some advantage such as, fairly long life (5,000 to 24,000+ hrs), fairly high lumen output per watt, fairly small in physical size and also some disadvantage for example, HID lamps need time to warm up. It differs from lamp to lamp, but the normal warm-up time is two to six minutes and HID lamps have a restrike time, meaning a momentary interruption of current or a voltage drop too low to maintain the arc will extinguish the lamp [45].

### **Lighting standards for library**

**Book stacks**, must be brightened perfectly so that students can find books easy and put long hours without any discomfort of sight. Evenness of lighting is more important than having special rate of light in a point. [46].

**Book stacks**, the IES recommends maximum 300 Lux, measured vertically on the stack face at a height of maximum 250 Lux [36], to design new stack area, standard lighting computation in a computer should be utilized to depict the light requirements when they happened. In addition, the stack and its signs are visible [39].

Finally, there are three type of lighting for bookshelves such as,

- Parallel scheme, where rows of linear fixtures are located directly above the stack aisles
- Perpendicular scheme, where rows of fixtures run perpendicular to the stacks and stack aisles
- Indirect scheme, where lighting is aimed upward rather than downward, and is bounced off the ceiling. The resulting light is diffuse and non-directional. Therefore, the light fixtures can be arranged in almost any uniform geometry above the stacks [30].

**Reading space.** Lighting levels of reading areas should be minimum 200 Lux average, measured horizontally at desktop, with task lighting added where it is appropriate in carrels and at tables [39].

**Lighting at service desks.** The light rates should be in between 430 to 530 Lux, on the desk. Such matter could've been achieved with one general light scheme. The lights shouldn't be strong or be glazed in one's work table. If the lights were situated up the noted table, the lights would appear right over one man's head [39].

**Staff areas.** The desired lighting level in staff areas can be achieved through a combination of general and task lighting, with 500 Lux on desks or tables and approximately 230 Lux elsewhere in the work area [39].

**Community rooms lighting.** Big rooms of conference and meetings must have contain 300-400 Lux of light, but the lights in front of the room space must be distinctly controlled. The lights should be changed or switched to 50 Lux for taking alerts when AV presentation. The note alert lights must bit into projection screen. To be flexible, various sort of light must've been present in the room .moreover, they should be merged to be good in other activities. Hence the walls are used for exhibition, which are controlled with light around the periphery [39].

Finally, for more understanding about artificial lighting in library, there is table which shows, standard lighting for different parts of library [47].

Table 1 Standard of lighting in Different Part of Library [39]

| Element Name                                      | Lux |
|---------------------------------------------------|-----|
| Bookshelves                                       | 200 |
| Reading area                                      | 200 |
| Librarian desk                                    | 500 |
| Upstairs                                          | 150 |
| Reading (newsprint, magazines, keyboard) lighting | 200 |

### **Standards for direct lighting, indirect lighting and Semi-direct light for library**

**Indirect lighting.** In this way, first, 90 to 100 percent of lighting sources goes to ceiling and cover most part of ceiling, after that the reflections of lighting from ceiling, cover all parts of space, this kind of lighting has minimum shadow compare to others types [48].

**Direct lighting.** In this way, 90 to 100 percent of lighting sources come directly to interior space, this kind of lighting makes the most shadows camper to others types of lighting and it's not suitable for users' eyes [48].

**Semi-direct lighting.** In this way, generally, 60 percent of lighting sources goes directly to interior space and 30 to 40 percent of lighting source goes to ceiling and top parts of walls, this way is better to indirect lighting and direct lighting, because in this way, lighting is uniform to all parts of space, and it's appropriate for users eyes [48]. Moreover, in the reading room, distance of lighting sources doesn't should 1.5, the distance of desk and lighting source [48].

According to library standards, the direction of light should come from left, top and with 45 degree to book. firstly, If light comes from right part, especially during writing, it makes shadow on the paper, and user feel tired early and also its not suitable for eyes. Secondly, if light come from 90 degree, it makes reflection on the paper, and it's not appropriate for study in library. Therefore, lighting direction for interior library is very important for users [49].

#### **3.1.1.2 Daylighting**

Throughout history, daylight or natural lighting has been a primary source of lighting in buildings, supplemented originally with burned fuels and more recently with electrical energy [50].

Natural light effects on users performance and perception because daylight is a control architecture tool. Daylight is one of the important features that can increase quality and how long someone will stay in a space [51].

Daylight is changeability because during the day, sun moves, the direction and the amount of daylight enter into the space through the window or roof [46].

According to (Edward M. Dean), there are two important parts for designing daylighting in library [46]:

#### **Light Quantity**

The Illuminating Engineering Society (IES) is one autonomous establishment of experts in which set the light forms and standards to build areas. The below chart is the suggestion rates of a library zone.

Table 2 Standard of Daylighting in Library [46]

| Space                                    | Minimum Lux | Maximum Lux |
|------------------------------------------|-------------|-------------|
| Inactive Book Stacks                     | 55          | 80          |
| Book Repair and Binding                  | 200         | 30          |
| Cataloging                               | 200         | 300         |
| Circulation Desk and Reference Desk      | 200         | 300         |
| Computer Areas                           | 200         | 300         |
| Audiovisual Areas                        | 200         | 300         |
| Audio Listening Areas                    | 200         | 300         |
| Reading (newsprint, magazines, keyboard) | 200         | 300         |
| Reading (fine detail items, small print) | 500         | 700         |

### Light Distribution

For good daylighting design, low glare lighting is a principal objective in libraries. Ideal ratios of brightness levels within the field of view are often described at 10:3:1, for brightness of visual task to brightness of the immediate surround to brightness of the general surround. A library space that largely achieves these ratios can be considered to have a good level of visual comfort and no glare conditions [46].

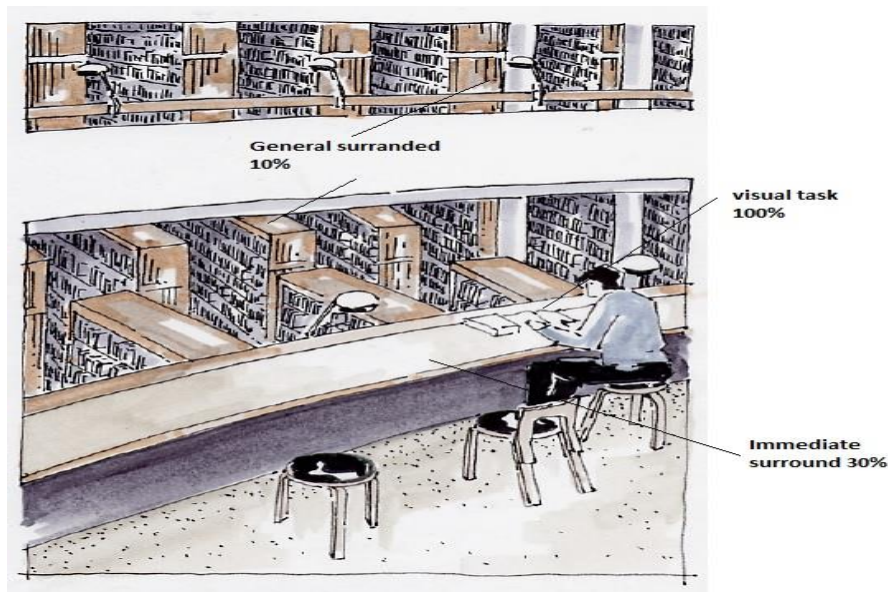


Figure 2 General surround, Visual task, Immediate Surround [46]

Other suitable lights for floors in a zone has good visual comfort (the glow loss). If you consider the reading task glow to be 100%, hence the round shining levels will be 30%, and the general shining would be 10% [46].

Daylight should be separated from multi-level systems of light control hence the shining will automatically be regulated to provide the adequate daylight, also electric saving would be in hands as a consequence.

Finally, According to GCCC (2007), light scheming must be assumed as 1) we should set the light degree at maybe 50 floor level. 2) Reduce or terminate the glow, illuminate signs and terms of glowing. 3) To form unique levels of inner lights and assent of light requirements in excursion levels, Form down levels of glow at 40 lux rate with monotony of 0.3 and intermediate level of 120 lux level [52].

Provide a decent glow rate to form the entry parts of a building and exit ways to help the public with vision improvements [7].

According to IES Recommended Light Levels for Library, for each part and elements of library, there is standard levels, for example, Book Repair and Binding, Cataloging, Circulation Desk and Reference Desk, Computer Areas, Audio Listening Areas. Moreover, there are two ways for preventing direct light from outside to inside, first,

choosing the best direction for place of library, and second, designer should use some tools which, doesn't allow to daylight come inside such windows treatments.

Generally, for using daylight in library, desks don't should more than 4.5 m from windows. In library, task of widows are not just because of lighting, they can also help to users to see the view of outside and feeling better during study. Also windows are important part of decoration for interior design [49].

### **3.1.2 Color**

Colors are important part of a man interesting which happens around us with the differences of light waves and their length, could be recognized within the eyes, and could be described by brain [53]. The man eye couldn't recognize the colors. The light reacts in the surface itself and transfers it to the brain [54].

Ittleson in 1960 defined the seeing process as a deal, same as a deal between a seller and a buyer. The deal means nothing if either sides don't take part. Observation, is a transition among viewer and his environment. Thus, whatever the environment presents for us is important, like, information of users, such as, intelligence and capability and perception [55].

Today, designer special focus about the interior space and effect of interior space to users. When a man references a library to gather information or even to spend his free time, he will feel confused amongst a mass of information and bored feeling as a result of closed environment in library. As a result, interesting environment designing and informal group sessions and talking to the others, could reduce such feelings [6].

The library color should provide a fearless periphery which improves the visional processes, reduces the stresses involves the mind growth based on visional actuation. As a matter of fact, this visional actuation, again will resister the mind and will resister junctures while upbringing the visual thought, problem solving and innovation [56].

Based on the subjects noted above, the color effect has special importance on library structure and, because of that, for inner periphery subjects, color, is one of the most important factors in library, Besides that, colors are one of the most interesting features

of decoration [57]. And can affect the designing with magnificent ways and also to our perception.

The color in architecture and painting is different, the first reason is that the color in architecture is 3\_D, likewise, the architecture color faces the changing the sunlight and, more importantly, the utilized stuff and their resistance against light, whether, moisture and etc., for instance, wood will turn on gray and gray in a matter of time [58].

In 1666, Isaac Newton, celebrated English scientist, he discovered, if a white light crosses a prism will dissolve into visible colors. Newton also discovered that each color is formed on a specific wave length and could not be dissolve into other colors, the further experiments showed that it could be made different colors by composing the lights. For instance if red and yellow are mixed, the color orange will be formed. The color formed based on other colors mixed, is called synthetic color. Some of the colors, like yellow and purple, will neutralize each other if mixed and will make white lights. These colors are called complement colors [59].

**Color wheel,** Use the color wheel, is one sure way to find colors appropriate to the desired color. Color wheel is composed of three colors: red, yellow and blue (primary colors), and the colors between them are known as secondary colors. Each color in this cycle can combine with near colors and also with opposite colors which known as a complementary color, which create harmonious and beautiful result. Using colors which are near to each other in color wheel, create mild combination and coordinated environment, in this way, viewers can easily see colors elements one to the other. Use a small amount of color with its complementary color, if use it by properly and correctly, the result become more brilliant and remarkable, and it prevent to being just one color dominant in space for example for interior library [60].

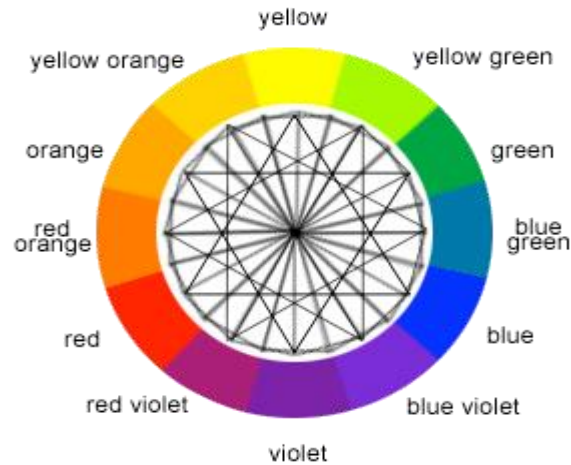


Figure 3 Wheel Color [60]

One of the first sources that had attentions on color effect in architecture, is Vitruvius. In his book. He had attention on natural and artificial colors and the places you can find them. For instance, two chapters of his book is about how you gain the color purple and its replicates [60].

Alberti had a different approach of colors in 1435, in his book he studied the color effects on remedy. His approach to color is more philosophic, and also he the classification colors according to their emotional and sentimental values [61].

Sim and Wilforth, by studying students 10-7 years old, found out that light and present colors has strong effects on their manners and will cause physiologic changes on them. When a fluorescent lamp was replaced with lamps with full spectrums and wall color of the school changed from red and white to blue and floor color changed from orange color to gray color, at the result, the blood pressure of students reduced from 120 to 100, Based on the teacher's report, after all these changes, students manners were improved, they had more attention, and showed less invasive manners. When the situation was regenerated to its first tendency, the set of data returned to back [62].

Also there are a lot of research's about effect of color to environmental and people, according these descriptions, designer should design color and use of them according to standard of library.

According to McCabe, G. B. (2003) puts it, that is should be recognized as color efficacy. Darker colors reduce actuate manners, bright colors on the other hand be actuated. Based on Gold city Council Branch Libraries (GCCC), 2006, a current approach to colors and material choose must be adopted to an inviting and welcoming feel, and with scene of good turnover, all together with interesting memorable building experiences and civic presence. The new library building will bring the beauty and clean lines, with the help of timeless and textural accede to color and desire. Colors must be choose according to natural background. The color shows elements like chosen walls and cleavages, choosing the furniture and prelate elements to help the spaces on a user group, while monolith at one total concept in space as an inviting, and actuate places to meet. Nowadays lighter colors do exist in the libraries more than many years ago [7]. these days' designers prefer to use bright colors compare to dark colors for interior library, most old libraries used Dark colors (brown, gray, beige, gold, deep red, deep green),while, new libraries use bright colors [4].

### **3.1.2.1 Effect of color on time**

according to Ghorbani book, in the space which used by red color and red light, people estimates more time, but, in same place which used by blue and green color, people estimates les time and they felt more relaxation [62].

Speed of Passing time, and the inability of humans to control them are among the factors that can cause unrest and anxiety in humans. While, using the suitable color can improve the space and make friendly ambient space. therefore, according this research of Moaoodi, in 2000, Using the blue and green in the educational space such as, library in better than red color. Because of effect of these colors to users in the library are better for relaxation, and also it has influence to their time and users can study in these spaces more time and feel less tired [4].

All the elements and aspects of interior library have influence to each other, for example, color is affected by another elements of interior library such as, lighting and kind of sources of lighting that bright on it. Commonly, designer use incandescent light

source and fluorescent light source, but, colors will be different appears under incandescent and fluorescent lamps. So, it is necessary to using the color under the similar source of lighting. Moreover, colors has influence to another's colors which use in the space of interior library.

### **3.1.2.2 Selecting color**

One of the important factors to choosing the colors for interior library is psychological aspect of them to their environment and also to people. In generally, it can possible to divide colors according to psychological effects in three categories such as: warm color, cool color, and natural color. Cool and restful colors likes, blue, green, and violet. Warm and active, stimulating colors are such as, red, yellows, and oranges. Neutral colors are having less psychological impact and less emotional content [4].

According to Carol R. Brown, as the color of fire and blood, red has the psychological implications of heat and intensity that lead to an association with danger. In library design, bright reds are seldom used as the main color in an area, however, they are sometimes used in children's areas in combination with the other primary colors (yellow and blue), or in adult areas as accent colors [36].

Using yellow is easier than warm color such as red, in library, because yellow is consider to fewer energetic implications. Like bright reds, yellows are often used in children's areas. Oranges may be used as accents in libraries, but those of us who lived through libraries in the 1960s are reluctant to select bright oranges as the predominant colors in a library [4].

According to John Pile, blue is said to encourage thought, contemplation, and meditation and so it is the color of intellectual activity. Therefore, blues are a good choice for quiet study areas in the library [36].

### **Selecting color for furniture's**

During choosing the color for furniture in interior library, interior designer should care about harmony of other colors, because according to effect of colors to another's colors which has been used with together in the same space [4].

Colors for furnishings should be selected along with other interior Selecting Materials, Finishes, and Colors finishes, including the color of laminates or wood to be used on built in millwork, doors, window and door frames, floors, walls, ceilings, columns, and building trim. Some interior colors will be determined by materials used in the building, for example, granite or marble used on walls and floors or metal used in the rails of a stairway [36].

### **Selecting shelf color**

According to experiments of designer for interior library, the lifetime of steel shelving is more than another furniture's, so because of this important reason, shelving must be purchased in a neutral, rather than a trendy, color that will continue to harmonize with library furnishings as other colors in the library change over time.[36]. Kinds of users is also important factor to selecting color for interior design, for example, generally, public library select one color scheme for adults space, but, for children space maybe, designers use different colors scheme for them, and two color scheme harmonize by having the same wood color to both space [3].

Designer should use color for identify specific job, for instance, if in library has many service desks for users, designers can also, use of same color for all services desks in order to provide library users with a visual cue regarding where to take information.

And also according to using color for specific functions, the use of colors in the same relative locations and in the same manner on every floor helps to assist users in finding specific space [2].

## Selecting carpet color

Carpet is one of the first interior finishes selected. The predominant colors in a carpet may determine the selection of other colors in the building. In recent years, many libraries have selected carpets with neutral colors. Carpet may initially be viewed in books of samples with each sample about 2" × 2" in size. As previously stated, it is impossible to know how a large expanse of carpet will look based on seeing a tiny sample. A carpet vendor will supply one or several squares of carpet to be viewed in making a selection. When a standard carpet is to be used, the planning team may be able to view the carpet in use at a nearby installation. As with any color selection, carpet samples should be viewed in the same light that will be used in the completed library. Carpet samples should also be considered in relation to other building finishes and materials that have already been selected. Carpet samples should be placed on top of a neutral-colored floor for viewing rather than on top of another carpet [36].

According to, Daria Pizzetta, an interior designer at (HHPA), says that her department sometimes looks at textiles to gather inspiration for a color scheme. Small wood samples can be obtained from furniture vendors. Wood finishes colors can also be based on wood-grain laminate samples. In some academic and special libraries, colors for new interiors may be predetermined by standard colors or finishes adopted by the larger organization of which the library is a part [38].

During the choosing color for interior library, all materials and furniture's and also books bring by themselves so many color to library, these colors can effect to perception of users in library. For example, dark color can make objective smaller and also bright color can make objective larger. For instance, in the small space designers should not be used dark color, because in perceptions of users it looks smaller [38].

An array of prospective colors is developed by using either color samples collected earlier or by using actual samples of fabric, laminate, wood, etc., provided by vendors. Architects and interior designers often have a library of finishes and colors from which to select samples for projects. It is difficult to see how a color will work in a particular situation without viewing the color in a large piece. Even an 8" × 10" piece of bright

yellow laminate may look quite different when the same color is used on a 24" × 66" end panel. If only small samples are shown to a local planning team, the interior designer should be asked to provide larger samples [36].

Selected color samples should be arranged in a scheme that shows how the colors will look next to each other in a library space. If possible, color samples should be proportionate to the size of the surfaces to be colored in the library. For example, an accent color used in upholstery may be shown in a smaller sample than one of a wall color or a carpet. Interior designers or a local planner can prepare a preliminary color board to be shown to a library board or other approving body. [36].

Therefore, here are some advices that designers should attention to them: [63].

- Up-to-date colors are maybe exciting, but mostly are used with changeable items when are done or tedious, like the wall colors.
- Bold colors are usually more successful in smaller amounts like signage or accents in carpet or fabric or wall paint.
- Natural colors are open ended and sometimes are recognized as mild. More contrast in tones and textures adds interest and practicality.
- The aim of designer is to cope with an interior system of colors which allows the ordinates in various functions in a library. Maybe the kids' area is the most brightened place. Teens have hip areas and the business rooms do have sedate colors. But their usage must be based on one building's characters.
- People and books do have colors. Libraries are crowded, vital, living areas, full of people, displays, and sign with happy colors is general. Likewise the computer screens do have colors. The chosen colors of a building interior must be arranged complement this array of daily changing colors.
- Generally, the color scheme for the interior should coordinate with the exterior. A Consistent statement is more successful and classic.

### 3.1.3 Selecting Materials

The task of selecting the materials, to be used in a library's interior should be done by design professionals and architects and interior designers, in consultation with the local planning team and, maybe, a library consultant. Design professionals should offer the planning team several options for materials should be prepared to provide other options if their initial selections are rejected [39].

In this section, selecting materials for interior library and using the suitable materials for floor, ceiling and wall and shelves and windows treatment of interior library are investigated.

#### 3.1.3.1 Floor

One of the most necessary materials for interior environment of library is choosing kind of floor materials, to begin, designers should first create the floor of the library. Because, floor, cover massive size of the library [64].

There are a lot of floor materials for using interior library such as, ceramic tile, resilient, stone, carpet and also, cork and vinyl tile [63].

**Carpet**, carpet's acoustical ability was first measured back in 1955 by Dr. Cyril Harris of Columbia University and now President of the Acoustical Society of America. Its ability to act as a noise absorbent was rated at .55 and interpreted as being as effective as most materials designed specifically for the purpose of noise reduction [64].

Carpet may be one of the first items that an interior designer selects. The colors in the carpet may provide the basis for the selection of other colors to be used in the interior design of the library [39], Designers should care about color of carpet which use in interior library, they should choose colors which not so much light and clear, because these kinds of color helps to hiding the soil into library and be more clear [63].

Denelle Wrightson, an architect and interior designer with Phillips Swager Associates, says she likes to initially present one square sample each of six to eight carpets for a client to consider. The carpets are looked at in several lights. On the basis of the first

review, she shows the client larger samples, six to eight squares, of carpets that the local planning team preferred in its first review.

According to Moris (2004), one of the important factors about choosing carpet for interior library is density and thickness of carpets. Also density of carpet has influence to weight of carpet, suitable dense carpet has a lot of face yarn and has small height. Designers should choose density carpet more than 4500. This number is best density carpet for interior library. There is one formula for carpet density,  $\text{density} = 36 + \text{face weight} / \text{pile height}$ .

One suitable kind of carpet for interior library is broadloom carpet, designers can use them in different roll size such as, 25, 30, 35 cm, while most common size for libraries is 25 cm.

Broadloom includes of tow common carpets for interior library such as, tufted and woven.

The most popular and essayist kind of broadloom for using interior libraries is tufted. Structure of tufted is like swing machine, because, it doesn't need to carry the face yarns puncture a primary backing. Also another kind of broadloom is woven, it is more expensive, camper to others, and structure of woven is, yarns are intertwined to each other's and includes of weft and warp in the weaving process. There are many kinds of woven carpet such as, Wiltons, jacquards, Axminsters. They have many options for using interior library such as flexibility and also sufferable [63].

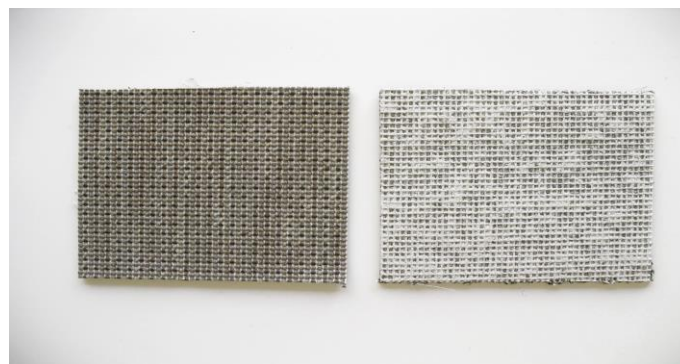


Figure 4 Tufted structure (Right) and woven structure (left) [63]

## Carpet Tiles

More than fourteen years ago, there was just one offered standard 45cm x 45cm size, but, these days, they improved and there is another standard like, 91cm x 91cm size.

These days, because of increasing the technology, interior library designers have many options to choosing suitable materials and also, accessibility of materials are easier the before, this accessibility of floor, provide carpet tiles for using these important elements of interior library [63].

Carpet tiles brought new design generations for interior architecture, they provide many options for using interior library and also, they have important roll to aesthetics of libraries.

It's not difficult to cut carpet tiles, so, we can find very different sizes of carpet tiles, therefore, designers can use any size of them for interior library.

The installation price for carpet tile is commonly cheaper than price of broadloom, but, product of carpet tiles is more expensive compare to broadloom [63].

**Stone**, while large areas of libraries are often carpeted, small areas, such as the entrance foyer, are usually covered with some type of hard surface flooring material. For example, stone, terrazzo, or tile may be used in a library entrance because of their durability, ease of maintenance, and aesthetic properties [39].

One of the common attribute of stones are very firmness, Stone workers commonly define the most appropriate texture for showing off the stones is natural beauty. Moreover, there are treatments and coatings that are applied to the finished stone that seal and protect it, or cause it to have a higher coefficient of friction (degree of slipperiness) [63].



Figure 5 Left part is lightest and wright part is darkness stone [39]

## **Stones types**

Most stones come from rocks and they have made from shale, which is combined clay, mud, and silt. There are many different types of colors and usual colors for interior are, black, grey, purple, and green.

Many countries such as, Canada, Vermont United Kingdom produce slates with high quality and harder and more expensive compare with producing of another's countries such as, brazil and china. Harder stones are very suitable for interior libraries while softer stone is appropriate for residential application [63].

Limestone is most often used as an exterior material, but travertine (a type of limestone) is used for interior flooring and walls. When travertine is used for flooring, sometimes, the surface of stone is pitted with many holes that are filled with epoxy resin [39].

Most of the stones are hard, but granite is one of the hardest stones in the world. And generally used in rough textures or as highly polished as marble. Designers also sometimes use Granite for horizontal countertops and vertical wall faces. Best size of granite for floor tile should be at least 2 cm. and also at least 3 cm for thick and stair treads. Moreover, granite walls thickness should be at least 2 cm [63].

**Terrazzo,** Another hard-surface flooring material used in libraries and commercial buildings is terrazzo.it is durable, water-resistant, and easy to maintain, terrazzo is typically used on floors in high-traffic areas in commercial buildings [39].

Terrazzo is an aggregate and composite mixture of small stone particles set in a cement binder that is poured, smoothed out, and polished to create a smooth surface. Because it is durable, water-resistant, and easy to maintain, terrazzo is typically used on floors in high-traffic areas in commercial buildings [66].

**Resilient Flooring,** resilient flooring which made from materials such as, fibers, plasticizers, synthetic resins, and fillers. Thin sheets or tiles are formed under heat and pressure. Designers use resilient flooring in some special spaces for library, for example, work areas, children's activity rooms, halls, rest rooms and closets [39].

Small and medium-sized public libraries with a limited budget may also select resilient-flooring materials for the entrance lobby [39].

Resilient flooring is designed to be durable, resistant to stains and water, and comfortable to stand and work on. There are a wide range of styles within this category, at a range of price points from very affordable to more expensive luxury brands of flooring [67], the most common types of resilient flooring are made from materials like cork, vinyl, linoleum, and rubber. These materials are all known for being extremely sturdy, and they also possess a natural springiness, especially when installed over a sprung subfloor [67].

Vinyl floors (available as pure vinyl, vinyl composition, vinyl tiles, and sheet vinyl) are durable, and installing of vinyl floors are very easy, and available in a so different colors and patterns. Rubber flooring (made from synthetic rubber) is available with a smooth surface or a patterned, raised surface in either tiles or sheets. This material has great resistance to wear and abrasion; however, only a limited number of colors can be produced [39].

**Synthetics,** Most of the synthetic floorings have a base in vinyl, whether it is pure vinyl, vinyl composition tiles (VCT), or sheet vinyl. Vinyl flooring is either homogeneous throughout its thickness, or made from layers of plastics bonded together. The top layer of the material is called the wear layer, and this is thicker in higher quality vinyls, ranging up to 20 mils [63].

**Naturals,** Two natural resilient flooring materials, linoleum and cork, were used in libraries a century ago and are being used in libraries today for a number of reasons. Linoleum flooring is made from natural materials, namely, linseed oil (which comes from pressed flax seeds), wood and cork flour, natural resins, and pigments. Typically, this composite is bound to a jute backing. Because linoleum is homogeneous, there is no layer to “wear out”. The thicker the material, the longer it will last, sometimes up to 40 years. Unlike vinyl flooring, linoleum does not show scuffs and scratches [63].

**Ceramic finishes,** they are very suitable for big space floor in libraries, ceramic tiles are man-made fired clay tiles. In additions, they generally use for walls and floors in

kitchens and also commercial restroom, ceramic tiles represent a family of products that can be much more comprehensive in their use. There are many kinds of ceramic tile which most of them use for commercial applications such as, quarry, porcelain tile and stoneware [63].

Ceramic and quarry tile are small, flat flooring units made of clay or clay mixtures. Ceramic tiles are durable, water-resistant (if glazed), easy to maintain, and are available in a wide variety of colors, sizes, and patterns. Glazed ceramic tile is often used in public rest rooms and in other locations where water is present. Ceramic tile is waterproof and can be cleaned easily. Quarry tile is sometimes used in library entrance lobbies. The tiles are set in mortar and finished with grouted seams. Slip-resistant quarry tiles with an embossed texture on the surface are available [39].

**Solid Hardwood Flooring,** Designers has been used Harwood for interior architecture more than 100 years ago, hardwood are little expensive, therefore, it is mostly found in upgraded spaces, like main study rooms and special collections rooms, and also, they give a warm and welcoming and rich look. One of the important advantage of Hardwood for floor is, refinished for many times and treated with polyurethane coating that restore their beauty [39].

The popular wood types for flooring is oak, they have very different colors but common colors are red and white, oak takes stain well and can range from whitewashed and clear finishes to medium and darker tones. Maple has condensed fine grain, because of this reason, modern libraries use from them, it looks like a uniform, and maple less texture than oak. Maple is fully light in coloration and, because of its hardness, is not porous and does not take staining well [63]

### **3.1.3.2 Ceiling**

Ceiling system play important role in library and support many elements in libraries. It has direct influence to, ventilation, acoustic, lighting and fire sprinklers functions of the library. They can be useful and basically unnoticed by the library users, for example, when acoustical ceiling tiles are used, or they can enrich and define a room's character,

such as might occur with the use of a wood plank ceiling system. Ceiling surfaces are also used to reflect light from indirect fixtures to give an equal low-glare light quality and a bright ceiling [63].

**Suspended Acoustic Tile,** The capability of a wall panel and ceiling to absorb noise is measured by its noise reduction coefficient (NRC). Designers suggest 0.65 is minimum NRC for ceiling tiles in libraries. The usual sizes for ceiling grids are 5.08cm x 5.08cm and 5.08cm x 10.16, and the lighting system is also often incorporated into this grid. It possible to hidden grid ceiling for building but it's not suggested in libraries, because they sometimes need to alignment, after repairing staff has removed tiles for access to air systems [63].



Figure 6 Acoustic Tile [74]

**Acoustic Wood Slat,** such slats are placed parallel with the use of wooden dowel. Such dowels are available in pliable material like plastic which will make curves in the note slats. Slats could be stouter, to make the roof having lattice shape and sometimes flat, and they form such ceilings with wood [63].

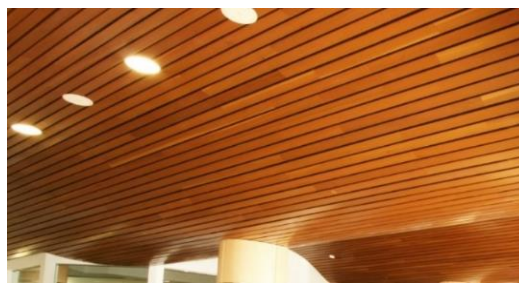


Figure 7 Acoustic Wood Slat [75]

**Glass Fiber Reinforced Gypsum, (GRS),** GRS is such a power, but also a small weight syntax of chock stone covered with glass fibers, they are custom molded in their manufacturing factories and could be shaped into any desirable shape and size, but at the times of production, it is rough and could not be geniculate. Pin dot (Small Holes) or bigger ones are there to increase the acoustic matters. And, the final product is nonexclusive, and could be painted like gypsum .roof CRG are mostly separated from the floor with the normal thickness of 1/8 to 3/16 degrees. Hence for the light weight and their easy way of installations, CRG has lesser costs than conventional plasters and other ways in which you can't work as it is been installed [63].



Figure 8 Glass Fiber Reinforced Gypsum, (GRS) [63]

### 3.1.3.3 Shelving

One of the important factor for suitable bookshelf in library is having balance between function of bookshelf and appearance [6].

A shelf with the perfect appearance maybe not be adequately strong. That means making changes as you work out the design [68].

Old style book stacks can occupy more than 50% of a library's environment and are still the preferred method of collection storage and access for high-use material. Efficient space planning of stack areas is an essential scheming matter to lessen the cost of building [69].

**Capacity** is defined as the number of volumes capable of being shelved on a linear foot of shelf. A typical section of shelving has shelves that provide three linear feet of storage per shelf. Typically, the published capacity for a collection will use volume numbers that will produce 25% of excess space per shelf, Best volume for a working set need shelves whom are just 70 to 75 % full

Table 3 standards of capacity of Cantilever-style Steel Shelving [69]

| <b>Cantilever-style Steel Shelving Capacity Schedule for Common Multimedia</b> |                    |                                       |
|--------------------------------------------------------------------------------|--------------------|---------------------------------------|
| <b>Media Type</b>                                                              | <b>Shelf Depth</b> | <b>Units per Linear Foot of Shelf</b> |
| Audio Cassette                                                                 | 20.32 to 25.4 cm   | 48.26 cm                              |
| Audio Compact Disc (CD), CD ROM and DVD                                        | 20.32 to 25.4 cm   | 76.2 cm                               |
| Audio book Cassette                                                            | 25.4 cm            | 25.4 cm                               |
| Media Kit (Audio Cassette w/Book)                                              | 25.4 cm            | 50.8 cm                               |
| Video Cassette                                                                 | 25.4 cm            | 25.4 cm                               |
| Current Magazines                                                              | 30.48 cm           | 2.54 cm                               |
| Current Newspapers                                                             | 30.48 cm           | 2.54 cm                               |

The capacity per shelving unit will vary based on the collection being housed. The factors involved in determining the capacity are volumes per linear foot (by collection type) and number of shelves per shelving unit [69].

**Shelving Height**, one of the most important decisions in scheming the shelving is the height of stack unit. The height of the unit will determine the number of shelves per unit,

which, in turn, will determine the capacity for each unit and the number of units required to house the planned collections. Most popular heights are 106, 167, 198, 213 or 228 cm. Such heights are show the height of the vertical side of the unit. The units 2 to 7 shelves are suitable for storing sets [69].

Decisions regarding the height of shelving to be specified depend on how the book stacks will be used [39].

Table 4 Suggestion Shelving Height for Different Types [69]

| <b>Volume Type</b>           | <b>Recommended Unit Height</b> |
|------------------------------|--------------------------------|
| Reference (High and Low)     | 106, 167, 228 cm               |
| Adult Fiction                | 228cm                          |
| Adult Non-Fiction            | 228 cm                         |
| Children's Picture Books     | 106 cm                         |
| Easy Readers                 | 106 cm                         |
| Juvenile Fiction/Non-Fiction | 106 cm                         |
| Young Adult                  | 106 cm                         |
| Large Print                  | 106, 167 cm                    |
| Current Periodicals          | 167 cm                         |

**Shelving Depth,** Standard adjustable shelves are available in many different depths; for example, 20, 22, 25, 30, and 40 cm. Some specialty shelves are only 15 deep. The shelf depth needed depends on the type of material to be housed on the shelf. Specialty shelves for audiovisual materials are usually 15 or 45 cm deep. Books for school-age children and adult fiction will fit on a 25 shelf. Most picture books, adult nonfiction and reference book shelving should be 30 cm deep. Law books may require shelves 35 or 40 cm deep [39].

## Shelving Types

**Cantilever-style Steel Shelving**, such a style, or bracket, these systems are largely utilized for book shelving and multimedia saving and screen. such kinds of shelving contains parasol tops or maybe end panels as ancillary subjects to be defined each by ones .The Cantilever-style Steel Shelving has two styles of single-faced and double-faced in large domain of unit heights and profundity. As in common, the standard width is 91 cm, the standard digit to be assumed for heights are: 106, 167, 198, 208and 228 cm [69].

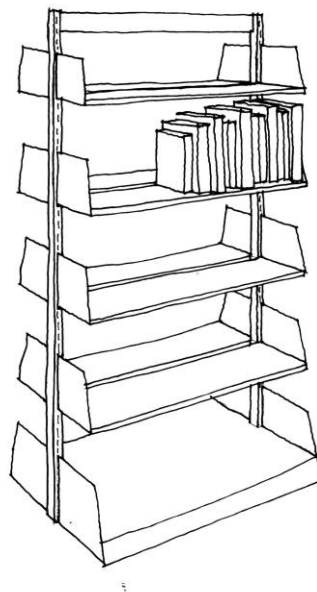


Figure 9 Double-faced steel cantilever-style shelving unit [46]

**Case-style Shelving Products**, the shelving based on case styles relates to any shelving system utilized one complete panel , or vertical part from the ground to upper parts as which has tunable shelves and supports which sticks the ending parts to vertical panels . Such shelving systems are assumed to complete the task, hence, are utilized widely in conference rooms work sites and offices, it is important when the elegance of our room is the matter of concern [46].



Figure 10 Case-style shelf [46]

**Multi-Tier Stack Core**, the multi-line kernels are engineered notably and is assumed for steel shelving systems as which are bound as 1 or 2 lines of shelving systems which the above parts are perfect to stack systems and are apart from each building structure systems . Basically, the shelving support systems support the stack grounds [69].

In large academic libraries where ranges of stacks are purely functional, steel shelving may be purchased without end panels. Likewise, some public libraries using the European-style starter/adder shelving may choose not to use end panels. Most libraries, however, choose to use some type of end panel [39].

### 3.1.3.4 Wall

There are few walls in a library, since they are quite open usually for open spaces with stacks and supervision by library personnel. Nevertheless, wall surfaces are important for the acoustic, aesthetic, and functional aspects of the spaces [63].

**Paint**, has reasonably price, and also can use paint easily, most libraries have painted walls. Paint is also desirable because of the wide range of colors and textures available, Painted areas can be changed easily and quickly [39].

There are two main kinds of inner paintings: Latex, that has watered originality, and alkyd, that has oil originality, latex kind of painting would be wiped by ordinary water and soap, but the alkyd would wipe with hydro carbon thinner.

Most interior designers, use latex for interior walls library, because using of latex is easy and also more important is, easy of clean up. [63].

Commonly, some glowing sorts of painting is more time consuming and is been able to be washed. The blemishes in the surface, anyway, are obvious on high-screen periods because there is light reflectivity.

Vinyl wall coverings are more expensive than paint, but they are durable and easy to clean. Vinyl wall coverings are used in vast sort of functions of colors and patterns and typically come in rolls 52” to 54” wide and 30 yards long. Three grades of vinyl wall coverings are available; type III vinyl wall coverings should be used in busy libraries. These wall coverings may be used throughout a library or may be used in selected areas, such as in halls and around columns that tend to get marred easily [39].

**Wood Veneer**, wood paneling is a wall remedy which could raise a zone and form a display and represent some wealthy and homebred finish with roots of color, texture, measure and modularity. The volumes of wood wall remedy at first would be designated by the budget. In the libraries , though woods , like oak , maple , and cherry are commonly used hence they will provide the best sorts of account tables , constant walls for donors and orientations or library title , walls and roofs in specific sets and club alike rooms [63].

**Acoustic Wall Board**, Acoustic wall panels are made of average density, resin having, fiberglass kernel are bound to library walls.

Acoustic panels are used to reduce noise and control sound in many different spaces. They can be fabric-wrapped and come in a large variety of types and colors to meet your design, budgetary, and durability requirements (Acoustical Solution, 2015).

In terms of function, they raise the acoustic on a chamber, and would bring track surface for posting, and will fortify the elegance of the space. The panels are bound to the walls

with various kinds of mechanical fixtures, magnetic fixtures or clung and the domain of surface zone to 5' x 10'. Acoustic panel have bigger NRC. Such panels are covered of vinyl and fabric wall covers chosen by the designer, and could be managed by various rim conditions. [63].

Another material that is utilized for lower wall zones in libraries is slat wall, a versatile

A versatile prefabbed material that is consisted of cleats or braids finished with wood or laminate that are applied horizontally to a backing. The regions amongst the slats provide a holder for specially designed plastic or wire display items. The slats could be finished to match other laminates or wood finishes in the building. Slat wall is available without inserts between the slats or with plastic or metal inserts [39].

### **3.1.3.5 Window Treatments**

Based on Beverley Moris (2004), the original appendage of the window remedy is to bring the sun and glowing obstacle, solely the southern and eastern offer. Besides, they should be utilized at the inner glass walls to form reclusion. Window types are commonly suggested for libraries (Vertical or Horizontal). For chambers with audio and visual characteristics, reticence shades are essential, and they are mostly used cohesion to common remedy of windows [63].

**Blinds**, vertical ones are made of slats in vertical mode and when open, stacks are in the sides. The sole stacks, normally have width from about 3", and mostly are placed to prevent intensive lights. Many colors are in hand, and they have two phases of solid and leaky style, and they are in two categories of metal and vinyl. When it is sort of easy to dislocate a sole slat, the blinds are purposed to be used instead of hefty metal zones since they bow and could be set out of adjustments [63].

The Horizontal blinds have slat contains which they run horizontally and stack right at the top at the time they are opened. The sole slats have width of 1" and are wood made, plastic or metal. They would be bend a little to be more flexible. Like the vertical ones, they could move along with our hands to cause shadows against the sunlight. Horizontal

slats would absorb the dirt and should've been washed out regularly. If horizontal ones were located in the library, they should be placed just in the office zones [63].

**Mesh Fabric Shades**, they work from above to floor parts in one rounder mechanism which operates manual or electric. The roll shade could hide in a place like pocket above the roof or be installed into one window patina when the window is large. The mesh happens in barren colors to be varied from black to other ones, and they have many degrees of openness [63].

## **CHAPTER 4**

### **A COMPARATIVE ANALYSIS ON ÇANKAYA UNIVERSITY**

#### **IN ANKARA**

During most of the twentieth century, academic libraries were characterized by activities that built similar collections of tangible materials and by systems of access and services that mediated between individuals and content to serve expressed information needs [70]. Academic libraries have important roles in university and also to students. The central role of the university library is to help students learn when they are away from their teachers which reflect in the library's dedication to the section, organization, preservation, socialization and making available for use the information and essential knowledge of earlier generation to the latter one [70], With regard to role of the university library to students, interior design has the most influence to students and users of libraries in university during their study in library and also appropriate design can help them to better study and research in university library.

#### **4.1 Description of case study**

According to main subject of this study which is analyzes interior design of library such as: lighting, color, and materials for instance, ceiling, wall, bookshelves, floor, and windows treatment are investigated. In this thesis, tow libraries from Çankaya University in Ankara are selected. Before start to methodology part and analyze important elements of interior library, first, according to case study which is Çankaya university in Ankara, there is summery and history of university libraries in Ankara.

## 4.2 University Libraries in Turkey

The history of libraries in Turkey dates back to the fifteenth century. During the Ottoman times, the first religious university libraries appeared at the end of sixteenth century. At the beginning of seventeenth century in major cities, mosques and colleges had libraries with small sized collections. This library system had dominated until the eighteenth century when the reform movement in the Ottoman Empire started. The first university libraries of Western type with printed books were established in the Imperial Naval Engineering College in 1793 and Imperial Military Engineering College in 1795 in Istanbul. In these libraries the textbooks were in French, which at that time was the dominating language of the Ottoman elite. These two institutions represent the first diversion from the traditional education of the “medreses”, and were later merged to form the roots of today’s Istanbul Technical University. This development continued until the foundation of Darülfunun ((House of Sciences) in Istanbul in 1863, the first university of western type. Darülfunun had a library which was open to students and to the public. In 1912 several faculties were set up in Dafülfunun, which gained scientific and administrative autonomy after the establishment of the Turkish Republic in 1924. The naval and military engineering colleges were merged in 1909 as the Higher School of Engineers, where engineering and architecture faculties were established and civilians were admitted to these colleges [71].

After the announcement of the university law in 1946, the government started to establish libraries also in other cities. In his report, Albert Malche underlines the key role of librarians in the university and describes the Turkish libraries with scattered, poor collections, insufficient funding, and lack of cooperation.

In the fifties we see the appearance of German library system with faculty, departmental and institutes libraries in Ankara, Istanbul University and Istanbul Technical University. The development of modern university libraries started when the Middle East Technical University (METU) was founded in 1956 in Ankara. METU Library was the first library that was based on American campus system, thereby providing central library services for all students and faculty [71].

Until 1960 the university libraries were controlled by the Ministry of Education. After the new constitutional, the universities gained their autonomy and librarians got the status of “expert” administrative staffing the universities. In these years in a number of universities Department of Librarianship and Archival Studies were established. After the military coup in 1980, the Council of Higher Education (YOK) was established in 1982 to bring the universities under the government control. The universities lost their autonomy. Within YOK, a Documentation Centre was established to supply universities with research articles and related documents by providing photocopying services to the universities. The Centre subscribed also some databases, where the academics could make searches. The aim of establishing this Centre was to encourage the universities to spend their budgets to the acquisition of books and other materials [72].

#### **4.3 Methodology**

Regarding to main subject of this thesis, two libraries from Çankaya University in Ankara are chosen. Interior elements of Çankaya libraries are analyzed and after that, there is comparative between Turkuaz campus library and Balgat campus library according to standards and literature review in chapter two, about lighting, color and materials has investigated.

Library standards are not same for all kind of libraries, for example library standards for public library is different compare to university library. Library standards are criteria which can measure for all service and elements of library. These standard provide by professional librarians and designers to achieve main objective of libraries.

Standard libraries can be used as the desired pattern, sample solutions, evaluation criteria, great for future development, and tools for suitable environment for using. Finally,

In this part, there is comparative between Turkuaz campus and Balgat campus which belongs to Çankaya University in Anakara.

These important elements are such as:

Criteria to analyze Çankaya library

- Lighting
- Color
- Materials

This study evaluates the criteria by doing surveys and making observations and taking pictures from interior library of Çankaya University. On the other hand, in this study, measurement of lighting in Çankaya libraries and appropriate lighting for library according to literate are investigated. And also color, and materials are investigated. , According to these investigate, there are some suggestion for interior libraries of Çankaya University for improving better designing.

#### **4.4 Çankaya University**

Çankaya University was established on July 9, 1997, by the Sıtkı Alp Education Foundation in Ankara, Turkey. The university began its teaching in the fall 1997 semester. Sıtkı Alp is the Chairman of the Board of Trustees.

In 2011, Turkuaz campus that is also known as New Campus opened. Many departments and faculties moved there. Area of Turkuaz campus is approximately 440.000 square meters. In addition, the new campus was awarded by the Arkitera Architecture Center.

This university include of five departments, Faculty of Architecture, Faculty of Arts and Sciences, Faculty of Economics and Administrative Sciences, Faculty of Engineering, and Faculty of Law.

##### **4.4.1 Balgat Campus**

Çankaya library area is 1200 m<sup>2</sup>, and include of 2 floors, ground floor include of 69 private desks, these private desks are in 5 rows, and also, it has 23 group desks which most of them are in middle space of library. In this floor, there are two degree fluorescent lamps, 36W and 23W. For every private desk, there is one 23W fluorescent

lamp. There are two kind of bookshelves in this library, first one is for books and second one is for magazines.

First floor of BALGAT library is 800 m<sup>2</sup>, and include of 28 group desks, there is no private desks in this floor. And also, there are 4 bookshelves and 6 bookshelves for newspapers and magazines.

#### **4.4.2 Turkuaz Campus**

Turkuaz campus library area is 2214 m<sup>2</sup>, and include of three floors, -1 floor, first floor and second floor, -1 floor is just for reading area (magazine and newspapers), first floor and second floor are have exactly same plan, according to literature review ( see page, 15), this is best way for library plan for different floor, and both floors are include of two kinds of private desks with different colors and different styles, first style which is with white color are 20 desks and second style are one long red desks which include of 9 chairs, and there are 14 group desks.

In first and second floor, in each floors, there are 2 kind of bookshelves, first design, there are 46 bookshelves which designed in two rows, and second deign for bookshelves, in two rows, and every row has 5 bookshelves. So there are 10 bookshelves in this part.

#### **4.5 Analysis of Two Libraries**

In this part, according to main subject of this thesis, which is interior environment of library, and according to literature review in chapter two, color and lighting and materials of two libraries from Çankaya University, are analyzed.

##### **4.5.1 Lighting Design**

In this part, there are investigated about lighting design for both libraries from Çankaya University in Ankara. All important part and elements of these libraries in separator parts, according to standards of lighting library are analyzed.

#### **4.5.1.1 Balgat campus**

Balgat Campus include of two floors, ground floor and first floor. There is different design lighting from each floor. In addition, Daylight has important influence for this differences between first floor and ground floor.

Lack of lighting for interior library, is not suitable for users and it causes feeling tired early and eyes become weak. Generally, for interior library lighting, there is one standard factor which is 70, and it means, if there are 100 users in the library, if 70 persons have enough light for reading and study, the lighting of that library is standard. It's clear, if 90 persons have suitable lighting, it's more better [1].

According to literature review in previous chapter in lighting part, standards lighting for different parts of interior library are investigated. For example light level guidelines for some important part such as, book stacks, reading area, librarian desk, upstairs lighting, and Reading (newsprint, magazines, and keyboard) areas.

#### **Bookshelves lighting**

In Balgat library, fluorescent lamps have been used in two degree types, 36w and 23w. The suggestions level lighting for bookshelves in library is 200 Lux, in Balgat library, bookshelves have been designed in ground floor, according to four types, first design is, four bookshelves put to next to each other's, and they have supported by two 36W fluorescents lamps, so, lighting level for this type is according to high of bookshelves is 270 Lux. While, these fluorescents lamps covered by separator, It spread light in uniformly to surface, so, it's appropriate for users. Therefore, in this point of view, lighting design for these bookshelves is near to standard.



Figure 11 lighting Bookshelves for Balgat Library (Taken by the author)

The second type of bookshelves design in ground floor is, three bookshelves put to next to each other's. They supported by two 23W fluorescents lamps, so, the Lux equal 138. According to standard for bookshelves lighting it must be 200 Lux, so its 62 lux less than standard.



Figure 12 lighting Bookshelves of Balgat Library (Taken by the author)

The third type of bookshelves design in ground floor of Balgat library is, two bookshelves put to next to each other's. They supported by two 23W fluorescents and also daylight. According to table of chapter two, it must be 200 Lux, while, Lux for these bookshelves is 175, but, these bookshelves are so close to windows, and they can use daylighting. Therefore, lighting level for these bookshelves during day time is

suitable but at night it's little not enough for users and maybe users eyes become tired early.



Figure 13 lighting Bookshelves for Balgat Campus Library (Taken by the author)

The fourth type of design in this floor is, there are single bookshelves which designed in one row, they supported by, 23W fluorescents lamps, so, and Lux is 197, it's so close to standard.



Figure 14 Lighting Bookshelves for Balgat Campus Library (Taken by the author)

### **Bookshelves for magazine and newspapers**

The suggestions level for reading of magazines, newsprint and keyboard is 200 Lux, while Cankaya library, exactly like reading area and lighting for bookshelves is 200 Lux.



Figure 15 Lighting bookshelves for Balgat Campus Library (Taken by the author)

### **Bookshelves in first floor**

In this floor there are two types of bookshelves, first for books and second types is for magazine and newspapers.

**Bookshelves lighting for books**, according to standards and also bookshelves for ground floor, it must be 200 Lux, while Balgat library bookshelves in this floor, supported by one 36W fluorescent lamps for reach one, and the Lux for each bookshelves equal 300 Lux. Therefore, lighting for this type of bookshelves in this floor is 100 Lux more than standards of lighting.



Figure 16 Lighting Bookshelves for Balgat Library (Taken by the author)

**Bookshelves lighting for magazines and newspapers**, there is one type bookshelves for magazine and newspapers in this floor which put four bookshelves in next to each other but these bookshelves are smaller than bookshelves for books, these bookshelves supported by one 36 fluorescent lamps, and the Lux in average equal 216. Therefore, it's suitable for users and their eyes when they are looking for newspapers or magazines from this bookshelves.



Figure 17 lighting Bookshelves for Balgat Library (Taken by the author)

### **Reading area lighting**

The suggestions level lighting for reading space is 200 Lux, while in Balgat library according to measuring in all parts, in average it equal 190, and it's near to standard o lighting for reading area.



Figure 18 Reading area lighting Balgat Library (Taken by the author)

### **Librarian desk lighting**

The suggestions level lighting for librarian desk is 500 lux, while Balgat library lighting for librarian desk, supported by two 36 fluorescent which has 140 cm distance from each other and one 23W fluorescent for librarian desks, and its equal 450 Lux. And it's near to standard but need to be stronger light.



Figure 19 Librarian desk lighting Balgat Library (Taken by the author)

### **Stairs lighting**

The suggestions level lighting for upstairs is 150 lux, while Balgat Campus library, has one upstairs, and it supported by one fluorescent lamp, so, the Lux for upstairs is 172, and it's so near to standard of library.

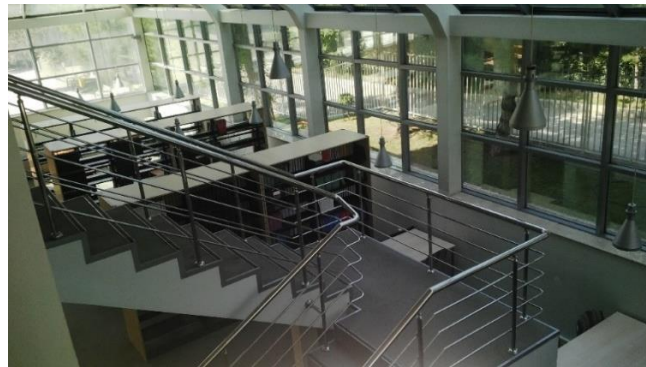


Figure 20 Stairs lighting Balgat Library (Taken by the author)

### **Users' desk lighting**

The suggestions level for users' desk lighting is 500 Lux, while Balgat library is include of 69 private desks, and for each desk, there is one fluorescent lamp, so, the Lux for each desk is near to 500 lux, and it's according to standards of library and it's suitable for students. And also there are 23 desks for group study, it's clear, these desks are bigger than private desks, so, they supported by 36W fluorescents, so, user's group desks lighting is 480 Lux.



Figure 21 Users' desk lighting Balgat Campus Library (Taken by the author)

Table 5 Lighting Measure in Balgat Campus Library

| <b>Elements and parts lighting for BALGAT campus</b> | <b>Measure (LUX)</b> |
|------------------------------------------------------|----------------------|
| <b>Bookshelves for ground floor</b>                  |                      |
| Four bookshelves design                              | 270                  |
| Three bookshelves design                             | 138                  |
| Two bookshelves design                               | 175                  |
| One bookshelves design                               | 197                  |
| For magazine and newspapers                          | 200                  |
| <b>Bookshelves for first floor</b>                   |                      |
| Bookshelf                                            | 300                  |
| Bookshelves for magazine and newspapers              | 216                  |
| <b>Reading area</b>                                  | 190                  |
| <b>Librarian desk</b>                                | 450                  |
| <b>Stairs lighting</b>                               | 172                  |
| <b>User desks</b>                                    |                      |
| Private desks                                        | 510                  |
| Group desks                                          | 480                  |

### **Light direction in Balgat Campus**

According to observation and taking pictures from all part of library such as, study rooms, private desks and group desks, all artificial lighting for desks come from 90 degree, and according to standard during writing or study, and also according to literature review (see page, 23), it makes reflection on the paper, so it's better to move them in 45 degree, moreover, these lamps covered with separators which make lighting uniformly, and its help to less the reflection on papers.

## Daylight in Balgat Campus

According to standards in literature review, standard of daylighting must be between 215 Lux to 315 Lux. Balgat library has appropriate daylighting during daytime, in most parts but for private desks which are in left and right part of library in ground floor, there is so much daylight, specially, between 1 o'clock to 3 o'clock, in fact, at this time specially, in summer, users can not use from these private desks, because in average, Lux becomes between 500 to 1000, and according to standards of lighting it's so much, therefore, most of the users prefer to use group desks or first floor for study.



Figure 22 Daylight in Balgat Library (Taken by the author)



Figure 23 Daylighting in Balgat Library (Taken by the author)

Moreover, according to standards, distance of desks must be less than 4.5 to 5 meters from windows, in ground floor, all private desks are less than 4.5 meters distance to

windows, and also, have an appropriate view, and it has good influence to students during study in these desks.

Most Group desks in ground floor are so near to windows or distance of them are less than 5 meters, just 7 group desks are more than 5 meters distance to windows in this floor.

In first floor. There are 28 group desks, and most of them have good view except 4 group desks which are in middle of library.

#### **4.5.1.2 Turkuaz Campus**

This library is modern style and include of three floors, (-1) floor and first floor and second floor, (-1) floor just for rest and reading such as, magazines and newspapers. First and second floors are have exactly same plan and same design, according to literature review, this is the best way to design for different floors of library (see page, 15).

In this point of view, in this part, just for first floor lighting investigated, because, second floor has exactly same plan and same design for lighting, and also about color and materials.

This library supported by 23 and 36W fluorescent lamps and halogen lamp and HD lamps.

#### **Bookshelves lighting**

In first floor, there are 2 styles bookshelves, first for different books and second for magazines and newspapers. For first styles there are 46 bookshelves in two rows, and these bookshelves are supported by 36 fluorescents lamps, according to literature review about Parallel Scheme (see page 21), this library used exactly like this design, the parallel scheme installed in three lines, one of them is on the middle of the bookshelves, and two of them are installed on cornels of each bookshelves, therefore, students have many opportunities for bookshelves lighting in this library, in this part lighting for these bookshelves in different ways are investigated.

If students use all three parallel scheme line for lighting, in this way the Lux in average become 332 Lux, and its 132 Lux more than standard of lighting.



Figure 24 Bookshelves lighting Turkuaz Library (Taken by the author)

If students turn two of these parallel scheme, the Lux in average become 205, and this measure is so near to standard. And it's good for student, when they are looking for their books from bookshelves.



Figure 25 Bookshelves lighting Turkuaz Library (Taken by the author)

In third way, if students use just one of these parallel scheme, the Lux become so poor and equal to 108, and it's not appropriate for users.



Figure 26 Bookshelves lighting Turkuaz Library (Taken by the author)

### **Bookshelves lighting for (magazine and newspaper)**

For this bookshelves in Turkuaz library, there are 2 different lamps according to their light, first 36w (parallel scheme), and other is 23W fluorescent lamps which covered by circle separator in every 145cm, each types has, different Lux to bookshelves.

Also, there are two types bookshelves according to their height, the shorter bookshelves light is:

If light come from parallel scheme: 230 Lux.

If light come from 23W fluorescent lamps: 150 Lux.

The lighting for higher bookshelves,

If light come from parallel scheme: 250 Lux.

If light come from parallel scheme: 180 Lux.



Figure 27 Bookshelves lighting Turkuaz Library (Taken by the author)



Figure 28 Bookshelves lighting Turkuaz Library (Taken by the author)

### **Reading area lighting**

According to standard the Lux for reading area in library must be 200 Lux, in this library like Balgat campus library, according to average in different parts of library which investigated is near to standards and its 217 Lux.

### **Librarian desk lighting**

The suggestion lighting for librarian desks according to standards in chapter two (see table 3-1), is 500 Lux, while according to observation and measure Lux, there are two kind of lighting for librarian desk, first by, parallel scheme and second by 23W fluorescent lamps which installed in every 492 cm for librarian desks.

If librarian use from parallel scheme, the Lux for desk in average is, equal, 445.

If librarian use from 23W fluorescents lamps, Lux according to average equal, 228.

If librarian use both of them in the same time the Lux in average become, 645.

In this point of view, during day, if lighting is not enough, librarian can use 23W fluorescent lamps, and during night time, it's suitable to use parallel scheme, because it's so near to standards of lighting.

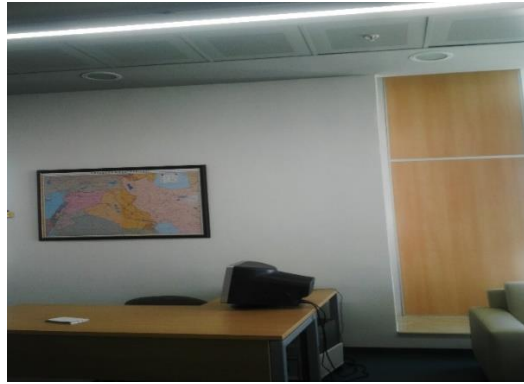


Figure 29 Librarian desk lighting Turquaz Library (Taken by the author)

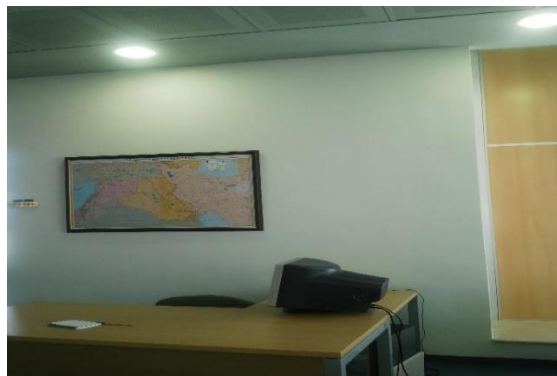


Figure 30 Librarian desk lighting Turquaz Library (Taken by the author)

### **Stairs lighting**

The suggestions level lighting for stairs in 150 Lux, while Turquaz Campus library, in stairs, according to average for every stairs, equal 274, and it's so much lighting for these stairs, and it's not according to standard for stairs in libraries.



Figure 31 Stairs lighting In Turquaz Library (Taken by the author)

### **User's desks lighting**

In this library there are three kind of desks for students, first, private desks, second, group desks, and in third style, students can use it private or group, its long and modern desk with 9 chairs. In this part the lighting level for each styles desks for student investigated.

**Private desks lighting**, these types of desks, supported by tow kind of lamps, parallel scheme and 23W fluorescent which covered in circle separators in every 492cm, so, in this library, students have two options for lighting, despite of Balgat campus which there is one type lighting for private desks. Finally, according to lighting standards for user's desks it must be 500 Lux, while Tuekuaz campus library lighting for private desks:

If students use the parallel scheme for private desks: 278 Lux.



Figure 32 Private desks lighting in Turkuaz Library (Taken by the author)

If students use 23W fluorescent lamps for private desks: 194 Lux

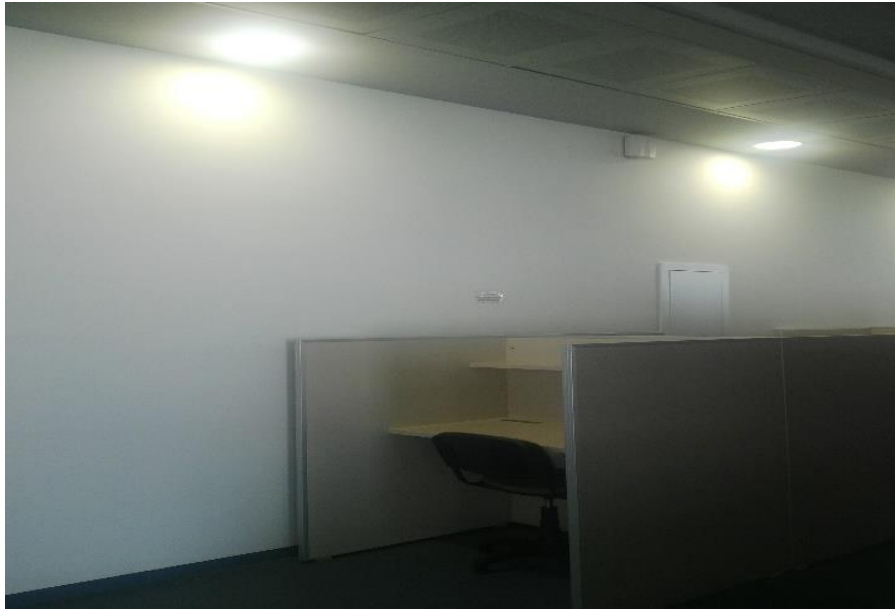


Figure 33 Private desks lighting in Turkuaz Library (Taken by the author)

If students use both of them in the same time for private desks: 472 Lux

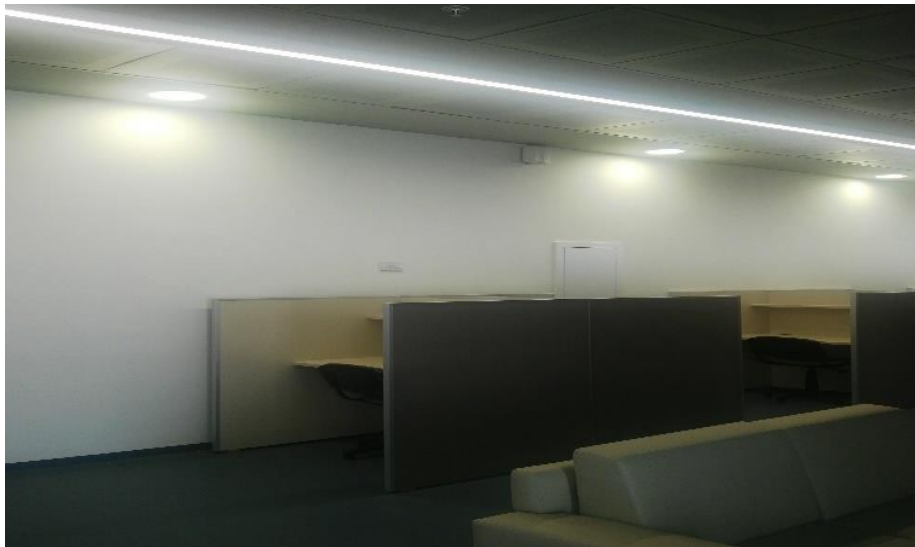


Figure 34 Private desks lighting in Turkuaz Library (Taken by the author)

In this point of view, best way for study by private desks in this library is the third way, And use both artificial lamps at the same time, because in this way the Lux is appropriate to users.

**Group desks lighting,** this types of desks are so close to windows, so, in daylight part will investigate about measure daylight during day for these desks, but, artificial lighting to these desks are two fluorescents lamps with different style and degree, first, parallel scheme fluorescents lamps and second, 23W fluorescents lamps. Therefore:

If use the parallel scheme for group desks: 300 Lux



Figure 35 Group desks lighting in Turkuaz Library (Taken by the author)

If use 23W fluorescents lamps for group desks: 184 Lux



Figure 36 Group desks lighting in Turkuaz Library (Taken by the author)

If students use both of them at the same time for group desks: 490 Lux



Figure 37 Group desks lighting in Turkuaz Library (Taken by the author)

Therefore, for group desks exactly like private desks, the best way for using lighting is turn both types of lamps, also, these desks, can use from the another two parallel scheme which are for bookshelves, and far from these desks, but they can also effect to these desks for more lighting .

**Multi work desks for (private and group study),** these type desk, supported by HD lamps, in every 114 cm, there is two HD lamps for each students, therefore, the Lux for each part for study and reading equal 132 Lux. And it's so much lower than lighting standard for lighting.



Figure 38 Multi work desk lighting for Turkuaz Library (Taken by the author)

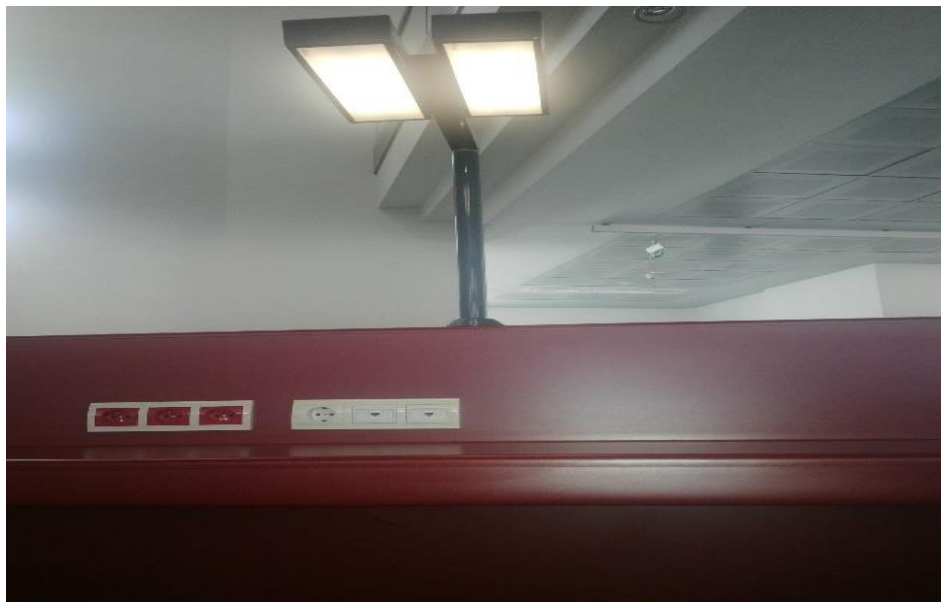


Figure 39 Multi work desk lighting for Turkuaz Library (Taken by the author)

Table 6 Lighting Measure in Turkuaz Campus Library

| Elements and part of new campus library          | Measure (LUX) |
|--------------------------------------------------|---------------|
| <b>Bookshelves</b>                               |               |
| Three parallel scheme lighting                   | 332           |
| Two parallel scheme lighting                     | 205           |
| One parallel scheme lighting                     | 108           |
| <b>For magazine and newspapers</b>               |               |
| Parallel scheme for higher bookshelves           | 250           |
| Parallel scheme for shorter bookshelves          | 230           |
| 23W fluorescent lighting for higher bookshelves  | 180           |
| 23W fluorescent lighting for shorter bookshelves | 150           |
| <b>Reading area</b>                              | 217           |
| <b>Librarian desks</b>                           |               |
| Parallel scheme                                  | 445           |
| 23W fluorescent                                  | 228           |
| Parallel scheme+23W fluorescents                 | 645           |
| <b>Users desks</b>                               |               |
| <b>Private desks</b>                             |               |
| Parallel scheme                                  | 278           |
| 23W fluorescents                                 | 194           |
| Parallel scheme+23W fluorescent                  | 472           |
| <b>Group desks</b>                               |               |
| Parallel scheme                                  | 300           |
| 23W fluorescents                                 | 184           |
| Parallel scheme+23W fluorescent                  | 490           |
| <b>Multi works desk</b>                          | 132           |
| <b>Stairs lighting</b>                           | 274           |

## **Lighting direction in Turkuaz Campus**

According to Previous survey and investigate about different parts and elements of Turkuaz library, lighting direction for this library include of three different kind of lighting such as, 23Wflorocent, 36W fluorescent which designed in parallel scheme and HD fluorescent lamp. Therefore, students and users have many options for choose suitable lighting direction for their study, for example, for using private desks and group desks. According to lighting standard about lighting direction in previous chapter, best design for lighting direction, specially, for writing, from left part and oblique. Therefore, according to lighting part for private desk and group desks, which there are two types artificial lighting for students, both types come from oblique direction, specially 23W fluorescent, its more oblique than parallel scheme, and also, students can use these desks from two sides, so it's so appropriate for right hand and left hand students which want to use these desks, therefore, for right hand students, light come from left and for left hand students light come from right part, in this situation, light doesn't make shadow on the paper during writing.

Moreover, lighting direction for multi work desk is appropriate, but according to standards which lighting direction must be oblique, students can coordinate their chairs with lighting direction, because, this desk is long and students can move their chairs easily.

## **Daylight in Turkuaz Campus**

This library has big and long windows from four sides, especially from west part of library which group desks designed in this part and they are so close to windows, and students have beautiful view during their study, but, exactly, like Balgat campus daylighting, during day time especially, between 1 to 3 o'clock, there is so much day lighting on these group desks, it's between 500 to 1000 Lux in this time, and there is not any window shade for reduce daylighting at time.

Moreover, despite to Balgat campus, for private desks there is appropriate daylighting, because, daylighting direction in not direct, and its suitable for users.



Figure 40 Daylight in Turkuaz Library (Taken by the author)

## 4.5.2 Color Design

In this part, color of important part and elements of Balgat and Turkuaz libraries are investigated. In addition, influence of these colors in their spaces has explained.

### 4.5.2.1 Balgat Library

According to observation as a designer for interior architecture, Balgat library is not rich about using different colors for different parts and elements of interior library. Mostly used colors in Balgat library are white, grey, dark wood color, light wood color, black, silver and cream.

Table 7 Color for Balgat Campus Library

| Elements                           | Color                         |
|------------------------------------|-------------------------------|
| wall                               | white                         |
| ceiling                            | white                         |
| floor                              | Gray                          |
| Private desks                      | Dark Wood                     |
| Group desks                        | Cream                         |
| bookshelves                        | Cream and black               |
| spectators                         | silver                        |
| Handrails                          | silver                        |
| Chairs for private and group desks | Cream, Silver, Black and grey |

According to literature review, these days' designers prefer to use bright colors compare to dark colors for interior library, most old libraries used Dark colors (brown, gray, beige, gold, deep red, deep green), while, new libraries use bright colors. In Balgat library also, the dominant color is bright light.

In this part, all colors of Balgat library will investigate, using same color in different part of library such as, wall, ceiling, and floor has different influence to users, for example, Warm and bright colors: from top (ceiling) are stimulus, from both sides (wall) are warmth and from the bottom (floor) are rising style.

Warm colors and dark: from top (ceiling) fleeing polite, from both sides (wall) restriction and for bottom (floor) are reassuring [5].

Cold and bright colors: from top (ceiling), relaxation, from both sides (wall) making area bigger, from bottom (floor), soft and friendly [5].

Cold and dark colors: from top (ceiling), are threatening, from both sides (wall), making area smaller, and from bottom (floor) are heavy and cumbersome [5].

Doctor Sadr, in his book (color and human, 2000), white color for interior space such library and green for ceiling has suggested, based on doctor Sadr, it cause of, fleeing relaxation and avoid of all stress during study in library

**Wall colors in Balgat Library**, the color of walls in this library is white, Psychologists believe that the white color symbolizes: purity, innocence, purity, serenity, peace and friendship [2]. This color is one of the most commercial color which use for decoration and interior library. Because, it can combination with all colors.

The use of white color for interior library, especially for basic coverage, is useful and interior space seems bigger. Balgat library has suitable daylight, so, there is opportunity for designers of this library to change the wall color after many years, because, in many libraries, designers cannot use another color except white, because lack of lighting to interior library, while, Balgat library has very good daylighting. Moreover, when white color combination with daylight and artificial lighting such as, fluorescents, it can help to low lighting space in library and makes space brighter.



Figure 41 Wall colors in Balgat Library (Taken by the author)

**Floor color in Balgat library,** the color of floor in this library is gray, according to literature reviews in previous chapter there are three kinds of color, warm colors, cold color and natural colors, gray is natural color, and it has not any meaning, while, when gray color use with blue or red in library, it creates vibrant and high emotions in space. But in this library there is not blue and red color. Moreover, Sometimes gray as a complementary color to use, and it can nicely combine with white and cream colors, in other hand, from a psychological viewpoint, this color in very good for floor and back grand and it can easily make balance with others color specially with natural colors. Balgat Campus library exactly, used from this ability of gray color, and combine this color with natural color and white color for most parts and elements of interior library. According to explanation about colors in Balgat library, which this library is not rich about color variety, gray floor plays important roles in this library because, from a psychological viewpoint, this color can activate the library environment and create sensitivity to color differences in this library, so, because of exist of gray color in this library, differences between colors become more clearly and library looks with more colors. Also according to literature, which, color of floor, it must be not so much light and clear, therefore, gray, is best color for this library, first, this library in not rich from color variety and second it's not so much light and clear, and helps to hiding the soil into library and be more clear.



Figure 42 Floor color in Balgat Library (Taken by the author)

**Ceiling color in Balgat library**, according to observation of this library, ceiling has white color, it's an appropriate color for ceiling, because, according to wall part, the white, psychologically is, a symbol of purity, innocence, purity, peace and make space brighter and looks larger, using natural or artificial light such as fluorescent light in the ceiling recommended as Balgat library.

**Elements colors in Balgat library (bookshelves, desks, chairs, lusters)**, the color of bookshelves in this library is cream and black, and colors desks for private desks is gray and black, color while these desks occupy most space of this library, and the color of group desks is cream, black and silver (neutral colors), finally, color of separator is silver and its again natural color. Therefore, it's easy to recognize that, the aim of designers in this library, using dominant natural colors such as, cream, white, gray, black, wood color.

The best choice in educational space like university library, that need to focus and study, is using natural colors [62], exactly what designers did in Balgat library. And the most colors in this library are natural colors such as, white and cream and gray.

#### 4.5.2.2 Turkuaz Library

According to observations and take pictures from all elements of Turkuaz campus library from Çankaya university, this library like most of the universities libraries, used mostly from natural colors, but, despite Balgat campus library, in this library, used also, from another colors such as, dark blue and red, finally, according to this table, designers used these colors in new Turkuaz library.

Table 8 Color for Turkuaz Campus Library

| Elements                           | color            |
|------------------------------------|------------------|
| wall                               | white            |
| ceiling                            | Silver and white |
| floor                              | Dark blue        |
| Private desks                      | White and silver |
| Group desks                        | white            |
| Multi works desks                  | red              |
| bookshelves                        | Cream and silver |
| spectators                         | silver           |
| Handrails                          | silver           |
| Chairs for private and group desks | Black and grey   |

According to explanations about Balgat campus from Çankaya university, in these days, most of the libraries use bright colors for interior library while many years ago, designers preferred dark colors for interior libraries. Whatever, in this part, all colors elements and parts investigated and moreover, influence of them to interior library environment investigated.

**Wall color in Turkuaz library,** this library, exactly like, Balgat campus library, used white color, and according to explanations about white color especially for basic and huge part of libraries, such as, wall, using this color is suitable for interior walls and

interior library looks bigger and this color give fleeing relaxations to users and student for study. This library like Balgat Campus library, has appropriate daylighting, therefore, designers have opportunities to change this color for interior walls.

**Floor color in Turkuaz library**, designers chose dark blue for floor in this library, according to literature, there are three kind of colors, and blue color is cool color, it is first and foremost a calming color.

This color increase peace of mind and physical and also improving the self-confidence. And according to literature review, blue and green color suggested from many articles for interior library. Most of the colors in this library are natural colors such as, cream and black and white, therefore, using this color for floor is good suggestions from designers, to makes this library rich from color variety.

**Ceiling color in Turkuaz library**, most parts of this library painted with white color, just very small parts on each corners of ceiling are silver but the dominant color for ceiling is white color. Based on explanations about white color which is best color for hug part of library. This color makes space brighter and its good choice for ceiling.

**Elements colors in Turkuaz library (bookshelves, desks, chairs, lusters)**, in this library, colors of bookshelves is, cream and silver, both of them are natural color, based on literature review, natural colors are appropriate color for interior library, moreover, desks colors for private desks is, white and silver, and colors desks for group desks is white, and for multi-works desk, designers chose red color. White and silver also, according to previews explanations about natural colors, are suitable, and most libraries use natural colors for interior library, while designers preferred red color for multi-works desk which there is one in first floor and second floor, because of this color and floor color, this library looks more rich from different colors.

### 4.5.3 Materials

In this part, in order to, analysis the important parts of interior library, kind of materials such as, floor, wall, shelve, ceiling and windows treatment which used in Balgat Campus and Turkuaz Campus from Çankaya library are investigated.

#### 4.5.3.1 Balgat Campus Library

**Floor Finishes,** in this library designer's preferred carpet for floor, it has good acoustic properties, can be reasonably maintained, is relatively inexpensive, and offers abundant aesthetic opportunities.in ground floor and first floor grey carpet used. Moreover, and this makes variation and texture in the appearance, which can help to hide soil and stains.

**Ceiling Finishes,** this library include of two ceiling, according to literature, there are three kind of ceiling for library such as, Suspended Acoustic Tile, Acoustic Wood Slat and also, Glass Fiber Reinforced Gypsum. This library used gypsum in all part of ceiling and also in right part of ceiling, there are large windows with oblique degree which connected to ceiling, because of these windows, this library has appropriate daylighting.

**Wall Finishes,** according to literature review, most of the libraries use paint for surface of walls, Balgat Campus also, use white color for all walls in this library. One of the important factors of painting is, there are many standards colors for using within interior library, so, designers have many options to selecting color, based on wall color for other part and sections of environment library. According to literature review, (see. Page 46) there are two kind of painting for walls, first Latex and second Alkyd, this library use from latex which is easier to clean-up with water and also is cheaper than Alkyd.

**Book shelve,** in Balgat Campus, in first floor, there are 40 bookshelves for books and 10 bookshelves for magazines and newspapers. There are two kind of shelves in this

library, first for books, Cantilever-style Steel Shelving, and second for references is Case-style Shelving Products.

According to standard the most common standards heights for shelving in library are, 106, 167, 198, 213 or 228 cm , Balgat Campus shelves for books and also magazines and newspapers is exactly 198 cm, , according to standards. In second floor, there are four bookshelves for books and six bookshelves for magazine and newspapers, this floor, like ground floor bookshelves, height of bookshelves for both types are 198 cm, therefore, in this library, height of bookshelves, in first floor and second floor for both types of bookshelves is exactly according to standards and its appropriate for using from students easily.

According to standards depth for bookshelves are 20, 22, 25, 30, and 40 cm. In this library, after measured the depth of bookshelves, depth is 22 cm, and it's according to standards.

**Window Treatments**, in Balgat library. Designers did not use any windows treatment such as, blind and Mesh fabric shades.

#### **4.5.3.2 Turkuaz Campus Library**

**Floor Finishes**, in Turkuaz library, designers used resilient flooring, which made of materials such as, fibers, plasticizers, synthetic resins, and fillers. According to the literature it's appropriate for interior library. This type of flooring repel liquid and dirt. In all part of this library, used from synthetic materials for resilient flooring with dark blue color. This kind of flooring is one of the standards materials which use for flooring in libraries.

In this library, there are big windows, and have appropriate daylighting, but, sometimes, when daylight is so much and come to interior library, this kind of flooring, makes reflections daylight despite carpet which used in Balgat Campus, in to the environment of library. Therefore, it's not appropriate for student's eyes when they are in library.



Figure 43 Floor Finishes in Turkuaz Campus Library (Taken by the author)



Figure 44 Floor Finishes in Turkuaz Library (Taken by the author)

**Ceiling finishes,** in Turkuaz library, designers used Suspended acoustic tile for all part of ceiling. This kind of ceiling in one of the standards ceiling for libraries. The usual sizes for ceiling grids are 5.08cm x 5.08cm and 5.08cm x 10.16 but in this library designers used, 15.24 x 15.24 cm. Moreover, according to literature, it possible to hidden grid ceiling but it's not suggestions for libraries, also, this library didn't use from this style design, because, need to alignment, after repairing staff has removed tiles for access to air systems.

**Wall finishes,** in this library like Balgat Campus, used from paint for interior walls, its most common for libraries. In every floor of this library, designers used latex, and white color for walls.

**Bookshelves,** in this library, there are three styles design from height and depth, but, all three styles are Case-style shelving products, which is one of the standards shelves for library.

There are 46 bookshelves for different books and 10 bookshelves for references and 13 bookshelves for magazines and newspapers.

Bookshelves height for references and books according to measure is two meters, therefore, it's according to suggestions for height bookshelves in library.

Depth of bookshelves is 10, and it's according to standards.

**Windows treatment,** in this library like Balgat Campus, there is not any windows treatment.

## **4.6 Comparison Between Two Libraries**

In this section, according to analyzing interior environment factors which effect to interior library such as, lighting, color, and materials in two libraries of Çankaya University (Balgat Campus, Turkuaz Campus), there is comparison between two interior libraries.

### **4.6.1 Lighting**

Based on literature review in chapter two, lighting plays important role in libraries especially during writing or reading in libraries. After lighting investigating in two libraries, it's clear to understand, in two libraries there are negative and positive points in each lighting parts, therefor, according to these two tables which belong to lighting investigating for Balgat and Turkuaz libraries.

Table 9 Comparison Lighting Between Balgat and Turluaz Campus Libraries

| <b>Balgat lighting</b>              | <b>Lux</b> | <b>Turkuaz lighting</b>                          | <b>Lux</b> |
|-------------------------------------|------------|--------------------------------------------------|------------|
| <b>Bookshelves for ground floor</b> |            | <b>Bookshelves</b>                               |            |
| Four bookshelves design             | 270        | Three parallel scheme lighting                   | 332        |
| Three bookshelves design            | 138        | Two parallel scheme lighting                     | 205        |
| Two bookshelves design              | 175        | One parallel scheme lighting                     | 108        |
| One bookshelves design              | 197        | <b>For magazine and newspapers</b>               |            |
| For magazine and newspapers         | 200        | Parallel scheme for higher bookshelves           | 250        |
| <b>Bookshelves for first floor</b>  |            | Parallel scheme for shorter bookshelves          | 230        |
| Bookshelf                           | 300        | 23W fluorescent lighting for higher bookshelves  | 180        |
| For magazine and newspapers         | 216        | 23W fluorescent lighting for shorter bookshelves | 150        |
| <b>User desks</b>                   |            | <b>Users desks</b>                               |            |
| Private desks                       | 510        | <b>Private desks</b>                             |            |
| Group desks                         | 480        | Parallel scheme                                  | 278        |
|                                     |            | 23W fluorescents                                 | 194        |
|                                     |            | Parallel scheme+23W fluorescent                  | 472        |
|                                     |            | <b>Group desks</b>                               |            |
|                                     |            | Parallel scheme                                  | 300        |
|                                     |            | 23W fluorescents                                 | 184        |
|                                     |            | Parallel scheme+23W fluorescent                  | 490        |
|                                     |            | <b>Multi works desk</b>                          | 132        |
| <b>Librarian desk</b>               | 450        | <b>Librarian desks</b>                           |            |
|                                     |            | Parallel scheme                                  | 445        |
|                                     |            | 23W fluorescent                                  | 228        |
|                                     |            | Parallel scheme+23W fluorescent                  | 645        |
| <b>Stairs lighting</b>              | 172        | <b>Stairs lighting</b>                           | 274        |
| <b>Reading area</b>                 | 190        | <b>Reading area</b>                              | 217        |

**Bookshelves lighting comparative,** According to investigated about lighting design for Balagat Campus library and Turkuaz Campus library, in Turkuaz Campus, there are more kind of lamps such as, fluorescents in two measures and two kind of sizes and also HID lamps, in comparative with Balgat Campus. Moreover, according to methodology part, students in Turkuaz Campus, have more options lighting, for their study in this library. In this point of view, students have three options for bookshelves lighting which best choice is turn two parallel scheme for bookshelves, because, its more closer to lighting standards for bookshelves lighting. While, In Balgat Campus library, students have not many options for choosing suitable lighting for their study, for each design bookshelves, there is just one option lighting which for four bookshelves design, there is so much lighting, according to standard, and about others design lighting for others bookshelves, for three and two design bookshelves there is lower than standards of lighting. Moreover for magazines bookshelves in this library, again, student just have one choice. Therefore lighting design for bookshelves in Tuarkuz library is more appropriate and students have many options for each part of library despite of Balgat library.

**User desks,** in Balgat Campus, there are two kind of desks which supported by fluorescents lamps, according to investigated, lighting measure for both types desks are so close to standard, moreover, in Tuarkuz campus library, there are two kind of lighting for group desks and private desks, butt, in fact, like, Balgat campus library, students have one choose for lighting because if they use just one type lighting, it's become so lower than lighting standard. In both libraries, lighting for private and group desk is according to standard. But, in Tuarkuz library, there is one multi-works desks with red color which has so low lighting for study, therefore, it's better to add one lamps for each part of desk.

**Librarian desk,** in both libraries, there are two different measure lamps, and for Balgat Campus library, if librarian use both types lamps, lighting become according to standards, but in Tuarkuz Campus library, if librarian just use parallel scheme, it has enough for librarian just little is lower than lighting standard.

**Stairs lighting,** lighting in Balgat Campus is so near than Turkuaz\_Campus library, In Turkuaz campus library there is so much lighting.

**Reading area,** in both libraries, according to average Lux for different parts of reading area, both reading area are so close to lighting standards for this area, and its appropriate lighting for both libraries.

**Daylighting,** according to investigated about daylight for Balgat and Turkuaz Campus libraries, both libraries have appropriate daylighting because of huge windows. But, both of the, especially, daylight measure for private desks in Balgat Campus and daylighting measure for group desks in Turkuaz Campus, during the 1 to 3 o'clock, there is so much daylighting, in fact, students cannot use from these desks at this time. Based on this problem, and according to material part and window treatment, designers can add Blinds or mesh fabric shades, for these libraries.

#### 4.6.2 Color

In this section, based on investigation about colors in Balgat and Turkuaz Campus libraries, there is compression about color in both libraries.

Choosing a suitable color for covering the walls, is the first step for interior designing in library, but, its maybe seems difficult to find appropriate colors elements to combine perfectly with wall color, therefore, according to literature review in color part using the color wheel is the one of the best ways to find the best colors [4]. according to walls color of Çankaya libraries are white, so, according to literature review, it's an appropriate color for walls, especially for interior libraries which haven't enough daylight, while, Çankaya libraries have appropriate daylighting, therefore, for Balgat library, it's possible to change the wall color to blue or green, according to floor color which is gray and one of the ability of this color is combination with blue and green and red easily and makes space more actively.

Although , using different colors is good for visual perception and reduce tiredness, but, for interior library, using the multiple colors is not appropriate, because, using so different colors don't allow to users to focus in their study. Balgat library, also, used just natural colors and wood color for interior, so, it's possible to add one color to interior elements such as wall or other parts, but changing and painting the wall color is expensive, so the use of large color posters is recommended. Moreover, it's possible to change the color shelve by using paint colorful poster by pasting them into the inner part, these posters have specially colors for each elements or subjects can be considered [4].

In Turkuaz Campus library, has more variety colors than Balgat Campus, because in this library, there are red and dark blue colors, and especially blue color for floor, makes friendly space for students and it has influence to students.

#### **4.6.3 Materials**

According to explanation about materials part such as, wall finishes, ceiling finishes, floor finishes, bookshelves and windows treatment, for Balgat and Turkuaz Campus libraries, both libraries used same materials for their bookshelves and also for wall, both libraries used latex material for painting their walls. Moreover, in both libraries, there is not any windows treatment, according to lighting part, because lack of this factors, students have problem in specials times for using desks, therefore, in both libraries, can use blind and mesh fabric shades which have many colors and also natural colors for this problem.

Ceiling materials, Balgat Campus library used gypsum for ceiling while Turkuaz Campus library used from Suspended acoustic tile for all part of ceiling. This kind of ceiling in one of the standards ceiling for libraries and this type is acoustic and makes environment of library more silence.

Floor finishes are different in both libraries, Balgat Campus used carpet for floor while, Tuarkuz Campus library used resilient flooring, which made of materials such as, fibers, plasticizers, synthetic resins, and fillers, both types of floor materials are according to standard materials which can use in libraries and each one has advantage, for example,

carpet is acoustic and its appropriate for library environment, but it is not repel liquid and also, it can help to hide soil and stains While, resilient flooring is repel liquid and dirt, moreover, carpet finishes has important options which is, it doesn't make reflection lighting from daylighting or artificial lighting sources, while resilient finishes reflect lighting and it's not appropriate for interior environment library.

## **CHAPTER 5**

### **CONCLUSION**

Based on this study, factors affecting environmental design, its importance, and the points to be taken into consideration are explained below.

Interior designers of libraries should be aware of standards for interior library environment, and according to these standards should design library. In connection with the issues mentioned above, the design of factors in a library such as, lighting, color and materials which are very important for users and students of library during their study and these factors have influence to environment of library which is important space for study. Moreover, in a library, students need to be able to focus on their task more than other spaces. Therefore, designers must design according to standards of library which make a space friendly and comfortable for students.

According to the paragraph above, there are important factors which affect interior design of a library, and the interior of a library consists of some vital factors, which were investigated in this study, namely, lighting, color and materials. Lighting is one of the most necessary factors which have direct influence on the interior of a library, and the environment of the library can easily be change by using different kinds of lighting sources. Based on this view, designers should make use of standard measure lighting and also appropriate lighting direction for reading areas, desks, bookshelves, stairs, and librarian desks which can help students for their study and also false lighting design measure and false lighting direction can affect student's eyes in a negative manner.

Therefore, designer should use the following criteria during designing lighting to interior libraries:

- Choosing an appropriate direction lighting, direct lighting can bad influences to users.
- Lighting measure must be according to standards of lighting which explained in this thesis.
- Using indirect lighting by designing artificial lighting
- Measure lighting source by special tools for libraries if lighting measure is not according to standards, it should be changed.
- Manipulation of daylighting by designing windows and using windows treatments

According to this study and investigated about case studies, having many opportunities for choosing best lighting during study is so important, for instance, in Turkuaz campus library, students have many options and different lighting style such as, parallel scheme for most part of library despite Balgat campus library which, for each part just there is one lighting option for students. Moreover, direction of lighting, using different styles lighting and different kind of lighting sources such as, fluorescent lamps, Incandescent Lamps and HID lamps in necessary in library, which Turkuaz campus library used from all of them and improved suitable lighting design for students.

Another important and interesting factor about designing interior library is color, color like lighting has consequential influence to create environment such boring space or active space. Therefore, designers have important responsibility about choosing color in different part and elements of libraries. According to literature review (see page 30), there are three kinds of color, bright, dark and neutral colors. Bright colors and neutral colors are the best choose for interior library. The new libraries building must demonstrate a clean line aesthetic, backed up by a layered, textural and timeless approach to the color and materials palate. Color must be incorporated selectively and based on a neutral background [7].

Moreover, color effect to speed of time for users and also makes users feel exhausted or makes users more active during their studies. Therefore, designers must be aware about

color influence to their environment and choose best colors from wheel color during use colors with together.

For instance, according to case studies in this study, designers in both libraries especially in Balgat campus library just used neural colors, but in Turkuaz campus library designers added blue and red color. Because of these two colors, interior space of this library is friendly and more comfortable.

Selection of appropriate materials is another important factor in view of neatness, cleanliness and maintenance field (see pages 34 to 41), and moreover, there are standards which designers should use for libraries elements such as bookshelves according to height and depth standards for providing comfortable materials and standards material for users in libraries. Furthermore, choosing appropriate materials can help to providing ambient and acoustic environment for creating suitable environment for study.

Based on investigated cases studies, in both libraries, designers used standards material for all parts but, for example, in Turkuaz campus library, designers used resilient for floor finishes which is one of the standards materials for interior library while in this library during daytime, there is so much daylighting and this kind of materials reflect lighting into library, but resilient has another advantage such as, repel liquid and dirt.

In fact, there are many kind of materials which can use in library but the important factor find an appropriate materials according to every library satiation, for example, if designers use carpet for Turkuaz library campus, there is not any reflection in this library.

In conclusion, libraries have an important role in university education and also community. Therefore, designers should be very conscientious in improving their projects. This study can be utilized if required as a source in interior library design about important factors such as, lighting, color and materials. Many standards and suggestions about these factors which designers can help from it for providing an appropriate space for users.

In future studies, based on this thesis which has investigated the important factors in interior library by, measurement, taking pictures, explanations about effect of these factors, and survey about standards of libraries, and also, comparison between two libraries, it would be applicable idea, searching about psychological effect of these factors such as, lighting and color to students and users during their study in libraries. Because, users play the most important role and are main characters in library, all designers should try to use these factors to provide appropriate and comfortable space for users of libraries.

Limitation: there is limitation about special tool for lighting measure in both libraries, during this study, this tool was not available, because of this limitation, this investigation has used a special software, which is named “Light Meter”, this software exactly measures light like that special tool, just there is limitation in this software, which is, it measure maximum to 37985 Lux. Fortunately, in this study, there is no need to this degree, therefore, all parts of libraries were measured by this software.

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