

Users' Satisfaction through better Space Management in Higher Education
libraries: A case study of University of Malaya library in Malaysia

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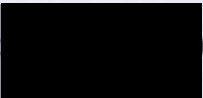


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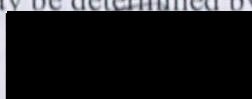
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Users' Satisfaction through better Space Management in Higher Education libraries:
A case study of University of Malaya Main library in Malaysia

Abstract

This study aims to evaluate the implementation of interior space management and its impact on the users' satisfaction and energy usage at the University of Malaya in Malaysia. Determining the users' satisfaction with interior spaces within the Main Library was done by measuring satisfaction level regarding different spaces within the building, temperature, relative humidity (RH), light intensity, and arrangement of different facilities within the Main Library. Moreover, the study aims to find the impact of space management on energy efficiency term by measuring temperature, RH, and light intensity regarding different spaces, and how the interior space affects the energy usage. The literature review explained that in which spaces are formed and arranged affects working productivity and feeling of groups. Also, the literature review mentioned that one of main principles in managing interior space is the satisfaction and comfortable level of users and staff. In addition, moving toward green building and energy efficiency involves building structure, interior space, facades, and the amount of energy usage. A questionnaire survey was distributed to know the respondents' opinions on their satisfaction level on the variables regarding learning space and their perception on lighting and thermal comfort. Moreover, semi-structured interview was utilized to achieve the third and fourth objectives of the research. The interview was done with deputy chief library and development department within UM. The third measure used in this study was an empirical measurement of lighting, RH, and light intensity to compare the results with standards used to sit the actual amount. The study has shown an overall satisfaction level with various spaces within the Main library. Furthermore, the research has likewise shown the main barriers in managing space concerning users' satisfaction and

energy efficiency. There was a lack of regulations to monitor the use of space and do a proactive maintenance. The empirical measurement has presented a gap between the actual IEQ and the planned outputs regarding standards used. The study has demonstrated that the space management will defiantly affect users' satisfaction and energy efficiency.

Keywords: Learning spaces, spaces management, users' satisfaction, energy efficiency, Indoor environmental quality.

University of Malaya

Abstrak

Kajian ini bertujuan untuk menilai pelaksanaan pengurusan ruang dalaman dan kesannya terhadap kepuasan pengguna dan penggunaan tenaga di Universiti Malaya di Malaysia. Menentukan kepuasan pengguna dengan ruang dalaman di Perpustakaan Utama telah dilakukan dengan mengukur tahap kepuasan mengenai ruang yang berbeza dalam bangunan, suhu, kelembapan relatif (RH), intensiti cahaya, dan susunan fasilitis yang berbeza dalam Perpustakaan Utama. Selain itu, kajian ini bertujuan untuk mencari kesan pengurusan ruang pada istilah kecekapan tenaga dengan mengukur suhu, RH, dan intensiti cahaya mengenai ruang yang berbeza, dan bagaimana ruang pedalaman memberi kesan kepada penggunaan tenaga. Kajian literatur menjelaskan bahawa di mana ruang dibentuk dan diatur mempengaruhi produktivitas kerja dan perasaan kelompok. Selain itu, kajian literatur menyebutkan bahawa salah satu prinsip utama dalam mengurus ruang dalaman ialah sikap pengguna dan kakitangan yang selesa dan kakitangan. Di samping itu, bergerak ke arah bangunan hijau dan kecekapan tenaga melibatkan struktur bangunan, ruang dalaman, fasad, dan jumlah penggunaan tenaga. Tinjauan soal selidik diedarkan untuk mengetahui pendapat responden mengenai tahap kepuasan mereka terhadap pemboleh ubah mengenai ruang pembelajaran dan persepsi mereka tentang pencahayaan dan keselesaan terma. Selain itu, wawancara separuh struktur telah digunakan untuk mencapai objektif ketiga dan keempat dari reseacch. Rsearch itu dilakukan dengan timbalan ketua perpustakaan dan jabatan pembangunan di dalam UM. Kesan ketiga yang digunakan dalam kajian ini adalah ukuran pencahayaan, RH, dan intensiti cahaya untuk membandingkan keputusan dengan standard yang digunakan untuk menampung jumlah sebenar. Kajian ini menunjukkan tahap kepuasan secara keseluruhan dengan pelbagai jenis dalam perpustakaan utama. Selain itu, penyelidikan juga telah menunjukkan halangan utama dalam menguruskan ruang mengenai kepuasan

pengguna dan kecekapan tenaga. Terdapat kekurangan peraturan untuk memantau penggunaan ruang dan melakukan penyelenggaraan proaktif. Pengukuran empirik telah membentangkan jurang antara IEQ sebenar dan output yang dirancang mengenai piawaian yang digunakan. Kajian ini menunjukkan bahawa pengurusan ruang pasti akan menjejaskan kepuasan pengguna dan kecekapan tenaga.

Kata kunci: Ruang pembelajaran, pengurusan ruang, kepuasan pengguna, kecekapan tenaga, kualiti alam sekitar dalaman.

University of Malaya

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iii. List of Symbols and Abbreviations

COLA: Collaborative Area

EPBD: Energy Performance of Buildings Directive

EU: European Union

FM: Facilities Management

HE: Higher Education

HVAC: Heating, Ventilation, and Air Conditioning

ICT: Information Communication Technology

IEQ: Indoor Environmental Quality

IT: Information Technology

PST: Pedagogy Space Technology

RH: Relative Humidity

SMET: Science, Math, Engineering, and Technology

UM: University of Malaya

VRF: Variable Refrigerant Flow

VRV: Variable Refrigerant Volume

CHAPTER 1 INTRODUCTION

1.1 Research background and problem statement

Learning space configuration, drawn nearer from a holistic perspective, considers the range of learning exercises and the assortment of conditions essential for understudies to improve their scholastic experience. The improvement of casual understudy spaces bolsters formal instructive methodologies and conditions. In the previous decade, the ideas and prologue of knowledge commons, learning, and information have deliberately reclassified and imaginatively featured new employment of library space (LH Chan & Spodick, 2014). According to Choy and Goh (2016), academic libraries are never again centered around creating convenience space for the shelving of books and journals (physical collections). Library spaces have progressively been renovated to be student study and workspace and learning center, with accumulation space, pushed to the sides or out of the library building legitimate (Choy & Goh, 2016). Mwanzu et al. (2017) stated that open space is a portion of the library design that has at first been ineffectively tended to. This is proved in the numerous library structures that were in presence before the twenty-first century. Therefore, the conventional HE library needs to advance with the advances in innovation which have been pushing the amelioration of teaching methods and exercises, e.g. with "mixed learning" and "flipped classrooms", which empower asynchronous digital exercises (Ellison & Ellison, 2016). These, thus, have expanded student desires for better and more differed individual learning environments. Ball et al. (2008) illustrated in their study that we should originate a dynamic learning condition by boosting space as well as by guaranteeing it is thoughtful to

the developing method and to students' desires. Since the turn of the century, there has been huge improvement of learning space in academic libraries, with "new-forms" and restorations (Gale, 2013). Besides this, the assessment of the utilization of these and other different spaces have additionally evolved (Harrop & Turpin, 2013; Hunter & Cox, 2014).

University libraries are amidst extraordinary change and advancement. Moreover, energizing open doors exist to design new structures, using accumulations through digitization and promote new services, for example, measuring research affect (Beasley & Rosseel, 2016). As Bailin (2011) clarified, "technology and remote access are secluding individuals, though the physical library unites individuals". This is a piece of being a library, and along these lines, it is with the physical space that library organizers must keep up the best core interest. Technology and space can be integral, instead of antagonistic. Technology alone does not address the greater part of an individual's issues, and individuals keep on craving a physical area to get to data and each other, and "where one can really get involved and take advantage from the centrality of an organization's [or society's] intellectual group" (Freeman, 2005). Moreover, Bhatt (2011) went ahead to include that the library ought to likewise change its services to stay aware of different changes on the planet. The library must not fall behind in adjusting to new innovations, facilities, technology, and infrastructure.

Jochumsen et al. (2012) proposed a four-space display in their study that has been utilized as a part of open libraries in Nordic nations. It gives a desired result of library spaces at a conceptual level. The four are revelation space; learning space; meeting space and performative space. "The four spaces are not to be viewed as solid 'rooms' in a physical sense, but instead as potential outcomes that can be satisfied both in the physical library and in the internet. Watson (2013) supplied the inside design's point of view on design standards for

new libraries and learning commons. As indicated by him, libraries ought to incorporate adaptable or multi-utilitarian space that can be reconfigured every day, week by week or month to month to suit various capacities guaranteeing the space is completely utilized. Spaces ought to take into account the formation of decision with an assortment of spaces to suit diverse learning styles and needs. Different standards incorporate the arrangement of adequate volume of space to guarantee that students are comfortable; evacuation of obstructions amongst formal and casual spaces; consideration of collaborative and social spaces; and clear, coordinate information and communication.

When talking about libraries and sustainable development, the supposed "green libraries" are raised. This implies libraries which work for a naturally practical improvement through library exercises, library services, and library structures being designed in a way that limits negative effects on the environment (Michnik, 2015). In Shill and Tonner (2004) record of the improvement of the Lanchester Library, they push that they were making "a sort of shopping mall where the principle fascination was the Library!". Beard and Dale (2010) declared that the challenge for HE libraries in the UK has been to make distinctive spaces with the goal that spots, where students can study noiselessly, are accessible and in additional spaces for social learning.

1.2 Research aim and objectives

This study, therefore, aims to critically evaluate how users' satisfaction affects by the implementation of interior space management in university library in Malaysia. The study, therefore, would be achieved through the following objectives:

1. To identify how managing learning spaces affects users' satisfaction.

2. To determine whether the library spaces meet the users' expectations and requirements.
3. To establish the main barriers that are found in the implementation of an effective space management practice in the higher education library.
4. To recommend the improvement on the current practice of space management concerning users' satisfaction and indoor environment quality within the higher education libraries.

Table 1-1 shows the aim and objective of this dissertation, and even explains the methodology used to achieve each objective and the expected results of the objectives.

Table 1-1: The aim & objectives of the research

Aim	Objectives	Methodology	Expected Results
Assess the implementation of interior space management and its impact on the users' satisfaction in HE libraries in Malaysia.	Identify how managing learning spaces affects users' satisfaction.	Literature review; Questionnaire & Empirical Measurement	To know how the managing and planning of the HE libraries' spaces effect users' satisfaction and comfort.
	Determine whether the library spaces meet the users' expectations and requirements.	Literature review, Questionnaire & Empirical Measurement	To know whether the current design of space achieves the needs and expectations of users.
	Establish the main barriers that are found.	Interview	To have knowledge of the obstacles that face the implementation of space management.
	Recommend the improvement on the current practice.	Interview	To enhance the level of Malaysian HE libraries' space management in the future.

1.3 The significance of this study

This study may be significant because space management help the university in supporting the functions of academic libraries. The approximate amount of space actually used in the university libraries may be more helpful for the future planners for overall general guidelines. The specialist's perception of the effectiveness of the different types of spaces within the libraries as well as perceptions about the adequacy of those spaces may be used as planning tools to help others decide how to design and plan an effective space within the academic libraries. Furthermore, the academic libraries are considered the best places for students to do their assignments and study, so the library environment should be easy to find things such as books, study spaces should be well lit, furniture should be comfortable and easily movable to reconfigure spaces for multiple uses and the spaces should be suitable to achieve a high level of students' satisfaction. In the same time, it is important for the facility management team to establish the best ways to save energy and achieve a good level of indoor environment quality.

1.4 Methodology

The study would embrace triangulation strategy that consolidated both quantitative and qualitative information gathering in a successive blended techniques approach. The case study of UM Main Library, Kuala Lumpur, Malaysia was selected.

1.4.1 Data collection: Questionnaire survey, semi structured interview & empirical measurement

The targeted population of this study will be the students, staff of the Main Library, and the staff of facilities management within the university. From this population, a sample will be determined for the questionnaire survey. The contextual scope of this study will

cover the implementation of space management within HE libraries and its impact on users' satisfaction and energy efficiency. The questionnaire would be administered to the students to evaluate the implementation of space management within the library that makes the student feel comfortable and provides them with the appropriate study environment and to know whether the spaces meet the customer satisfaction. Therefore, the questionnaires will be sent randomly.

Semi-structured interviews held with the library' staff and the facilities management staff. This is to clear up and approve the implementation of sustainable space management in the HE library concerning customer satisfaction and energy efficiency. The defense of utilizing semi-structured interview is to find clarifications for any vague solution gotten amid the questionnaire survey session. The interview likewise could elucidate any inconsistent reactions from the literature review and give a chance to the researcher to discuss any new variables that were not asked amid the study done before.

Empirical measurement was utilized to measure the actual amount of temperature, relative humidity, and light intensity within the library. The purpose of using empirical measurement is to understand the relationship between the actual situation and the planned one, which is according to the standards.

The responses from the questionnaire survey will be analyzed using analysis packages namely Statistical Package for Social Sciences (SPSS) to produce both inferential and descriptive statistics results. Descriptive statistics provide information regarding the distributions of variables. It provides a measure of central tendency (mean, mode and median), standard deviation, skewness, kurtosis, maximum and minimum of values.

Inferential statistics utilizes advanced statistical tests to measure the difference between groups of variables.

1.5 Scope and Limitations of the study

This study focuses on evaluating the current practice of space management and its influence on users' satisfaction and indoor environment quality of the University of Malaya Main library. Moreover, this study aims to investigate space management impacts the satisfaction level among users of the Main Library, UM, and manage the space in the way that contribute to achieve the term of energy efficiency within the building.

The prime limitations of the study relate to the limited number of studies that combine the term of space management with both users' satisfaction and indoor environment quality, where most studies focus on space management individually or space management and satisfaction of users. Furthermore, the study uses three methods to achieve the objectives, which are questionnaire survey, semi structured interview, and empirical measurement. Therefore, comparing the outputs from various methods and comparing with polices provide a comprehensive result.

1.6 Research structure

The research includes six chapters, the complete workflow of research structure, which supplies a brief summary of each chapter is shown in Table 1-2.

Table 1-2: The structure of research chapters

Research chapter	Summary of chapter
Chapter 1 Introduction	This chapter introduces the research aim and objectives, methods used in this study, significance of study, and the scope and limitations of the study.
Chapter 2 Literature review	This chapter encompasses the space management literature review in higher education libraries, and how better space management leads to achieve energy efficiency and users' satisfaction within the library buildings.
Chapter 3 Research Methodology	This chapter introduces the methodology literature including the strategies and methods used in data collection, data analysis, and how these are integrated into the research methodology.
Chapter 4 Case study	This chapter introduces the case study used in this research, facilities within this building, and FM team responsible to manage the space, facilities, and maintenance within the library building.
Chapter 5 Data Analysis and Finding	This chapter includes a comprehensive analysis of all data collected by different methods to achieve the objectives of the research, and even explains the findings of this study.
Chapter 6 Conclusion and Recommendations	The final chapter in this study summarizes the research objectives and conclusion. It also recommends some ideas to improve the current practice, and suggests the recommendations for further studies.

1.7 Summary

Based from the introduction of the overall research structure and design in chapter 1, further explanation of the literature relating space management in chapter 2. The literature studies of space management in the next chapter will provide an overview of the whole concept of space management in higher education libraries, and the impact of it on users' satisfaction

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The scholarly library is the core of any university both as a turn of learning and research (Ferdin et al., 2011). Space is a standout amongst the most profitable assets a library has. Space is required to gather, chronicle and access recorded data (LH Chan & Spodick, 2014). Space is expected to study, to research, to take part in scholarly interests for the improvement of humanity. Freeman (2005) stressed that scholarly library as a place holds an exceptional position on campus as it emblematically and physically represents the academic heart of an establishment. He kept up that its architectural expression and sitting keep on reflecting the interesting heritage and conventions of organizations of which it is a section. University libraries are changing from being a supplier of information assets to that of a facilitator in the matter of information procurement by clients in picking up, instructing and research exercises (Choy & Goh, 2016). In this way, they mentioned that one of the principal roles of libraries today is to help students to be more successful information clients rather than simply giving materials and assets. Therefore, a decent university library building as a place is relied upon to give adaptable learning space and conventional reading rooms that support learning and grant (Freeman, 2005). The mission of a university library is along these lines substantially more extensive in scope and a score up the evolved way of life of the learning business. Moreover, the mission of the Library is "to empower staff and students to draw in ideally with the consistently changing information condition keeping in mind the end goal to prevail in their research, learning and educating objectives" (Choy & Goh, 2016).

The Libraries Facilities Management Department is in charge of the general building operations of Library (Rondeau et al., 2012). This incorporates taking care of hardware and room bookings for campus occasions, overseeing building furniture and getting ready for remodels, catastrophe and clearing arrangement, upholding safety and emergency rules, keeping up the building and benefactor security, and implementing loss control. Facilities Management is in charge of keeping up and repairing University facilities and in addition working and planning building frameworks; supplying utilities, grounds care, and custodial services; issuing keys through Key Control; and reacting to work demands submitted to Work Management (Rondeau et al., 2012). Through the Campus Construction Team, Facilities Management supplies minor development and remodels in participation with Planning, Design, and Construction. Figure 2-1 illustrates the facilities management services in the HE libraries that can be summarized in space, asset, and maintenance management; catering; safety; library database, attendance; and scheduling.

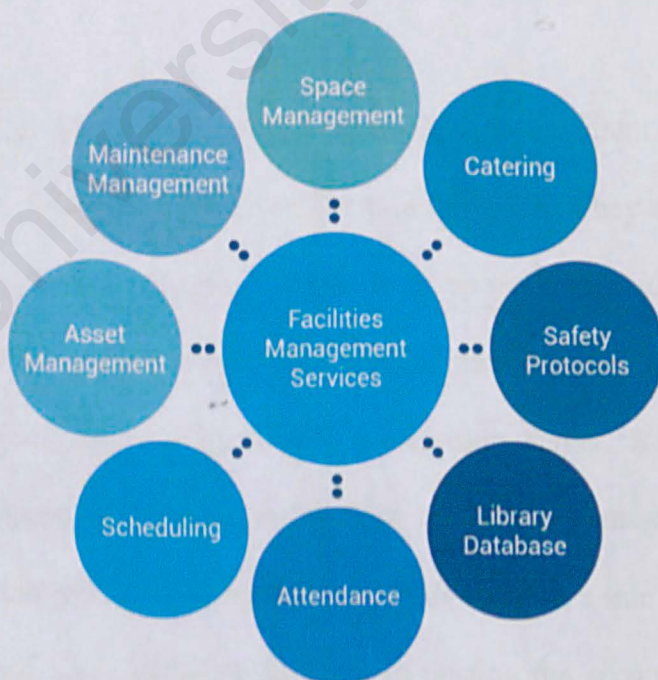


Figure 2-1: Libraries' Facilities Management Services

Source: Rondeau et al. (2012)

Choy and Goh (2016) stated that making arrangements for library structures and redesign includes numerous considerations that identify with comprehension and foreseeing the necessities of library clients. As these necessities change with technology, teaching method and for sure the bigger instructive scene, library arranging is not just a posting of alluring highlights and spaces required. Therefore, they mentioned that in library building ventures including external space designers and architects, ordinarily, a design brief is set up by the library to interpret attractive results of the library into particular space and facility needs. The change of conventional library space more often than not begins with the re-designing gathering, studying and reading spaces to more collaborative and innovation enhanced space (Choy & Goh, 2016). A review report distributed by Association of Research Libraries (S. Brown et al., 2014) uncovered that numerous libraries (84 percent of 72 reacting libraries) have plans to roll out huge improvements to no less than one of their learning spaces sooner rather than later, including classrooms, labs, collaborative area and creator spaces, alongside expelling collections.

Beard and Dale (2010) supplied five classifications of different client spaces in light of their perception of higher education institutional libraries in the UK. They are to be specific; short stay singular data gathering, open-space adaptable group work, individual quiet study, small-group intentional collaborative work, and lastly, organized educating and learning. Each zone is intended to help an alternate instructive or learning center. Beard and Dale (2010) recommended that applying learning points from others in an imaginative, adaptable and agile way while thinking about its own particular needs could be a sign of good library design. Rizzo (2002) supplied some valuable direction in posting the accompanying four sorts of space: highly active and engaging communal places; interactive collaborative places for individual research and group work; quieter less active places, for example, reading rooms,

study rooms and off the beaten path pondering spots for calm reflection and deep thinking. As indicated by Rizzo (2002), a fruitful library spaces configuration would have a decent harmony between these types of spaces. It ought to likewise have the capacity to transform over the yearly cycle of utilization to nearly coordinate request after some time.

2.2 The importance of managing spaces in academic library

As indicated by Choy and Goh (2016), Physical space assumes a critical part of helping the library to accomplish client driven missions. In numerous scholarly foundations, a critical number of students go through library space day by day. It is frequently said that the library on campus is a third place, a sort of holding, in the middle of an impartial space that serves as a change amongst dormitory and work. Students require properly arranged and well-designed spaces to suit the diversity of exercises they participate in (Painter et al., 2013). According to Choy and Goh (2016), students are in certainty captive audience which third places like libraries can conceivably shape their learning conduct and help them to accomplish their academic objectives. The path in which spaces are formed, arranged and designed affects our own prosperity, work productivity and feeling of group.

In a time of quick technological changes, far-reaching utilization of social media communication and appropriation of different learning modes, students today can pick an extensive variety of exercises to structure their daily lives to suit their necessities and inclinations (Redeker et al., 2012). To help learning and knowledge disclosure work of students, libraries should be a piece of these exercises by offering an assortment of services, exercises, and projects. Making powerful library spaces where these can be done and where students receive the most advantage is a critical objective of the Library (Choy & Goh, 2016).

Beard and Dale (2010) stated that while printed books remain some portion of the currency of learning they must be kept, found, obtained and returned, people still demand spaces for quiet study, with printed material such as books and journals and additionally progressively with technology. To oblige these various and broadening requirements, library space must be adaptable. Structures must have the capacity to show flexibility and to oblige both social and individual learning from undergrad to post-doctorate level while joining the technologies that are changing how learning happens (Beard & Dale, 2010). One measure of accomplishment can be related to expanded inhabitation and length of remain in the gathering spaces as well as those reserved for the individual silent study room. The reasons why new and renovated spaces pull in more noteworthy utilize may not be solely about the design and services but rather likewise about the picture of the library as a place to study. Students look for and verbalize in their demands, quieter or even more silent, groups and technology-rich learning spaces (Beard and Dale, 2010).

In a world progressively ruled by technology, the university library has turned into a place to discover that is always adjusting and evolving, reflecting "what the students do" (Biggs & Tang, 2007). The Ipsos MORI Student Expectations Study (Ipsos, 2007) for JISC depicted information/communication technology (ICT) "blurring into the forefront". This concisely portrays the experience of students as they grasp new advancements and promptly claim the library space in which they are accessible. The fruitful individual and silent space with great access to wireless technology is as imperative as the technology-rich group spaces.

2.3 Learning space

Cunningham and Tabur (2012) examined a four-level hierarchy of attributes in connection to the perfect learning space. Gotten from joining (Maslow, 1943) order of necessities and

(Kent & Myrick, 2013) wanted qualities, the essential needs begin with "Access and linkages", moving upwards towards "Utilizations and exercises", at that point "Sociability" and lastly "Comfort and picture". Figure 2-2 demonstrates the four-level hierarchy of attributes of perfect learning spaces in HE libraries.

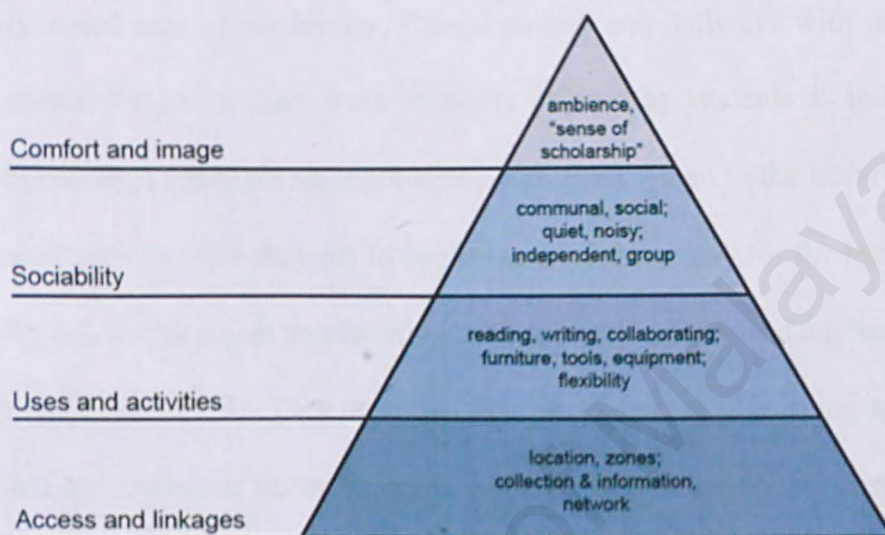


Figure 2-2: Hierarchy of learning space attributes

Source: Cunningham and Tabur (2012)

As per the research, a learning space ought to in a perfect world have qualities from each of the four levels. Regarding social areas, Watson (2013) stretched that their negligible arrangement is inadequate to help learning, and an assorted variety of social environments is required to facilitate distinctive types of discussion. While Bryant et al. (2009) noticed how a few students utilized designated group zones for individual study, finding the individual study areas too quiet. Albeit much has been composed of the social part of learning, numerous students still require the library to supply a peaceful labor environment. Design highlights of these areas have a tendency to veer far from diversions (visual or auditory) and incorporate a component of confidentiality. The research by Abbasi et al. (2014) found that individual

carrels stayed prevalent, despite the fact that they perceived the trouble of keeping up a quiet environment. They suggested great signage signifying distinctively zoned areas alongside apportioning walls and the utilization of soundproofing materials.

McLane and Dawkins (2014) noticed that private individual study does not generally demand a particularly zoned area of the library. Casual parlors and hallways with no particularly designated reason forced on them were regularly utilized by students as individual study spaces, where students could obtain more peace and privacy than in the library. They assert that such casual regions offer students to control and responsibility for the learning process. Moreover, the acknowledgment that learning can happen whenever and anytime was viewed by Popenici and Brew (2013). They proposed that the extension of learning spaces may not really require new structures, but rather more a re-assessment of existing casual spaces, for example, campus corridors. POPENICI and BREW (2014) likewise discussed how the utilization of "transitional spaces" can be impacted by the institutional culture and messages inside the spaces. Allan (2013) said that new library spaces should be more available, supply an extensive variety of study environments, support social engagement, be adaptable and future-confirmation, and offer understanding. Thus, he mentioned that a portion of the essential highlights affecting the adequacy of a learning domain is location, temperature, light, IT facilities, comfort (i.e. seating, work area space, food and drink, and washrooms), noise, cleanliness, and security.

The current expertise and mastery of library chiefs around there have developed in parallel with college-extensive improvement of formal and casual learning spaces, and has driven the authors as of late to propose that: One part this is sitting tight for the academic library is stretch out its impact and duties to assess learning spaces with others inside the university.

This insight can be utilized to incorporate the management of the diverse spaces and make them more appealing, encouraging, and popular (Walton & Matthews, 2013). Ellison and Ellison (2016) stated that a key component of advanced education in England is the number of independent study students must embrace outside of formal contact hours. It is in this manner incumbent on universities to furnish students with proper spaces in which to learn autonomously (Ellison & Ellison, 2016).

2.4 Principles of space design and management

According to Ferdin et al. (2011), space is an imperative idea in designing and planning scholarly library as a place. There are three fundamental components to deem and bridle together in arrangement and maintenance of space in the library. These components are the purpose, ease of use, and engaging quality (Ferdin et al., 2011). Thus, it requires an appropriate association for individuals to effectively discover what they need in the library. Cohen and Cohen (1979) noticed that the inside design perspective, for example, furniture and equipment designs, individuals and material movement designs, work process, lighting, acoustics, and even color influence how clients and staff function in the library. Interior design and administration of library building decide, to a huge degree, the rate of availability of materials and convergence of the library clients. A quiet space where lighting is sufficient makes it simpler for individuals to converge in the library than in an unendingly loud and dimly lit place. Ferdin et al. (2011) noticed that the three components that portray a decent space include:

1. A space for an assortment of library materials and extension or addition of collections.

2. It must be comfortable or behaviorally usable for the two clients and staff. The clients should discover the library, welcoming and staff having enough and inviting space as well, instead of being consigned to underground spaces and regarded as second-class citizens.
3. The library ought to likewise be appealing to the clients as far as the tasteful (excellence) through artwork decoration and other improving highlights. A library housed in a structure that is terrible and ill-kept kept says something of the administration and staff, for example, disorder and poor morale.

Differing space arrangements, for example, floor loading necessities, book stack spacing, furniture and equipment segment, and additionally power and energy prerequisites are taken into the account in the allocation of study and research areas in scholarly libraries (Ferdin et al., 2011). This is to oblige the usefulness, stylish and behavioral standards of the library building. Preservation and usage of space in the inside of the library are essential. It is the librarians' obligation to arrange stacks in suitable rows that encourage simple access to library materials on the shelves. A few issues that articulated these unpalatable words incorporate temperature extremes and water spillage. These might be the manufacturer's fault, coming full circle in absence of sufficient ventilation and in some cases lacking power supply (Ferdin et al., 2011).

Khan (2009) portrayed the designing and planning of open library structures. The New Review of Academic Librarianship (2006) devoted a whole problem to library design in Higher Education. After five years a considerable lot of the subjects of this issue are as yet topical; for instance, the necessity to design for physical space in an undeniably digital

environment (Walton, 2006). Likewise, in this problem, Roberts and Weaver (2006) examined the effect of technology-rich learning spaces. In this way, Beard and Dale (2008) made this a stride further and investigated the connection between libraries, technology, and instructional method. Late research on new and revamped casual learning spaces, for example, libraries, has noticed a movement in concentrate, far from print collections and towards the arrangement of more sociable, adaptable and organized learning environments, nearby enhanced client services (Ellison & Ellison, 2016). Oblinger and Lippincott (2006) featured the requirement for teaching method to lead design by considering what is required for the learning exercises that will bring about the required learning results, recommending that if students are furnished with the fundamental spaces and instruments, they can develop their own comprehension. Kehrwald et al. (2013) additionally, contended that for spaces to contribute to learning, they required an unmistakably expressed instructive reason. Thusly, services and facilities could cooperate towards the methods of insight supporting the space, instead of simply possessing the space. This is especially applicable in a "commons" area which has a tendency to incorporate various contending services.

Expanding on (Oblinger & Lippincott, 2006) endeavors to distinguish standards to design learning spaces, Radcliffe (2009) proposed a "pedagogy Space-Technology (PST) Design and Evaluation Framework". Radcliffe (2009) perceived that if in the formation of new learning spaces, the dissimilar interests of the stakeholders (e.g. management, academics, students and architects) could be united, at that point this could profit the design step as well as the inevitable operation and assessment of spaces. The structure comprises of non-specific inquiries went for giving everybody an equivalent voice in the design procedure. Lee and Schottenfeld (2014) have likewise proposed a structure for improving collaborative workspaces in arrangement with learning results and required practices. In practice, studies

have demonstrated various comparative architectural and design highlights of new and patched up higher education library spaces, known as "the look" (Boys, 2014). These incorporate an expansive lobby; a scope of conditions went for creating for both group and individual study, and in addition an assortment of learning techniques; additional space for social communication; minimal area for physical collection and staff; great Wi-fi network and PC accessibility; the arrangement of collaborative tools, (for example, huge PC screens and whiteboards) and the pervasive café (Bailin, 2011; Montgomery, 2014).

Cunningham and Tabur (2012) shared a scheme that can be utilized by architects and librarians while deeming client requirements in library space design. In this plan, the lower levels of the pyramid, i.e. access and linkages (including location, zones, collection, information, and network) and clients and exercises (comprising reading, writing, collaborating, furniture, tools, equipment, and flexibility) demonstrate the most fundamental needs of library clients. The higher levels of the pyramid, i.e. comfort and image (including ambiance and sense of scholarship) and sociability (containing communal, social, quiet, noisy, independent and group) show the largest amount trait of comfort and feel for a perfect learning space. Narum (2013) suggested the accompanying four inquiries be taken into consideration for futurity learning space design. In the first place, what do we need our students to become; second, what encounters influence that getting to be to happen; third, what spaces empower those encounters and finally, how would we know? Narum (2013) recommended that by concentrating on "getting to be", it might be less demanding to perceive how interests in physical spaces had any kind of effect in how students experienced learning. These inquiries may not be particular to libraries but rather exceedingly pertinent as academic libraries' central goal is regularly identified with how they could support learning, teaching, and research. Figure 2-3 explains the principles of designing libraries to meet their objectives.



Figure 2-3: Principles for designing libraries

2.5 Libraries' space framework

Choy and Goh (2016) stated that students have various requirements emerging from their subject of observe, the year they are in, learning conduct, inspiration, individual inclinations, and so forth. Therefore, an individual student additionally has diverse requirements under various circumstances. These necessities are communicated in exercises that students take part in. Accordingly, no one type of space will address every one of the issues and take into account the assortment of exercises (Choy & Goh, 2016). Fruitful library spaces must be shifted. According to Choy and Goh (2016), the student learning activities within the library can be served by four different types of spaces, which are collaboration, sanctuary, interaction and community.

Collaborative space alludes to dynamic ranges where students work with each other in different group setups to augment their aggregate quality. The enthusiasm for creating group-focused collaborative space is driven by the expanding appropriation of collaborative learning, collaborative learning and other gathering based methodologies in undergrad guideline (Choy & Goh, 2016). There is solid confirmation in the writing on the advantages of group learning in scholarly work. For instance, a meta-examination of research on little group learning in science, math, engineering and technology (SMET) college classes reasoned that "students who learn in little groups by and large exhibit more prominent scholastic accomplishment, express more good states of mind towards learning, and continue through SMET courses or projects to a more prominent degree than their all the more customarily showed partners" (Springer et al., 1999).

In arranging collaborative space, the main evident advance is to distinguish the necessities of groups working in spaces outside of their formal classroom (Choy & Goh, 2016). They mentioned that there are many sorts of group work that students may take part in. Some of these are conceptualizing; venture work; introduction work on; working out reports and papers; taking care of issues; peer learning; and casual social cooperation. Therefore, the authors said that many group assignments today require or are supported by the utilization of technology. Most group spaces must be mechanically empowered to serve the essential needs of students when working in groups. Be that as it may, in conveying technology for group utilize, it is vital to survey the genuine use by students. Despite the fact that students might be innovatively clever, if the expectation to absorb information in utilizing the technology is noteworthy, they will just not be utilized (Choy & Goh, 2016). The ambiance of a place is the character and state of mind it passes on to individuals encountering the space (Choy & Goh, 2016). Feeling affects the expanded utilization of the library by students. In a study of

182 Canadian and American libraries by Shill and Tonner (2004), it was discovered that change in the general facility ambiance of libraries after remodel work is a factor in adding to expanded facility use. Crook and Mitchell (2012) called it "social ambiance" where "students seemed to pick up the motivation of consolation from just being among others they knew were in a shared predicament".

Sanctuary space, as opposed to the group and cooperative spaces where an abnormal state of noise is unavoidable and adequate, the customary quiet space which was common and to be sure synonymous with libraries before has been pushed to the foundation. As Lankes (2012) wryly watched, "The present extraordinary libraries are changing from quiet structures with a boisterous room to noisy structures with a quiet room". Regardless of the prominence of collaborative and noisy spaces in libraries today, the interest for silent spaces by students is high. Beneficial scholarly work is generally proficient by individuals who have quiet minutes and the time and space to think and focus (Choy & Goh, 2016). In fact, the very demonstration of perusing requires hush as Carr (2011) brought up, "in the quiet spaces opened up by the delayed, undistracted perusing of a book, individuals made their own affiliations, drew their own particular deductions and analogies, encouraged their own particular thoughts. Standing et al. (1990) referred to past studies that demonstrate the abatement in learning execution of introverts (when contrasted with social butterflies) within the sight of low-level noise. In addition, as per Cain (2012), introverted are probably going to have an inclination for isolation, reflection, examination, working autonomously, writing over the discussion, and so on. These are exercises best done in a quiet domain. The conventional quintessential silent space in the library is the individual carrel where generations of students float towards once they require a careful intellectual exercise independent from anyone else alone with their books and notes (Choy & Goh, 2016). It is a

cross between the separated room and the huge open work area space yet a temperate arrangement from the library's perspective. Be that as it may, there ought to be an assortment of silent spaces to address diverse issues for an alternate level of quietness. At the profound end of silent spaces are spots of isolation with no diversion from noise and impedance. A run of the mill execution is the single study room. University of Hong Kong Libraries has a "profound silent room" where the utilization of technology including PCs and individual gadgets is restricted. This is designed "because of clients" requests for such a space (Sidorko & Fox, 2013).

Interaction space alludes to composed space where a library client associates with assets, services, custodians and other personnel. In spite of the fact that libraries today give a significant number of their services on the web, there are as yet critical explanations behind clients, especially students to make customary outings to the physical library for different sorts of communication. Spaces, where these associations happen, ought to be all around arranged and designed to boost open doors for productive and charming experiences amongst clients and the library (Choy & Goh, 2016). Librarians collaborate with clients in up close and personal mode generally through instructional classes, reference work areas administrations and individual counsel and admonitory work. For librarians, it is a vital channel of building up a cozy association with their clients while for students, such contacts upgrade their learning background. For instance, in a study on singular research interview amongst clients and librarians at University of Vermont, Magi and Mardeusz (2013) found that separated from fulfillment with settling data looking fork issues, "effective advantages of face-to-face correspondence are essential to these students. Fourie and Meyer (2015) noticed that "makerspaces in libraries are committed to inventive thought improvement and generation, to help for individuals to get to material not ordinarily accessible in their homes,

and to chances to go along with others in making and creating things; therefore, additionally to the arrangement of social spaces for down to earth and innovative exercises". Dickson (2013) portrayed the part of the twenty-first-century library to give media creation spaces that move past data education to media familiarity has resounded comparative exercises saw in makerspaces. Table 2-1 shows in summary the meaning and some benefits of spaces discussed in the previous paragraphs, which area collaborative space, sanctuary space, and interaction space.

Table 2-1: Different spaces within libraries and their benefits

Different spaces	Definition	Benefits
Collaborative space	Dynamic ranges where students work with each other in different group	<ol style="list-style-type: none"> 1. exhibit more prominent scholastic accomplishment. 2. express more good states of mind towards learning. 3. to distinguish the necessities of groups working in spaces outside of their formal classroom.
Sanctuary space	Quiet space to allow students study individually	<ol style="list-style-type: none"> 1. encourage students' own particular thoughts. 2. students require a careful intellectual exercise independent from anyone else alone with their books and notes.
Interaction space	Composed space where a library's client associates with assets, services, custodians and other personnel	<ol style="list-style-type: none"> 1. effective advantages of face-to-face correspondence are essential to students.

Source: Choy and Goh (2016)

2.6 The impact of modern library design on users' satisfaction

Pearce and Robinson (2007) contend that there is a requirement for administrators and policy creators in associations to see how to respond to changes in the academic environment. Libraries are associations without anyone else's input, and they too should respond to changes in the environment to stay applicable. All around, universities' libraries have been looking to

guarantee competitive skills in the evolving condition, and this has seen numerous libraries erect ultramodern designs for their structures (Mwanzu et al., 2017).

2.6.1 Impact of artistic modern library designs

As per Eigenbrodt (2009), the library might be the main and only physical space for learning and sharing information in a no institutional setting in a few nations. He includes that today it ends up noticeably vital for libraries to manage diverse accomplices in long-lasting learning, research, and arrangement of information. Cutting edge learning focuses can possibly wind up plainly alluring workplaces by the prudence of coordinating technology in an engaging general picture with shared and social spaces (Mwanzu et al., 2017). This suggests that open learning space can serve the variation information social orders by offering low-escalated and collaborative meeting places for their groups. Eigenbrodt (2009) contended that when a library is worked with far-reaching, multifunctional spaces, it could basically turn into an appealing spot for a look into interest and long-lasting self-guided learning.

Sufar et al. (2012) watched that the improvement of library building ideas ought to be developmental with new inspiring design and highlights showing up as the changing needs of the general population. They contend that library design is not just about the exterior envelope but on the other hand is about practical and energizing physical interior spaces and environments. It is very critical to consider the physical inside conditions containing inside space planning, and inside ambiance, for example, determination of lighting, furniture, materials, and completions when designing a library in the cutting-edge age (Sufar et al., 2012). This has specifically affected client satisfaction in the few current libraries on the planet.

As indicated by Juhņeviĉa and Ūdre (2010), the library needs to become "cool" and agreeable with the goal that young persons could consider it as a decent place for meetings and hang out together. They take note of that youngsters lean toward comfortable working environments and more flexibility to move around and investigate the space; they require a place to utilize their portable PCs and diverse zones to work. Numerous youngsters like to work in open spaces together with others, yet at the same time, some of them need to work in quiet study areas (Juhņeviĉa & Ūdre, 2010). As per Bell (2008), the present library energizes more social associations inside the library. These adjustments in library utilize have constrained administrators to reconsider their way to deal with the designing and planning of the library building. Numerous essayists underscore the essential part that the library plays as a social space, and how space arranging must mirror this (Mwanzu et al., 2017).

2.6.2 Impact of interior design and d cor in libraries

As per McCabe and Kennedy (2003), library design should contemplate and consider the mental impacts of colors in regards to advertising the library to attract and hold clients. He contends that dark colors may stifle sensitive conduct, while brilliant colors will fortify conduct. As indicated by Gold Coast City Council Branch Libraries (GCCC) (2007) in Australia, a contemporary way to deal with color and materials choice ought to be embraced and bring out an intriguing and well-disposed picture with a feeling of effectiveness, combined with a stimulating critical building knowledge and municipal nearness. The fabric determination for furniture and the utilization of graphics components and obviously characterized particular areas of the library are additionally basic (Mwanzu et al., 2017). As per the Library report, colors and finishes ought to fortify the interest of

the spaces to the assigned client age group, while flawlessly interlocking with the aggregate idea of the space as an enticing, invigorating spot to visit.

Researchers in the zone of library design have noticed that there are a few viewpoints that influence feelings, state of mind and client's experiences in libraries (Mwanzu et al., 2017). Current library structures with open space contemplations, colorful interior design, and great lighting impact human practices and discernment through parts of the surrounding, aesthetics and ergonomic variables. Those angles impact clients to return to the library, to remain longer and hold onto the library as a fun and energizing spot to investigate and visit (Mwanzu et al., 2017).

2.6.3 Impact of lighting

Lighting can control how the library looks and feels (Mwanzu et al., 2017). Great lighting is important for study, and repressed lighting might be utilized as a part of territories for reflection. As per Shill and Tonner (2004), the Lanchester Library utilizes light wells and natural ventilation to lessen the requirement for artificial light and air conditioning and has windows deliberately adjusted to limit sun oriented pick up and glare. As indicated by Gold Coast City Council Branch Libraries (GCCC) (2007), lighting ought to be without glare with a base level of 50 lux at ground level; eliminate glare, enlightening signage, and feature level changes; supplying uniform luminance levels inside and consent to the prerequisites for support brightening in all dissemination spaces, including freely available areas; supplying a base illumination of 40 lux, consistency of 0.3 and a normal kept up estimation of 120 lux; supplying a graduated level of illumination at building passages and ways out to help individuals with vision disability; supplying at least 50 lux outside the section or exit; lastly supplying sufficient centered lighting to gesture-based

communication translation for individuals who are hearing disabled in conference rooms, meeting rooms and auditoriums.

2.6.4 Impact of ventilation and temperature

Fanger (1984) characterized "Thermal comfort is the state of mind which communicates fulfillment and agreeable worldwide human body with complex thermal factors. Thermal comfort is an adjustment of the human body, and it has a tendency to acknowledge ecological conditions (Nadiyah Zafirah, 2015). Hussain and Oosthuizen (2013) contemplate featured that there are four essential factors that can influence human comfort, which ought to be considered by the HVAC design engineers before designing ventilating frameworks are viable air temperature, relative humidity, air velocity and mean brilliant temperature. Kosonen and Tan (2004) asserted that high effective ventilated office structures give a thermally worthy condition to human comfort and work that would keep in mind the end goal to empower better work profitability and less thermal disappointment. Hanim Mohamad Zailani et al. (2012) kept saying that users' consideration, focus, learning, hearing, and exhibitions will be enhanced by high ecological quality.

2.7 Green library building

As per Hauke et al. (2013), going green in library structures involves the maintainable parts of the structure of the building, i.e. the façades, the building atmosphere, ventilation, heating and cooling, the lighting, the interior fittings, green information and communication technology, these altogether include that can be pinpointed for green showcasing in the wake of opening and from which libraries can profit by.

Jankowska and Marcum (2010) mentioned that authors tending to the green library building subject talk about architectural designs that keep in mind sustainable arrangements in

remodeling or constructing libraries. Library structures utilize huge amounts of energy, electricity, and water, and in addition woods for the paper. They additionally deliver huge measures of solid waste (Jankowska & Marcum, 2010). The requirement for making green and sustainable library structures was advanced from the get-go by (B. Brown, 2003; Weiner & Boyden, 2002).

Green buildings are energy efficient; utilize nontoxic reused content materials and furniture, common sunlight, and low-flow toilets; and decrease the costs of maintenance (Jankowska & Marcum, 2010). Therefore, they mentioned that the Libraries Design Project supplies specific design planning and documentation beginning from acoustics for libraries through interior finish materials for library innovation foundation plan. Additionally, unmistakable is the writing on designing library spaces to encourage the library's new part as a research and learning center instead of a customary safe focus. This writing presents economical plans for library building insides and outsides and advances mindful utilization of renewable and nonrenewable assets to accomplish healthy and lovely conditions for the library clients while providing great conditions to the accumulations and services (Bennett, 2003).

Malaysian standard promotes the design, operation, maintenance of new or existing buildings in the way of reducing the energy consumption without affecting comfortable and satisfaction level of users (MS 1525, 2014). In the term of space and architectural design, MS 1525 (2014) guides to design an energy efficient building to optimize the energy efficiency, and even it outlines some factors affecting space management and design to ensure energy efficiency term, for instance, daylighting, façade design, and ensuring neutral ventilation. The fundamental guideline of good introduction in central locale is to maintain a strategic distance from presentation of openings to the exceptional sun oriented radiation from East and West.

2.8 Energy efficiency within library buildings

The energy efficiency in buildings, apparatuses, transport, and industry is one of the wide territories that the International Energy Agency was requested approach guidance through the G8 Gleneagles Plan of Action (Soares et al., 2015). In their work, Jollands et al. (2010) clarified how this arrangement can be vital by extending energy efficiency exercises using global level proposals. The authors likewise called attention to that tending to the numerous obstructions to energy efficiency can make the fundamental conditions for enhancing energy efficiency itself. As indicated by the authors, the energy efficiency hindrances portrayed by the International Energy Agency (2003b) can be gathered into three fundamental classes: the information and behavioral boundaries; the market association obstructions; and the technological boundaries. Different studies have brought up the significance of evolving energy utilize practices, forcing new approach measures and supplying technological advancement as a major aspect of the primary expected changes to enhance energy efficiency (Cansino et al., 2011; Egging, 2013; González et al., 2012). To be sure, the European Commission expressed that energy efficiency is considered as a standout amongst the most financially savvy routes for society to improve the security of energy supply and diminish emanations of greenhouse gasses and different contaminations (Plan, 2011).

Concerning building part, the Energy Efficiency Plan of the European Commission (2011) perceived that the best energy saving potential lies in structures. In this manner, the European Union (EU) strategy has distinguished the advancement of energy efficiency in structures as a key goal of its energy and climate approach (CEC, 2006; Raslan & Davies, 2012). The EU controllers have distributed the Directive on Energy Performance of Buildings (EPBD) (Directive, 2003) and its (Recast, 2010). The EPBD has turned into the significant channel for the way toward embracing execution based energy principles for buildings by all the part

states. As expressed by Egging (2013), the EPBD traces measures that required all part states to set least prerequisites and create techniques for deciding the energy execution of structures. Desire levels fluctuate by building sort and kind of undertaking. The usage of the EU Energy Efficiency Plan in the building part in various part states is accounted for in a few papers (Raslan & Davies, 2012; Travezan et al., 2013).

The lessening of the energy consumption in buildings relies upon clients' awareness with their energy consumption (Soares et al., 2015). A few studies have been investigating how inhabitants' practices may impact the energy consumption in structures, for instance, Fabi et al. (2013) assessed how unique conduct designs impact indoor climate quality and energy consumption. In the main examination, inhabitant practices (in particular, tenants' window opening and shutting practices) are identified with the building control frameworks; in the second investigation, a probabilistic approach is proposed and connected to recreate tenant practices sensibly. As expressed by Dahle and Neumayer (2001), a standout amongst the most critical measures that should be embraced to defeat boundaries to "greening" is to elevate the environmental attention within campus communities. In this manner, client's conduct winds up plainly definitive in the advancement of a manageable culture. As recommended by Barata et al. (2011), university campus may constitute an imperative research center to test and actualize new procedures prompting decreases in infrastructure costs and more positive effects on the encompassing zones. These authors additionally called attention to that one viewpoint as often as possible slighted is the capability of the scholarly world to impact the student's practices as well as the environmental awareness and propensities that they can create in the long haul, i.e. they can turn out to be effective powers to reshape the future society's models (Barata et al., 2011).

Linden et al. (2012) stated in their study on energy saving opportunities in university libraries that the design of library stockpiling, the area of storage inside a building, and the real space use, all affected the creation and support of the specific natural condition – and, thusly, on the response to a shutdown try. Extensive, customary stack structures, for example, those at Yale and Birmingham Public Library frequently have a significantly littler volume of accumulations contrasted with air volume in the space than do reason fabricated high-thickness stockpiling regions, for example, at Cornell and UCLA. In high-density storage spaces, there is a more prominent plausibility that the accumulation, once at balance, could apply some impact by filling in as a warmth sink and moisture cushion amid mechanical system shutdowns (Linden et al., 2012). What is more, they mentioned that the measure of exterior wall introduction space has an impact the probability that open-air atmosphere conditions will affect the indoor atmosphere amid a shutdown period. Spaces with almost no exterior wall exposure, or areas encompassed by other adapted areas, are more averse to be impacted by outdoor conditions (Linden et al., 2012).

2.9 Summary

Libraries are the core of the university and still considered the main place that students go through to study. It is clear that managing space in a modern way that incorporate the physical commons and technology ensures a high level of satisfaction among the library users. Moreover, the library buildings utilize a huge amount of energy especially in the term of air conditioning system and lighting, so the design and managing of the interior space of libraries through materials used in the interior design and managing the facilities within the building will lead to achieve a better level of energy efficiency without affecting users' satisfaction. chapter 3 will focuses on explaining the methods used in this research to collect and analyze data, and the justification of use these types of methods.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

This section talks about the methodology utilized as a part of fulfilling this research. The segment depicts the case area, the study plan, data collection methods, and data analysis strategies utilized as a part of this study. The talk reaches out to the criteria of respondents' choice, identification of study populace and in addition data transformation strategies.

The mixed methods approach was implemented in this research, which was carried out in three phases. The first phase was the literature review which covered the significance of space management in HE libraries and its impact on users' satisfaction and energy efficiency. In addition, the principles of space management in universities' libraries have also been discussed. The identification of possible decision-making components was carried out through broad literature, both by local and international researchers in accordance with the exploration center. Basic data and information were accumulated from different distributed materials. The discussion on mixed methods approach as a strategy for the research has additionally been completed in the literature review work out.

The second stage was the primary data collection utilizing questionnaire survey. This was for the most part to affirm the factors that had been identified from a review of the literature. Information and data to identify the implementation of space management and the influence of this implementation in the term of users' satisfaction and indoor environment quality was collected through a questionnaire survey, and using empirical measurement to investigate the

operative temperature, relative humidity, and lighting within the selected case study. This would empower quantitative data collected for further analysis, trailed by semi-structured interview for qualitative part. Stage 3 was a discussion on the ramifications of the analyzed outcome. Stage 3 additionally developed a finish of the study.

3.2 Research design

Gorard (2010) noticed that research configuration is a way to deal with sorting out a research work from starting to advance the likelihood of producing verification and proof that gives a legitimate response to the exploration targets of any study. Creswell (2013) kept up that the research design outlines are strategies and arrangements of research that breaking point the choices from wide presumptions to definite analysis and data collection strategy. By and large, there are four sorts of social research plans, which incorporate descriptive, explanatory, exploratory and evaluation research (Schutt, 2015). The outline of the distinctive sorts of social research ventures is as appeared in Table 3-1. As stated in the summary, it could be concluded that this research employed an explanatory research in nature due to it identifies the key decision-making factors for the space management in HE libraries and its impact on users' satisfaction and energy efficiency.

For data collection purpose in this explanatory research, a mixed method approach was utilized. Mixed methods combine both quantitative and qualitative methods (Creswell, 2013). In sociology, qualitative research includes estimations, numbers fundamentally in light of an examining procedure on the grounds that, in numerous sociology sorts of research, it is difficult to observe the whole the populaces for reasons of time, coordination and essentially difficulty. Qualitative research, then again, manages different types of information, for example, content, pictures, and so forth and is descriptive in nature including

usually talk. Normal data collection techniques incorporate interviews and observations. In uncommon conditions, smell and another tangible is viewed as (Gorard, 2010). Utilizing distinctive techniques in the endeavor to reduce and take out inclination brought forth the triangulation of information sources. As per Bishop (2015) obtained from one technique can prompt the improvement of the other strategy.

Table 3-1: Research types

Research type	Description
Descriptive Research	Depicting and characterizing the interest of social phenomena.
Exploratory Research	Tries to recognize what issues concern individuals, what implications they provide for their activities and how individuals get along in the setting under question. For the most part, this research sort includes qualitative strategy, as it requires taking a field of request toward another path; or catching unstructured information.
Explanatory Research	Tries to estimate how a social phenomenon changes accordingly towards another phenomenon with an alternate variety. It additionally investigates circumstances and end results of the phenomenon. Frequently, it involves surveys and experiments, quantitative methods most likely to be used for both approaches.
Evaluation Research	This sort is likewise considered as a logical research. Be that as it may, it just looks to examine the outcomes of arrangements or projects by the government.

Source: Schutt (2015)

Generally, there are four fundamental mixed method designs that have diverse plans and methodologies. Figure 3-1 demonstrates the Concurrent Mixed Method design that comprises of Embedded and Triangulation techniques. In these methodologies, quantitative and qualitative parts could be led simultaneously. Then again, Figure 3-2 demonstrates the Sequential Mixed Method outline that the quantitative and qualitative parts could be led

consecutively (Creswell et al., 2008). Three strategies under this research design are known as Explanatory, Exploratory and Embedded outlines.

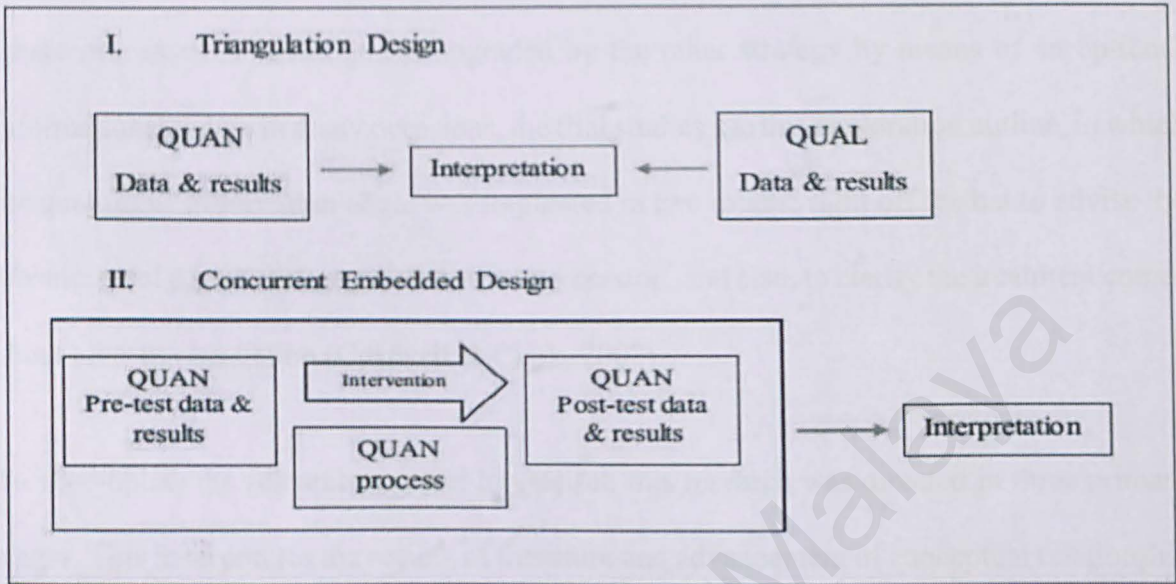


Figure 3-1: Concurrent mixed method designs

Source: Creswell et al. (2008)

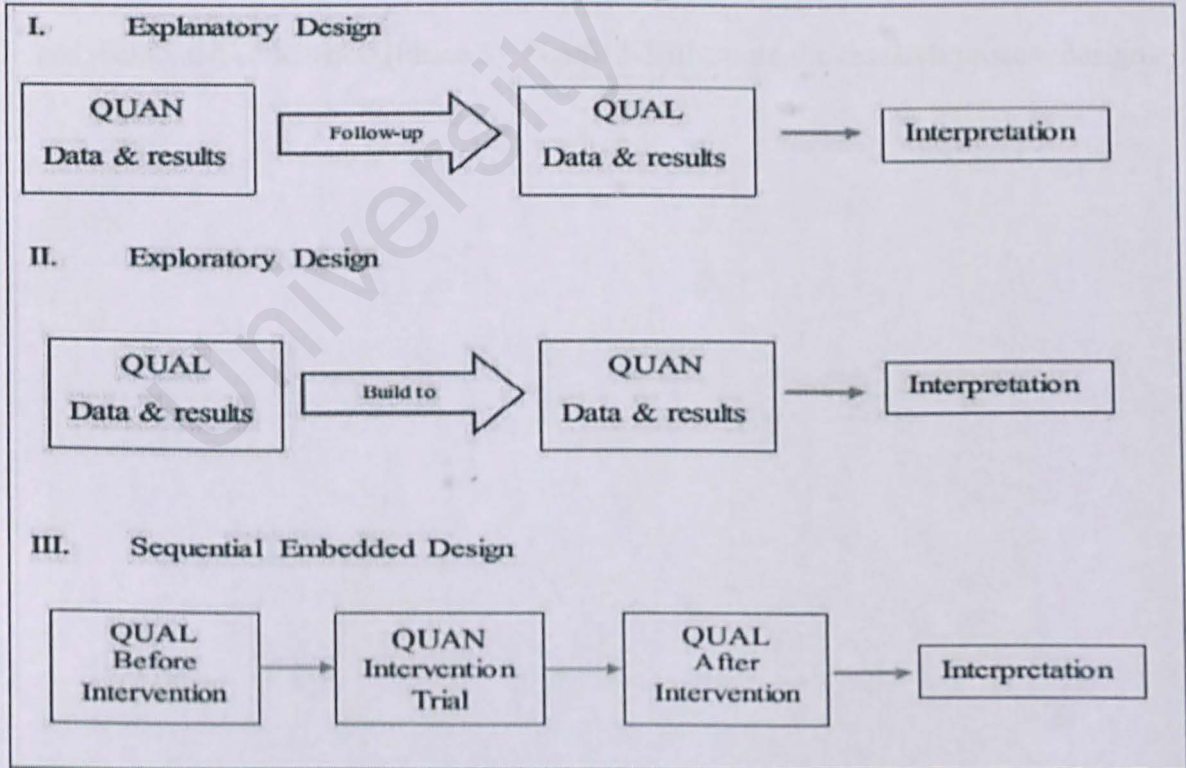


Figure 3-2: Sequential mixed method designs

Source: Creswell et al. (2008)

Triangulation Design in a solitary stage proposes data from qualitative and quantitative converged to build up a comprehension or think about various outcomes. The data are gathered and dissected parallels. Likewise, the Embedded Design proposes a review plan where one essential technique is upgraded by the other strategy by means of an optional informational index. In many occasions, the trial studies use this exploration outline, in which the qualitative information angle was implanted in two routes: right off the bat to advise the advancement of the treatment before the intercession, and also, to clarify the treatment comes about after the mediation (Creswell & Clark, 2007).

To accomplish the research aim and targets set, this research was directed in three primary stages. This incorporates the review of literature and advancement of conceptual relationship (Phase 1), quantitative data collection utilizing questionnaire survey and analysis and empirical measurement; qualitative data gathering utilizing semi-structured interview (Phase 2); and dialog and conclusion (Phase 3). Figure 3-3 illustrate the research process design.

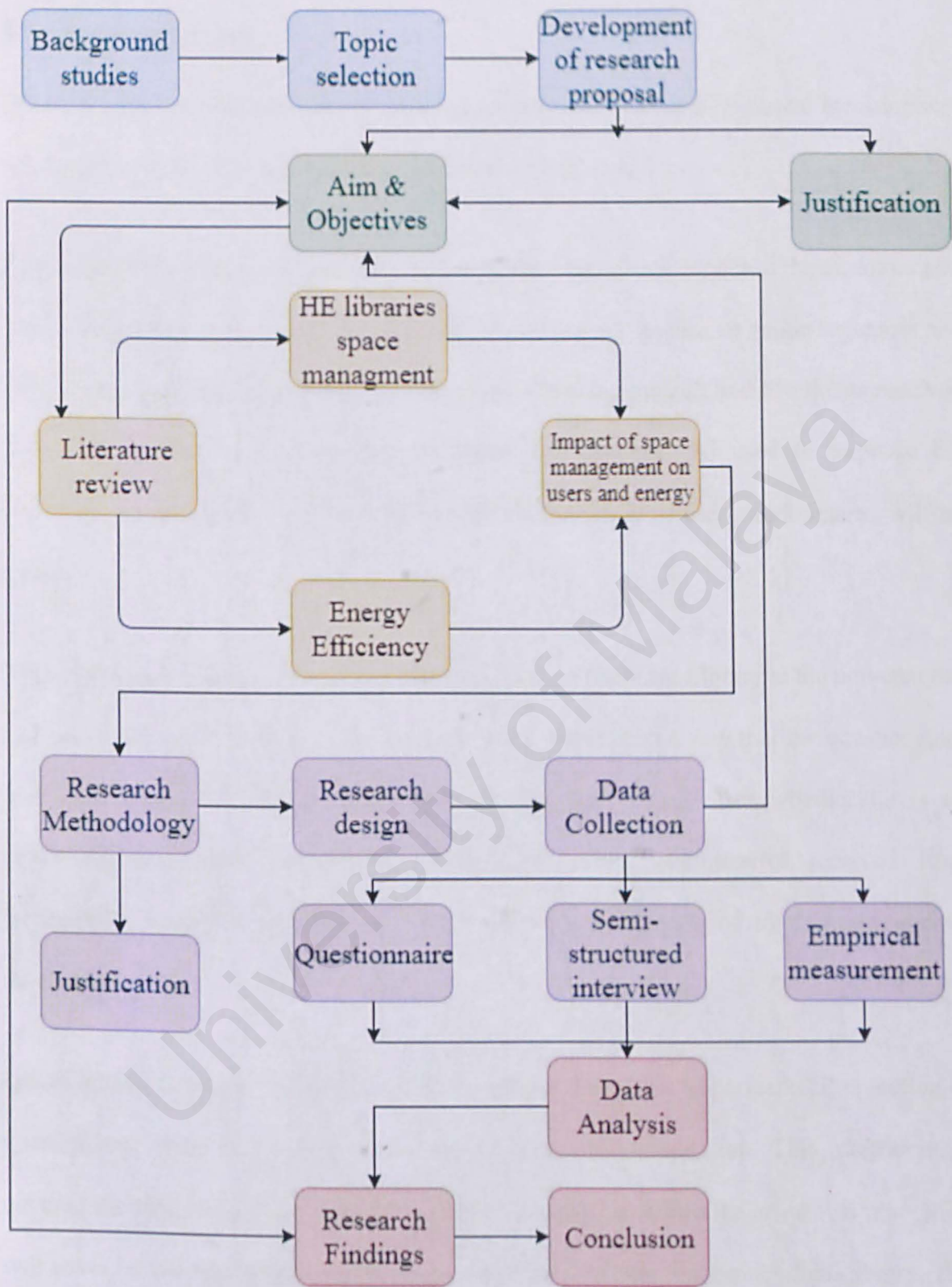


Figure 3-3: Research process design

3.3 Data collection

Generally, the questionnaire survey, semi-structured interview, and empirical measurement will be implemented for primary data collection for this study.

Before the survey questionnaires will send out to the respondents, a pilot of the questionnaire will be conducted on five potential respondents to avoid any unclear or vague sentences and terminologies utilized in the questionnaire. Some of the suggestions and comments received from the pilot survey exercise will be taken into account and used to improve the questionnaire are necessary before the actual dissemination of the questionnaires will be made.

310 questionnaires have been distributed to the users of the Main Library at the university of Malaya. Randomized section of respondents was done in such a way that the questionnaire was distributed in all floors within the building and to any user whether he is an undergraduate student, postgraduate, and others. The questionnaires received from respondents were 286 questionnaires with percentage 92.26% of total questionnaires distributed.

Questionnaire form was utilized to collect all information from respondents. Preparation of questionnaire form was based on the objectives of this dissertation. This questionnaire covered the first and second objectives of this dissertation, where the other two objectives will cover by the semi structured interview with the FM team and deputy chief library. The questionnaire includes four sections, which are a general information about the respondents; opinion on the learning spaces within the Main Library; perception on lighting system, thermal comfort of learning spaces, and the arrangement of different facilities within the

Main Library; and the last section was the view on how spaces in the Main Library could be improved. The questionnaire has been set up from more comprehensible, reasonable and systematic questions for respondents as shown in the appendix (please refer to Appendix A & B for more details).

Semi-structured interviews will be held with facilities managers and deputy chief library followed the questionnaire survey data collection. This will be to clarify and validate the implementation of space management in academic libraries and the barriers that faced the effective space management. The avocation of utilizing semi-structured interview is to find clarifications for any unclear answer gotten amid the questionnaire survey session. The interview likewise could clear up any conflicting reactions from the literature review and give a chance to the researcher to talk about any new components that were not asked amid the survey completed before.

Semi structured interview held with FM team and the library staff to approve the implementation of space management concerning users' comfort and energy efficiency. The questions of interview have been designed to achieve other objectives, which were not achieved by the questionnaire survey, and to explain unclear results from the questionnaire and literature review. Therefore, the questions have been set up according to the results came from the questionnaire and literature review (please refer to Appendix C & D for more details).

Empirical measurement was used to measure the current temperature, relative humidity, and light intensity within different spaces in the Main Library. Hobo logger equipment was used to do the measurement, which aims to compare the actual results with planned and requirements of the standard implemented. Moreover, to compare the results with the overall

satisfaction level of users with different spaces within the Main Library that comes from the questionnaire survey completed before starting the measurement. (please refer to Appendix E for measurement's results).

3.4 Data transformation and analysis

As per Sekaran and Bougie (2013), data transformation could be characterized as a "variety of the data coding, procedure of changing the first numerical portrayal of a quantitative incentive to another esteem." Analysis was completed to produce a statistic profile of the data assembled. Distinct analysis utilizing recurrence, rate and focal inclinations were utilized to analyze data acquired from the survey.

The research will use both descriptive and inferential statistics techniques to analyze the data from the study. The respondents from the questionnaire survey will be analyzed utilizing analysis packages namely Statistical Package for Social Sciences (SPSS) software to provide both inferential and descriptive statistics outcomes. Descriptive statistics contribute information concerning demographic form of the variables. It provides measurement of median, mean, mode, standard deviation, skewness, maximum and minimum of values. Inferential statistics uses high-level statistical exams to measure the variation between groups of variables. Statistical tests such as measures of central tendency and correlation tests will be implemented. Moreover, thematic analysis will be applied to analyze the outcomes of the interview.

3.5 Summary

Regularly, Chapter 3 talked about the choice of research design and methodology for the research that is the Sequential Mixed Method design with Explanatory Research in nature.

The procedure of data gathering was begun with literature review and improvement of reasonable relationship graph, trailed by a questionnaire survey; empirical measurement; and semi-structured interview. The questionnaire review was led in view of the reasonable relationship chart, while the semi-structured interview (quantitative) was directed to approve the survey overview comes about, and empirical measurement used to compare the current situation with the standard and results from the questionnaire. Lastly, data transformation techniques were talked about towards the finish of this area, which incorporates the inferential and descriptive methods of data analysis. In the next segment (Chapter 4), the case study of the research is exhibited.

CHAPTER 4 CASE STUDY

4.1 Introduction

A case study of university of Malaya Main Library was conducted to investigate users' satisfaction through better space management in HE libraries. The scope of this case study includes a questionnaire survey on library's users, a semi-structured interview of the facilities management team of university of Malaya and the staff of the library, and finally an empirical measurement within the Main Library building. The justification of using single case study is because a single case study is not as expensive and time consuming as multiple case studies. Single case study is better for writer to create a high-quality theory because this type produces extra and better theory. Moreover, single case study also makes the writer to have a deeper understanding of the exploring subject (Gustafsson, 2017).

4.2 Justification of case study

The case study, which is the Main Library of the university of Malaya has been chosen because this university is the oldest and best university in Malaysia and one of the best universities in the world, the age of building, where the building built in 1959, location of the building, where this study focuses on Klang Jaya area, capacity of library, which is able to contain a large number of students, and because that the framework of space management discussed previously in the literature review was implemented within the building.

4.3 Background of the building

4.3.1 Introduction

The University of Malaya Library was set up in (1959) and has an aggregate gathering of more than a million titles until now. UM Library comprises of a Central Library, which supplies library facilities to the entire grounds and a system of a branch and unique libraries to achieve the particular and extraordinary requirements of some faculties. The Central Library sits amidst the University Campus. It is a four-story building with a story space of (17,372) square meters. The library is headed by the Chief Librarian, with a supplement of expert librarians, support, and technical staff.



Figure 4-1: University of Malaya Main Library

The ground floor involves the administration counters, reference desks, self-charging machines, and free-range readings and satellite TV (ASTRO). While Second Floor is put aside for Current Journals, Thesis and Dissertations Collection, Pendeta Discovery terminals and study region. Third Floor is saved for bound diaries and reference corridor

while the fourth floor obliges the Media Collection and bound diaries. Second and above flooring, also, hold the vast majority of the library's gathering.

Full seating capacity is (1,608) and there are altogether (53) daily carrels with (21) set aside for the visually impaired. The Central Library also has (5) computer labs i.e. Lab A, Lab B, Lab C, Lab D and Lab S as well as computer facilities at every floor. Information skills programs are held in Lab C and D to educate users on the effective method of information searching using IT tools in the library.

Space information includes the rooms' code; rooms' name; and rooms' area is in the Appendix 'G'.

4.3.2 Facilities within the Main Library

Computers: The PCs Laboratory has been established in the Library by the Center for IT and its offices have been offered to understudies since July 1997. All PCs with the internet connection have accommodated the utilization of understudies. PC Labs are open as indicated by Library opening hours.

Discussion rooms: Individuals needing private discussions may hold discourse room and use on two-hourly premise. Discussion rooms situated at the second, third and fourth level and reservations might be made at the administration counter at the ground floor. It's just for library's enrolled individuals.

Individual study carrels: The Library supplies 55 carrels to postgraduate understudies, scholastic staff and researchers. Carrels are likewise particularly held for dazzle understudies. Postgraduate understudies need to fill in a frame and carrels are for every day utilize.

Photocopying: Photocopying administrations worked with business sellers are given in the Library. There are staff-worked and self-benefit photocopying administrations. The client ought to watch and agree to the present enactment of copyright in Malaysia.

Computer laboratories: UM Library comprises of 5 PC labs which furnished PCs with internet connection for use of undergrad (Lab An and D), postgraduate and research reason (Lab B and C) lab for incapacitated (Lab S).

Reading areas: Reading facilities are available on every floor of the Library. Uses are advised to leave library books on trolleys after usage. Please do not attempt to shelve these books. Shelving items in the wrong places will result in serious retrieval problems.

The Main Library at the University of Malaya includes the three types of spaces discussed in the literature review, which are collaborative space, sanctuary space, and interaction space (**2.5 Libraries' space framework**). For more information regarding the layout of each floor within the Main Library refer to Appendix 'F'.



Figure 4-2: Ground floor within the Main Library



Figure 4-3: Collaborative area within the Main Library



Figure 4-4: Second floor within the Main Library



Figure 4-5: Third floor within the Main Library



Figure 4-6: Fourth floor within the Main Library

4.4 Facilities Management team

Department of development and estate maintenance (JPPHB), UM is responsible to protect the interests and well-being of the campus community as well as users of its facilities; to create an effective, committed and dynamic management of the University's properties; and to implement efficient and cost-effective development projects of the University.

Maintenance and development services are provided in many specialized fields, and are handled by the following divisions: administrative; finance; civil engineering; planning and architecture; property management; contract and quantity surveying; electrical and electronic engineering; and mechanical engineering to provide support services to all facilities within UM campus including the Main Library, which is the case study in this research. Therefore, the department support the Main Library building by managing of engineering services; maintenance of building and compounds; estate management; renovation works; and development projects.

4.5 Summary

This chapter provides a clear overview of the case study selected for this research. Information about the case study shows that UM Main Library contains a huge number of facilities, and FM team within University of Malaya contributes in all aspects to ensure that the functionality of library is effectively working. In the following segment, Chapter 5, analysis of the data collected by the questionnaire survey, semi structured interview and empirical measurement is shown. Moreover, the findings will explain in chapter 5.

CHAPTER 5 DATA ANALYSIS AND FINDINGS

5.1 Introduction

This chapter offers the data analyzed from questionnaire survey, semi structured interview, and the measurement of temperature, relevant humidity, and lighting within the Main Library building carried to the space management within HE libraries and its impact on users' comfort and productivity and energy efficiency. Fundamentally, the data analyzed are concerning to the satisfaction level of different spaces within the Main Library including the term of energy, the barriers of implementing an effective space management concerning users' satisfaction and energy efficiency, and the correlation between the current space management and the future plan of space management within the Main Library building.

5.2 Normality test

Normality test was utilized to determine the distribution of the variables' results. Results from Kolmogorov-Smirnov test as shown in Table 5-1 articulates that the data is not normally distributed because significant value (P-value) is less than 0.05. Therefore, non-parametric analysis will be used for further statistical test.

Table 5-1: Normality test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Find space within COLA	.255	286	.000	.889	286	.000
Space is convenient within COLA	.313	286	.000	.843	286	.000
Space is too noisy within COLA	.190	286	.000	.909	286	.000
Interior design increases productivity within COLA	.244	286	.000	.882	286	.000
Furniture is comfortable within COLA	.300	286	.000	.826	286	.000
Furniture is movable within COLA	.237	286	.000	.893	286	.000
There is a place to use own laptop within COLA	.290	286	.000	.801	286	.000
Close to books/ COLA	.232	286	.000	.890	286	.000
Near to printing facilities/ COLA	.221	286	.000	.898	286	.000
Find space within quiet area	.297	286	.000	.860	286	.000
Space is convenient for individual study within quiet area	.283	286	.000	.833	286	.000
Space is too noisy within quiet area	.252	286	.000	.875	286	.000
Interior design increases productivity within quiet area	.260	286	.000	.875	286	.000
Furniture is comfortable within quiet area	.314	286	.000	.838	286	.000
There is a place to use own laptop within quiet area	.320	286	.000	.814	286	.000
Close to books/ quiet area	.249	286	.000	.880	286	.000
Near to printing facilities/ quiet area	.234	286	.000	.896	286	.000
Find space within PCs lab	.187	286	.000	.901	286	.000
Furniture is comfortable within PCs lab	.238	286	.000	.888	286	.000

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PCs lab is convenient for group study	.196	286	.000	.906	286	.000
PCs lab is convenient for individual study	.265	286	.000	.877	286	.000
Space is too noisy within PCs lab	.212	286	.000	.902	286	.000
Interior design increases productivity within PCs lab	.203	286	.000	.895	286	.000
Computers meet my needs	.219	286	.000	.895	286	.000
Near to printing facilities/ PCs lab	.221	286	.000	.903	286	.000
lighting ground floor	.320	286	.000	.725	286	.000
lighting open space level2	.314	286	.000	.735	286	.000
lighting open space level3	.347	286	.000	.698	286	.000
lighting open space level4	.328	286	.000	.732	286	.000
lighting collaborative area	.287	286	.000	.774	286	.000
lighting individual carrels level2	.284	286	.000	.778	286	.000
lighting individual carrels level3	.265	286	.000	.766	286	.000
lighting individual carrels level4	.268	286	.000	.773	286	.000
lighting group rooms	.310	286	.000	.770	286	.000
ground floor/ temp comfort	.274	286	.000	.789	286	.000
open space level2/ temp comfort	.234	286	.000	.852	286	.000
open space level3/ temp comfort	.232	286	.000	.893	286	.000
open space level4/ temp comfort	.263	286	.000	.848	286	.000
collaborative area/ temp comfort	.210	286	.000	.886	286	.000
individual carrels level2/ temp comfort	.274	286	.000	.807	286	.000
individual carrels level3/ temp comfort	.247	286	.000	.837	286	.000

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
individual carrels level4/ temp comfort	.258	286	.000	.808	286	.000
group rooms/ temp comfort	.300	286	.000	.796	286	.000
humidity ground floor	.391	286	.000	.657	286	.000
humidity open space level2	.374	286	.000	.695	286	.000
humidity open space level3	.374	286	.000	.673	286	.000
humidity open space level4	.379	286	.000	.686	286	.000
humidity collaborative area	.356	286	.000	.726	286	.000
humidity individual carrels level2	.284	286	.000	.767	286	.000
humidity individual carrels level3	.290	286	.000	.765	286	.000
humidity individual carrels level4	.298	286	.000	.757	286	.000
humidity group rooms	.311	286	.000	.749	286	.000
Interaction area	.241	286	.000	.860	286	.000
Shelves of books & journals	.272	286	.000	.863	286	.000
Printing facilities	.208	286	.000	.903	286	.000
Toilets	.297	286	.000	.860	286	.000
Drink & Snack area	.207	286	.000	.900	286	.000

a. Lilliefors Significance Correction

5.3 General information

The first section within the questionnaire is a general information about the respondents. This section contains eight (8) questions.

5.3.1 Age of Respondents

Table 5-2 concludes the age of respondents, where the age of respondents is divided into three (3) categories. The first category involves the respondents who are between (17)

years old and (23) years old, the second category includes the respondents who are between (24) years old and (30) years old, and the last category implicates the respondents who are more than (30) years old. The majority of respondents is who their ages between (17) years old and (23) years old, where the percent of them is (64%). Moreover, the percent of the second category is (24.1%) and the percent of the third category is (11.9%).

Table 5-2: Age of Respondents

Age	Frequency	Percent	Cumulative Percent
17-23	183	64.0	64.0
24-30	69	24.1	88.1
>30	34	11.9	100.0
Total	286	100.0	

5.3.2 Gender of Respondents

The second question within this section is about the gender of the respondents. Table 5-3 demonstrates the percent of male and female who involved in the questionnaire. The percent of both male and female was similar, where the percent of male was (48.6%) and the percent of female was (51.4%).

Table 5-3: Gender of Respondents

Gender	Frequency	Percent	Cumulative Percent
Female	147	51.4	51.4
Male	139	48.6	100.0
Total	286	100.0	

5.3.3 Nationality of Respondents

The third question within the first section talks about the nationality of the respondents. The respondents were from (30) countries, which means the respondents were from Malaysia and (29) international countries. Table 5-4 explains the percent of each

nationality of respondents who participate in this research. The majority of respondents are from Malaysia that means local respondents. The percent of them was (65.7%) and the percent (34.3%) of respondents was international respondents who are from (29) countries. The majority of international students was the students from China, where the percent of them was (10.1%).

Table 5-4: Nationality of Respondents

Nationality	Frequency	Percent (%)	Cumulative Percent
Malaysian	188	65.7	65.7
Somalian	5	1.7	67.5
Yemeni	11	3.8	71.3
Maldivian	1	0.3	71.7
Syrian	4	1.4	73.1
Kazakhstani	1	0.3	73.4
Omani	1	0.3	73.8
Sudanese	3	1.0	74.8
Chinese	29	10.1	85.0
Libyan	2	0.7	85.7
Thai	3	1.0	86.7
Bangladeshi	4	1.4	88.1
Japanese	2	0.7	88.8
Bruneian	2	0.7	89.5
Palestinian	1	0.3	89.9
Indonesian	6	2.1	92.0
Iranian	3	1.0	93.0
Nigerian	4	1.4	94.4
Belgium	2	0.7	95.1
Pakistani	2	0.7	95.8
Moroccan	1	0.3	96.2
S. Korean	3	1.0	97.2
Algerian	1	0.3	97.6
Ghanaian	1	0.3	97.9
Saudi	1	0.3	98.3
American	1	0.3	98.6
German	1	0.3	99.0
Iraqi	2	0.7	99.7
Srilankan	1	0.3	100.0
Total	286	100.0	

5.3.4 Level of Study

The respondents in this study are divided into four (4) categories, which are bachelor, master, Ph.D, and others. During collecting data, there are two (2) groups within the last category, which are foundation and diploma. Table 5-5 explains different categories of respondents according to the level of study. More than half of the participants in the questionnaire were bachelor students with (57.7%), students of the master's degree constituted (25.5%) of the respondents, and (11.5%) of the total is Ph.D students. Moreover, (5.2%) of respondents were divided into two (2) groups, which were foundation students with (3.8%) and diploma students with (1.4%), which was the lowest percentage of the participants in this study.

Table 5-5: Level of Study of Respondents

Level of Study	Frequency	Percent	Cumulative Percent
Bachelor	165	57.7	57.7
Master	73	25.5	83.2
Ph.D	33	11.5	94.8
Foundation	11	3.8	98.6
Diploma	4	1.4	100.0
Total	286	100.0	

5.3.5 Frequent visit of the Main Library

The style of the visit of the Main Library is divided into four categories, which can be summarized as follows daily; weekly; bi-monthly; and monthly. From (286) respondents in this questionnaire, (133) respondents visit the Main Library daily, which was the highest number of visitors, so the percent of daily visiting was (46.5%). The percent of weekly visiting was (44.1%), and the percent of monthly visiting was (5.2%). However, the lowest percent of visiting was the bi-monthly visiting with (4.2%). Table 5-6 shows all the results regarding the style of library visiting.

Table 5-6: Frequent visit of the Main Library

Library visiting	Frequency	Percent	Cumulative Percent
Daily	133	46.5	46.5
Weekly	126	44.1	90.6
Bi-monthly	12	4.2	94.8
Monthly	15	5.2	100.0
Total	286	100.0	

5.3.6 Hours per Visit

The sixth question within the first section of the questionnaire focused on the hours that the respondents spend in the Main Library per visit. This part was divided into four (4) categories that can be summarized as following the first category was respondents who spend less than one (1) hour in the Main Library per visit, second one was respondents who spend one (1) to two (2) hours per visit, the third category was respondents who spend three (3) to four (4) hours per visit, and the last category was respondents who spend more than five (5) hours per visit to the Main Library. Table 5-7 shows that (45.5%) of respondents spent three (3) to four (4) hours in the Main Library every visit, and the first category, which was respondents who spent less than one (1) hour in the Main library per visit represents the lowest percentage with (1%), which equaled three (3) of the total respondents within this study.

Table 5-7: Hours per visit of the Main library

Hours per visit	Frequency	Percent	Cumulative Percent
<1h	3	1.0	1.0
1h-2h	53	18.5	19.6
3h-4h	130	45.5	65.0
>5h	100	35.0	100.0
Total	286	100.0	

5.3.7 Reasons of visiting the Main Library

Figure 5-1 elaborates the reasons beyond visiting the Main library. The majority of students considered doing assignments is the main reason of the visiting, where (209) respondents chose this reason. Looking for books; journals; and articles and studying for exams got similar selection from the respondents as reasons of visiting the Main library with (175) for books and journals, and (187) for studying for the exam. Moreover, (158) of respondents saw that the reason of visiting the Main Library was for surfing internet. Even though, group meeting was the least influenced cause to visit the Main Library.

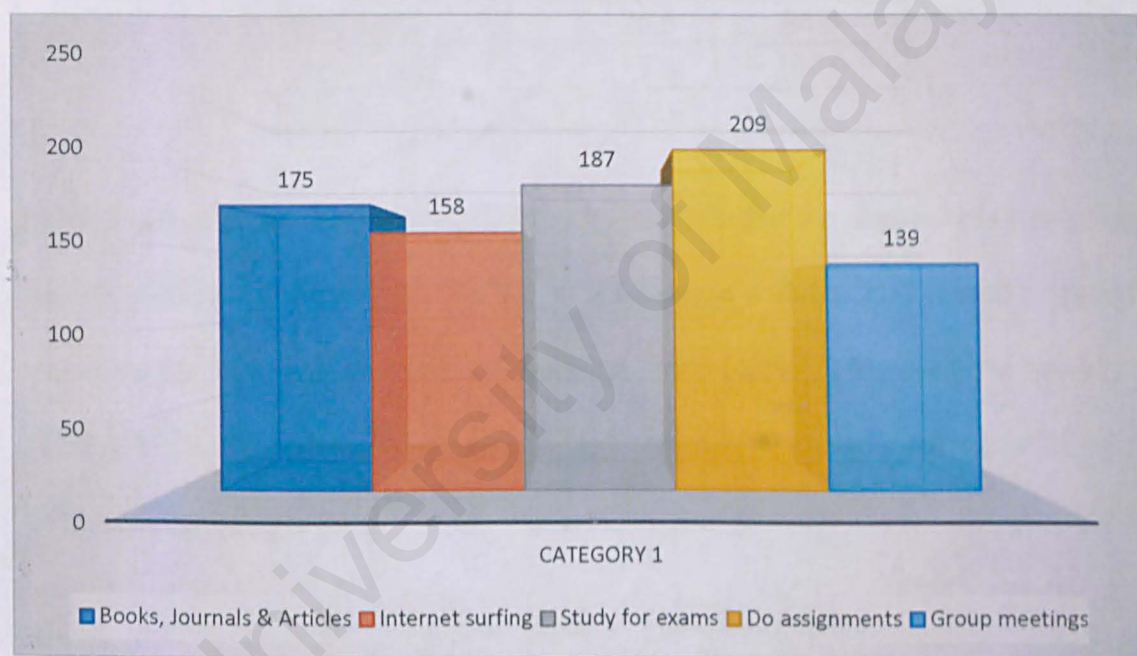


Figure 5-1: Reasons of visiting the Main Library

5.3.8 Use of different spaces within the Main Library

The last question within the general information section of the questionnaire clarifies the use of different spaces within the Main Library. In this question, the spaces in the Main Library are divided into five (5) categories, which are collaborative area; group study rooms; individual study carrels; quiet/ silent area; and PCs lab. Figure 5-2 illustrates the frequent uses of the spaces discussed above. In the term of collaborative area, Table 5-8

shows that the weekly use was the highest with (38.8%) of respondents, and the percent of respondents who utilized this area daily was (19.2%) and monthly was (26.6%). However, never use of this area was the lowest percentage with (15.4%) of respondents who participate in this study.

Table 5-8: Frequent use of Collaborative area

	Frequency	Percent	Cumulative Percent
Daily	55	19.2	19.2
Weekly	111	38.8	58.0
Monthly	76	26.6	84.6
Never	44	15.4	100.0
Total	286	100.0	

In the space of group study rooms, Table 5-9 describes that the respondents who have not used this area before symbolized the highest percentage with (46.2%) of total respondents, and the daily use was the lowest percentage with (4.2%). However, the weekly use equalized (22.7%) of total respondents and monthly use amounted (26.9%) of total respondents in this research.

Table 5-9: Frequent use of Group study rooms

	Frequency	Percent	Cumulative Percent
Daily	12	4.2	4.2
Weekly	65	22.7	26.9
Monthly	77	26.9	53.8
Never	132	46.2	100.0
Total	286	100.0	

Also, Table 5-10 shows that the respondents who have not used the individual study carrels are the highest with (31.1%), and the daily use of this area was the lowest with (17.5%).

Moreover, the weekly and monthly use of the individual study carrels were approximately similar with (29.4%) for weekly use and (22%) of monthly use of individual study carrels.

Table 5-10: Frequent use of Individual study carrels

	Frequency	Percent	Cumulative Percent
Daily	50	17.5	17.5
Weekly	84	29.4	46.9
Monthly	63	22.0	68.9
Never	89	31.1	100.0
Total	286	100.0	

In the quiet/ silent area, Table 5-11 manifests that the number of respondents who have not used this area is the lowest number, which is (13) respondents only with a percentage (4.5%) of total respondents. Even though, the daily and weekly use of the quiet/ silent area were approximately equal. The weekly use recorded the highest number of respondents with (40.6%) of the total, and the daily use equaled (33.9%) of total respondents. Otherwise, the percentage of respondents who use this area monthly was (21%).

Table 5-11: Frequent use of Quiet/ Silent area

	Frequency	Percent	Cumulative Percent
Daily	97	33.9	33.9
Weekly	116	40.6	74.5
Monthly	60	21.0	95.5
Never	13	4.5	100.0
Total	286	100.0	

Lastly, Table 5-12 shows that the number of respondents who have not used the PCs lab before is the highest, where they equal (126) respondents with a percentage (44.1%), and the number of respondents who use the PCs lab every day are the lowest number with a percentage of (7.7%). On the other hand, the number of respondents who use this area

weekly equal (49) of the total with a percentage (17.1%), and the percentage of respondents who use the PCs lab monthly is (31.1%) of total respondents.

Table 5-12: Frequent use of PCs lab

	Frequency	Percent	Cumulative Percent
Daily	22	7.7	7.7
Weekly	49	17.1	24.8
Monthly	89	31.1	55.9
Never	126	44.1	100.0
Total	286	100.0	

Figure 5-2 illustrates the frequent use of different spaces within the Main Library.

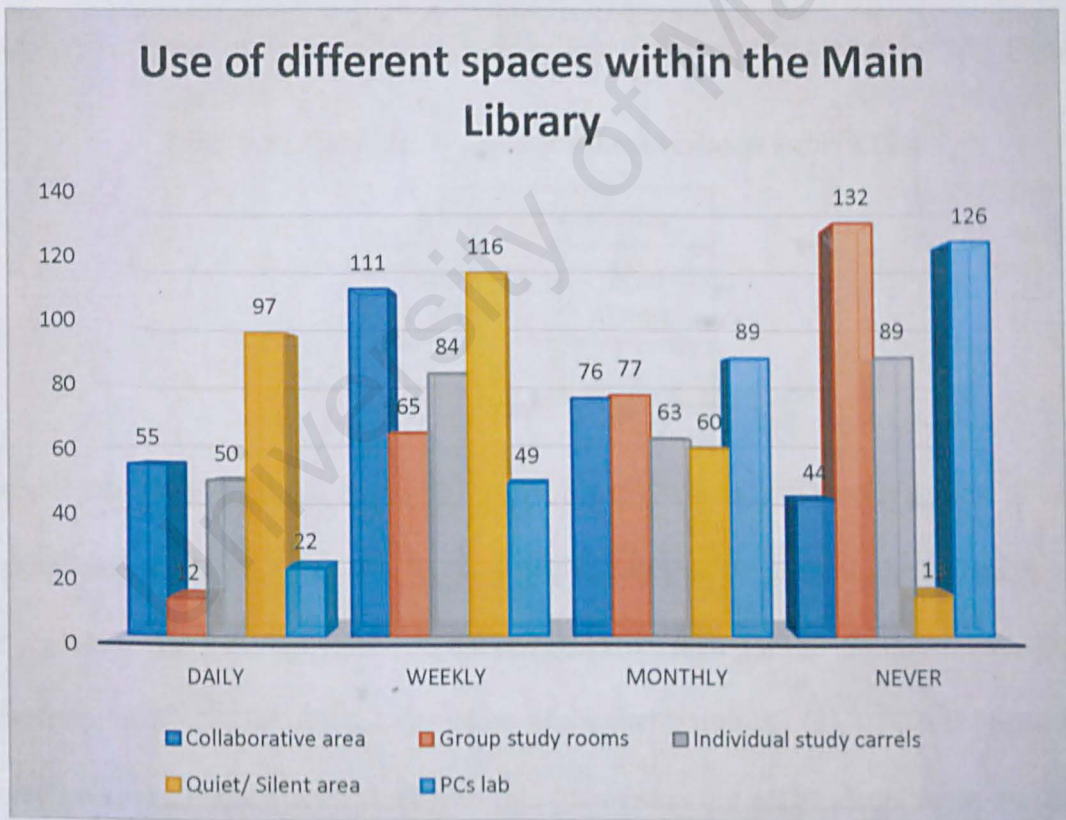


Figure 5-2: Frequent use of different spaces within the Main library

5.4 Satisfaction level regarding learning space within the Main library

The second section of the questionnaire was about measuring the satisfaction level within different learning spaces. This section included three (3) questions. The first question contained many factors to measure the satisfaction level of respondents within the collaborative area, the factors included in the second question measured the satisfaction level of respondents within quiet/ silent area, and the third question was to measure the satisfaction level of respondents within PCs lab.

5.4.1 Satisfaction level within collaborative area

From Table 5-13, the reliability equaled (0.81), so we can consider as measured by cronbach's Alpha for the satisfaction level within Collaborative area to be very good.

Table 5-13: Reliability Analysis of satisfaction level within COLA

Reliability Statistics	
Cronbach's Alpha	N of Items
0.809	9

From Table 5-14, the mean of the factor number (5), which is "There is a place to use own laptop" was the highest with (4.07), so the question that focused on the satisfaction level on a place to use own laptop within the collaborative area got the highest answer from the respondents. Moreover, the std. deviation of the factor number (3), which is "Space is too noisy" was the highest with (1.10), so this factor was the respondents most variable on, where they were the most spread out on as measured by std. deviation.

Table 5-14: Mean & Std. deviation of different factors contributed to the satisfaction level within collaborative area

Different factors	Mean	Std. Deviation	N
Availability to find space	3.35	1.091	286
Space is convenient	3.70	0.890	286
Space is too noisy	3.16	1.100	286
Interior design increases productivity	3.59	0.916	286
Furniture is comfortable	3.95	0.871	286
Furniture is movable	3.47	0.961	286
There is a place to use own laptop	4.07	0.868	286
Close to books	3.53	0.935	286
Near to printing facilities	2.66	1.030	286

Table 5-15 shows the average mean of total factors, which are nine (9) factors. The minimum mean is nine (9), if respondents answer all questions by strongly disagree, and the maximum mean is (45), if respondents answer all questions by strongly agree. According to Table 5-15, the average mean of factors was (31.48), so we can say that overall the respondents were approximately satisfied within the collaborative area.

Table 5-15: The average mean of the satisfaction level within collaborative area

Mean	Variance	Std. Deviation	N of Items
31.48	29.921	5.470	9

Table 5-16 explains if item deleted, what the alpha would have been if the item was not included in the scale, and we can know which is the item by looking at the last column, where the highest number mentions the factor that did not help in term of coefficient alpha.

In this study and according to Table 5-16, the factor that did not really contribute in the satisfaction level within Collaborative area was factor number nine (9), which is “Near to printing facilities”, so we can delete this question from the study.

Table 5-16: Cronbach's Alpha if Item Deleted related to collaborative area

Different factors	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Availability to find space	28.13	24.012	0.441	0.800
Space is convenient	27.78	22.259	0.818	0.752
Space is too noisy	28.32	23.341	0.506	0.791
Interior design increases productivity	27.89	27.606	0.153	0.830
Furniture is comfortable	27.53	22.657	0.785	0.757
Furniture is movable	28.01	23.789	0.555	0.784
There is a place to use own laptop	27.41	24.699	0.518	0.789
Close to books	27.95	22.594	0.726	0.762
Near to printing facilities	28.82	26.891	0.184	0.831

In Table 5-17, the factors contributed in the satisfaction level within the collaborative area are arranged starting from the factor that increase the satisfaction level to the factor that did not contribute too much in making the satisfaction level high. The most three factors that got the high answer from the respondents were there is a place to use own laptop, furniture is comfortable, and space is convenient with mean in order (4.07, 3.95, 3.70). The high level of satisfaction regarding place to use own laptop within collaborative area mentioned that the library provides a spacious space within collaborative area that helps

users to use their own laptops. Moreover, the respondents considered that the furniture provided in this area is good and convenient to sit for long time, and the reason beyond that is FM team inspect the building to find the improper furniture and maintain or change it regularly.

However, the majority of respondents were not satisfied in the term of whether the printing facilities are near to the collaborative area with mean equals (2.66), and the reason behind this unsatisfied is because the only printing facility in the library building located in the level 2, and contains just two (2) printing machines and one (1) computer. Students use collaborative area have to walk through quiet area at level three and level two to reach printing facilities, which is difficult for students and may cause noise for students use quiet area. Also, the satisfaction level of the level of noise within collaborative area was ranked as the eight (8) factor over the total factors, which are nine (9) factors. Some respondents supposed this area as a noisy area because the students work together in this area and the sound of groups will be higher, which affect the productivity of the students who want to study individually or need calmer to focus more on their study.

Table 5-17 shows that the std. deviation of the last three factors, which are find space, space is too noisy, and this area is near to printing facilities were the highest, where the results were in order (1.09, 1.1, and 1.03), and that means the variability of the answers that respondents gave for the question related to these factors was high. Even though, the variability of the answers of the factor focused on the place to use own laptop was the lowest because the std. deviation for this factor was the lowest with (0.868).

Table 5-18 shows that there is statically significant difference between different variables of satisfaction level within collaborative area because P-value is less than (0.05).

Table 5-17: Mean & Std. deviation of different factors orderly within collaborative area

Factors	Mean	Std. Deviation	Rank
There is a place to use own laptop	4.07	0.868	1
Furniture is comfortable	3.95	0.871	2
Space is convenient	3.70	0.890	3
Interior design increases productivity	3.59	0.916	4
Close to books	3.53	0.935	5
Furniture is movable	3.47	0.961	6
Availability to find space	3.35	1.091	7
Space is too noisy	3.16	1.100	8
Near to printing facilities	2.66	1.030	9

Table 5-18: Friedman test of different variables of satisfaction level within COLA

Test Statistics ^a	
N	286
Chi-Square	431.787
Df	8
Asymp. Sig.	.000

a. Friedman Test

From the open-ended question focused on the comments regarding collaborative area came from the respondents, the majority of feedbacks was that the respondents were unsatisfied with the number of plugs, so they asked for more plugs within the collaborative area. Moreover, the respondents suggested to add more tables and chairs to enhance the capacity of this area, and as mentioned before that the majority of respondents were unsatisfied with the term of printing facilities, the respondents requested more printing facilities near to collaborative area.

5.4.2 Satisfaction level within quiet/ silent area

Table 5-19, the reliability equaled (0.57), so we can consider it as measured by cronbach's Alpha for the satisfaction level within Collaborative area to be acceptable.

Table 5-19: Reliability Analysis of satisfaction level within quiet area

Reliability Statistics	
Cronbach's Alpha	N of Items
0.574	8

From Table 5-20, the mean of the factor number five (5), which is "There is a place to use own laptop" was the highest with (3.85), so the question that focused on the satisfaction level on a place to use own laptop within the quiet/ silent area got the highest answer from the respondents. Moreover, the std. deviation of the factor number eight (8), which is "Space is near to printing facilities" was the highest with (1.06), so this factor was the respondents most variable on, where they were the most spread out on as measured by std. deviation.

Table 5-20: Mean & Std. deviation of different factors contributed to the satisfaction level within quiet/ silent area

Different factors	Mean	Std. Deviation	N
Availability to find space	3.63	0.999	286
Space is convenient for individual study	3.99	0.803	286
Space is too noisy	3.74	0.992	286
Interior design increases productivity	3.48	0.881	286
Furniture is comfortable	3.70	0.899	286
There is a place to use own laptop	3.85	0.893	286
Close to books	3.52	0.897	286
Near to printing facilities	2.71	1.059	286

Table 5-21 displays the average mean of total factors, which are eight (8) factors. The minimum mean is eight (8), if respondents answer all questions by strongly disagree, and the maximum mean is (40), if respondents answer all questions by strongly agree. According to Table 5-21, the average mean of factors was (28.62), so we can say that overall the respondents were approximately satisfied within the collaborative area.

Table 5-21: The average mean of the satisfaction level within quiet/ silent area

Mean	Variance	Std. Deviation	N of Items
28.62	13.929	3.732	8

Table 5-22 demonstrates if item deleted, what the alpha would have been if the item was not included in the scale, and we can know which is the item by looking at the last column, where the highest number mentioned the factor that did not help in term of coefficient alpha. In this study and according to Table 5-22, the factor that did not actually contribute in the satisfaction level within Quiet/ Silent area was factor number nine (9), which is “Near to printing facilities”, so we can delete this question from the study to increase the coefficient alpha.

Therefore, if we remove the last factor, which is “this space near to printing facilities”, we can increase the value of cronbach’s alpha (Reliability), and make it reach the satisfied range, which is $(0.65 < \alpha < 0.95)$. Table 5-23 shows that the value of cronbach’s alpha or as called “reliability” increased, and the new value was (0.652), which is better than the previous one that equaled (0.574).

Table 5-22: Cronbach's Alpha if Item Deleted related to quiet/ silent area

Different factors	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Availability to find space	24.98	10.565	0.364	0.511
Space is convenient for individual study	24.63	9.960	0.655	0.430
Space is too noisy	24.87	9.924	0.484	0.467
Interior design increases productivity	25.13	12.481	0.108	0.591
Furniture is comfortable	24.92	11.801	0.214	0.561
There is a place to use own laptop	24.77	10.810	0.395	0.504
Close to books	25.09	11.784	0.218	0.560
Near to printing facilities	25.91	13.185	-0.049	0.652

Table 5-23: Reliability without printing facilities factor

Reliability Statistics	
Cronbach's Alpha	N of Items
0.652	7

In Table 5-24, the factors contributed in the satisfaction level within the quiet/ silent area are arranged starting from the factor that rise the satisfaction level to the factor that minimized the satisfaction level in this area and contributed to the dissatisfaction level. The most three factors that got the high feedback from the respondents were space is convenient for individual study more than collaborative area, there is a place to use own laptop, and space is too noisy with mean in order (3.99, 3.85, 3.74). The high level of

satisfaction regarding the convenient and quietness level within the quiet/ silent area indicated that the library has prepared this place in such a way as to ensure that it is suitable for students who wish to study in an individualized setting more than the collaborative area, as well as the term of design this place in a manner suitable for individual study. Furthermore, the respondents considered that the quiet/ silent area includes places to use own laptop, which means the FM team and Library staff succeed in managing this area, and provide specific spaces that enable the students to use their own laptops. Finally, the third factor that was one of the most factors contributed in the satisfaction level within quiet/ silent area was space is not noisy. The reason beyond that this area is not noisy is because the library provides a strict regulation that do not allow students who want to study together or do their discussion and group assignments to use this area that is specified for students who are looking for quietness to study or do their research efficiently and effectively.

However, the majority of respondents were not satisfied in term of easy to access printing facilities from quiet/ silent area with mean equals (2.71), and the reason behind this unsatisfied is because the only printing facility within the library building located in the level 2, and contains just two (2) printing machines and one (1) computer, where the quiet/ silent area is located in three levels within the library building, which are level two (2), three (3), and four (4). For instance, if student wants to print some papers and he sit at level four, he has to go down stair and walk through different space to reach printing facilities, which is uncomfortable situation. Also, the satisfaction level of the interior design of the quiet/ silent area was ranked as the seven (7) factor over the total factors, which are eight (8) factors. Some respondents supposed the interior design of this area does not help in increasing the productivity of students, and the reason beyond that is because this area is

designed traditionally, and the library does not look forward changing the interior design of this area and make it more creative to meet the students' perceptions and the recent development of the world in this era in the term of interior design, which aims to help raise the efficiency and effectiveness of the users of the place.

Table 5-24 indicates that the std. deviation of the factors, where factors such near to printing facilities, find space, and space is too noisy were the highest, where the results were in order (1.06, 0.999, & 0.992), and that means the variability of the answers that respondents gave for these questions was high. Even though, the variability of the answers of the factor focused on the convenient for individual study was the lowest because the std. deviation for this factor was the lowest with (0.803).

Table 5-24: Mean & Std. deviation of different factors orderly within quiet/ silent area

Different factors	Mean	Std. Deviation	Rank
Space is convenient for individual study	3.99	0.803	1
There is a place to use own laptop	3.85	0.893	2
Space is too noisy	3.74	0.992	3
Furniture is comfortable	3.70	0.899	4
Availability to find space	3.63	0.999	5
Close to books	3.52	0.897	6
Interior design increases productivity	3.48	0.881	7
Near to printing facilities	2.71	1.059	8

Table 5-25 shows that there is statically significant difference between different variables of satisfaction level within quiet/ silent area because P-value is less than (0.05).

Table 5-25: Friedman test of different variables of satisfaction level within Quiet area

Test Statistics ^a	
N	286
Chi-Square	315.052
df	7
Asymp. Sig.	.000

a. Friedman Test

From the open-ended question focused on the comments regarding quiet/ silent area came from the respondents, the majority of comments was that the respondents were unsatisfied with the number of plugs especially at level two (2), so they asked for more plugs within the quiet/ silent area. Moreover, the respondents stated that some chairs at third floor making noises when there is any movement of those who are using, and also some chairs were broken. Also, the respondents seek to make the interior design of the quiet/ silent area more productive.

5.4.3 Satisfaction level within PCs lab

From Table 5-26, the reliability equaled (-0.15), so we cannot use variables measure the satisfaction level in nonparametric tests or to measure the significance differences between a group of factors. Descriptive analysis will be utilized to gauge mean and std. deviation of each variables to determine satisfaction level within PCs lab.

Table 5-26: Reliability Analysis of satisfaction level within PCs lab

Reliability Statistics	
Cronbach's Alpha	N of Items
-.148	8

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

In Table 5-27, the factors contributed in the satisfaction level within the PCs lab are arranged starting from the factor that increase the satisfaction level to the factor that did not contribute too much in making the satisfaction level high. The most three factors that got the high answer from the respondents were space is convenient for individual study, computers meet my needs, and furniture is comfortable with mean in order (3.56, 3.39, 3.36). The high level of satisfaction regarding space is convenient for individual study within PCs lab mentioned that the library provides a quiet space within PCs lab that helps users to do their works productively. Moreover, the respondents considered that computers within the lab meet users' needs explained that the library provides the PCs lab by good computers to facilitate users in getting what they want. The respondents considered that the furniture provided in this area is good and convenient to sit for long time, and the reason beyond that is FM team inspect the building to find the improper furniture and maintain or change it regularly.

However, the majority of respondents were not satisfied in term of easy access of printing facilities from PCs lab with mean equals (2.65), and the reason behind this unsatisfied is because the only printing facility in the library building located in the level two (2), and contains just two (2) printing machines and one (1) computer. Additionally, the satisfaction level of space is convenient for group study within PCs lab was ranked as the seven (7) factor over the total factors, which are eight (8) factors. Some respondents supposed this area as inconvenient area for group study because the students could not work together, where some students consider the group study is more productive that individual style.

Table 5-27 shows that the standard deviation of the last three factors, which are find space, this area is near to printing facilities, and space is convenient for group study were the highest, where the results were in order (1.08, 1.05, and 1.04), and that means the variability of the answers that respondents gave for the question related to these factors was high. Even though, the variability of the answers of the factor focused on the space is convenient for individual study was the lowest because the std. deviation for this factor was the lowest with (0.948).

Table 5-27: Mean & Std. deviation of different factors orderly within PCs lab

Different factors	Mean	Std. Deviation	Rank
Space is convenient for Individual study	3.56	0.948	1
Computers meet my Needs	3.39	0.984	2
Furniture is comfortable	3.36	0.937	3
Space is too Noisy	3.36	1.018	4
Interior design increases Productivity	3.17	0.959	5
Availability to find space	2.85	1.076	6
Space is convenient for Group study	2.69	1.045	7
Near to Printing Facilities	2.65	1.049	8

From the open-ended question focused on the comments regarding PCs lab came from the respondents, the majority of feedbacks was that the respondents were unsatisfied with the number of computers, so they asked for increasing computers within the PCs lab. Moreover, the respondents suggested to increase the number of labs that can be used any time.

5.5 Satisfaction level regarding lighting, temperature, and humidity

The third section within the questionnaire is about the infrastructure facilities of library, which focuses more on three (3) main categories. The three (3) categories are lighting, thermal comfort which will be discussed in this section, and arrangement of different facilities within the Main Library building, which will be analyzed in section (5.5). The aim of this section is to measure the comfortable and satisfaction level of respondents with the lighting system, temperature, and relative humidity within different spaces.

5.5.1 Satisfaction level regarding lighting within different spaces

Table 5-28 demonstrates the satisfaction level of lighting within different spaces in the Main Library. The spaces in this table were arranged according to the level of satisfaction with the lighting from the area that received the highest level of satisfaction from the respondents and ending at the area that got the lowest level of satisfaction.

The minimum mean to each space was one (1) if all respondents considered the lighting in the space is poor, and the maximum mean was five (5) if all respondents rated the lighting in the space as an exceptional.

According to Table 5-28, the first three areas that got the higher level of satisfaction were open space in level four (4), open space in level three (3), and the individual study carrels in level (4) with mean in order (3.81, 3.80, & 3.79). However, the spaces that got the lowest level of satisfaction with lighting from the respondents were group study rooms, individual study carrels in level two (2), and open space in the ground floor with an amount of mean in order (3.72, 3.73, & 3.75). Therefore, the respondents think that the lighting system in these areas need to improve, and make it more better because lighting affect the users' comfort and productivity.

In the term of std. deviation, the std. deviation of the individual study carrels in level two (2) was the highest with (0.787), which means that this factor was the respondents most variable on where is the lighting poor as a worst level and exceptional as a better level of lighting, where they were the most spread out on as measured by std. deviation in Table 5-28.

Overall, the satisfaction level with lighting in all spaces within the Main Library rated as a good, and the majority of respondents were satisfied with the lighting system within the Library, but they are looking for more improvements to the system in some spaces.

Figure 5-3 shows that how the respondents answered the question related to the lighting within different spaces in the Main Library. The last part in the chart, which defines as a “not applicable” refers to the respondents who participant in this study, but they have not used the area for study before, so they were not able to rate the lighting system.

Table 5-28: Satisfaction level with lighting within different spaces

Different spaces	Mean	Std. Deviation	Rank
Open space/ level 4	3.81	.731	1
Open space/ level 3	3.80	.709	2
Individual study carrels/ level 4	3.79	.746	3
Individual study carrels/ level 3	3.78	.721	4
Collaborative area	3.78	.773	5
Open space/ level 2	3.75	.738	6
Open space/ ground floor	3.75	.686	7
Individual study carrels/ level 2	3.73	.787	8
Group study rooms	3.72	.780	9

From Figure 5-3, it is clear to see that the lighting within all spaces got a good level from the majority of respondents who are familiar with each space. Even though, the

respondents who rated the lighting system within the different spaces in the Main Library as a poor or substandard was a low number of respondents, where the percentage of respondents who rated the lighting system as a poor did not exceed (1.4%) from the total respondents, and who rated the lighting as a substandard did not exceed (4.5%) from the total respondents.

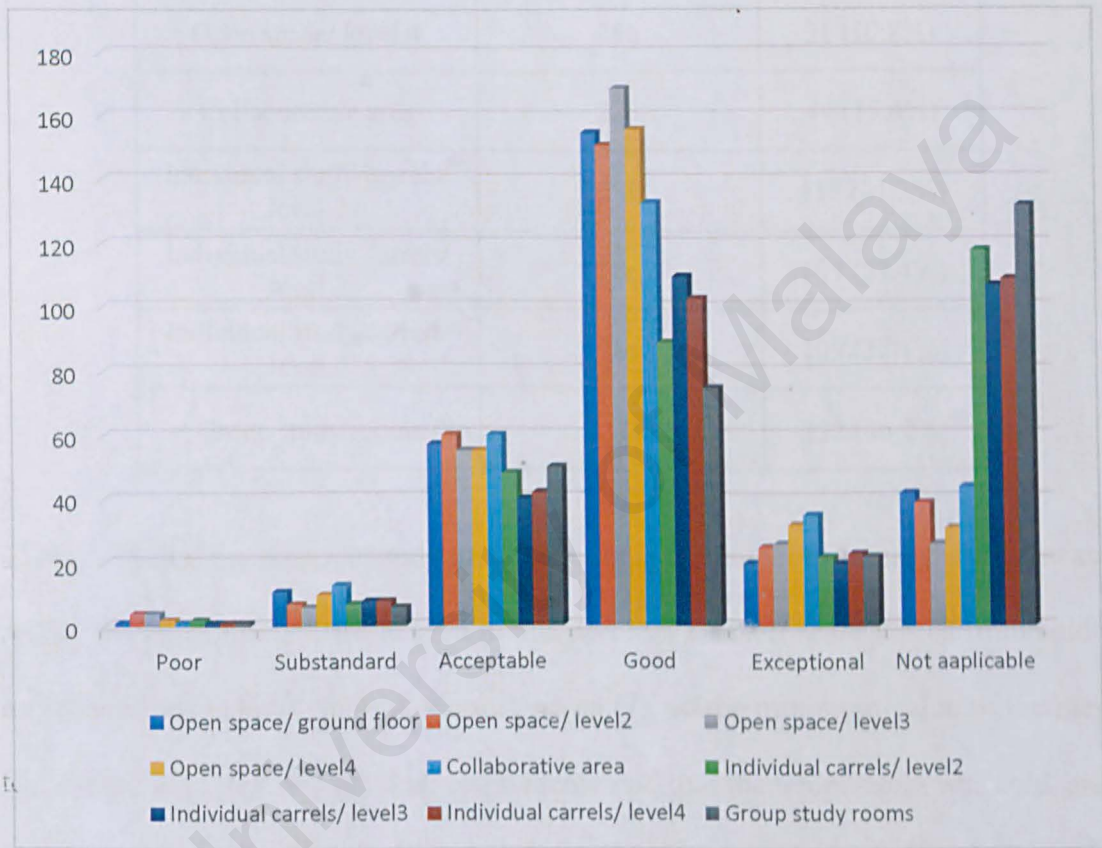


Figure 5-3: Classification of lighting by respondents within different spaces

5.5.2 Scale of temperature

Table 5-29 represents the respondents who have not used each space within the Main Library, so they were not able to decide whether the temperature was cold, hot, or between of them. The number of respondents who have not used a space differ from space to others, and these respondents would not be able to answer the following parts related to the temperature and humidity within different spaces, so they were considered missing in analysis the data related to temperature in this part and following parts.

Table 5-29: Respondents who have not used different spaces

Different spaces	Total respondents	Not applicable
Open space/ ground floor	286	42 (14.7%)
Open space/ level 2	286	39 (13.6%)
Open space/ level 3	286	26 (9.1%)
Open space/ level 4	286	31 (10.8%)
Collaborative area	286	44 (15.4%)
Individual study carrels/ level 2	286	118 (41.3%)
Individual study carrels/ level 3	286	107 (37.4%)
Individual study carrels/ level 4	286	109 (38.1%)
Group study rooms	286	132 (46.2%)

Table 5-30 explains who respondents feel about the current temperature in different spaces within the Main Library. Scale used in this part was a Likert scale started from cold with a number one (1) until hot with number seven (7), so the minimum value of the mean in each space would be one (1) if all respondents said that the temperature was cold, and the maximum value would be seven (7) if all respondents said that the temperature was hot. Table 5-30 arranged from the space that has a maximum mean regarding temperature and finishing with the space that has a minimum value of mean regarding temperature.

The three spaces that got a higher mean were collaborative area, group study rooms, and open space in ground floor. Whenever the mean increases, that means the space was considered warmer more than cooler. The mean of collaborative area equaled (3.66), which means the temperature within collaborative area was considered neutral. The group study rooms' mean equaled (3.13), so the temperature within group study rooms was deemed a

slightly cool according to the respondents. Moreover, the temperature within open space of ground floor was rated as a slightly cool because the mean was (3.04).

However, spaces that got the lowest mean were open spaces in level two (2), level three (3), and level four (4) with amount in order (2.59, 2.72, & 2.79). Therefore, the majority of respondents considered that the temperature within open space of level two (2) as a cool, and the temperature of the open space of level three (3) and four (4) as a cool to slightly cool.

In the column of std. deviation in Table 5-30, which elaborates the variability of each factor, it is clear that the scale of temperature in all spaces was variable on. Even though, the std. deviation of the temperature scale in the individual study carrels in level 3 was the highest with (1.38), so the respondents most variable on determine the temperature in this space.

Table 5-30: Scale of temperature within different spaces

Different spaces	Mean	Std. Deviation	Rank
Collaborative area	3.66	1.367	1
Group study rooms	3.13	1.224	2
Open space/ ground floor	3.04	1.101	3
Individual study carrels/ level 4	2.96	1.212	4
Individual study carrels/ level 3	2.89	1.376	5
Individual study carrels/ level 2	2.86	1.205	6
Open space/ level 4	2.79	1.130	7
Open space/ level 3	2.72	1.257	8
Open space/ level 2	2.59	1.133	9

5.5.3 Satisfaction level with temperature within different spaces

Table 5-31 explains the mean and std. deviation of the satisfaction level regarding temperature within different spaces in the Main Library that done by using the descriptive analysis. The spaces arranged in this table according to the highest mean got. The minimum mean of each space was one (1) when respondents chose “much too cool” to answer this question, and the maximum was seven (7) when respondents chose “much too warm” for determining the satisfaction level regarding temperature. However, when the respondents chose number four (4), which is comfortable, it means the respondents were satisfied with current temperature.

Collaborative area, group study rooms, and open space in ground floor were got the highest mean with amount in order (3.85, 3.47, & 3.42). Therefore, the majority of respondents considered that the current temperature within collaborative area was comfortable, and this area was the best area for students regarding the temperature. Moreover, the temperature within the group study rooms and open space in ground floor were considered comfortably cool to comfortable according to the majority of respondents participated in this research. However, the satisfaction level regarding temperature within open space in level two (2) had the lowest mean (3.08), but was still considered as a comfortably cool.

From Table 5-30, which elucidates the scale of temperature, and Table 5-31, it is evident to see that the majority of respondents considered the temperature as a comfortably cool and comfortable in all spaces within the building, which means that the respondents feel that sometimes the temperature was cooler than what should be in some spaces.

Table 5-31: Satisfaction level with temperature within different spaces

Different spaces	Mean	Std. Deviation	Rank
Collaborative area	3.85	1.132	1
Group study rooms	3.47	1.030	2
Open space/ ground floor	3.42	.850	3
Individual study carrels/ level 4	3.32	.936	4
Individual study carrels/ level 2	3.27	.944	5
Individual study carrels/ level 3	3.25	1.064	6
Open space/ level 3	3.24	1.079	7
Open space/ level 4	3.23	.942	8
Open space/ level 2	3.08	.970	9

Figure 5-4 explain how respondents feel about the temperature and the satisfaction or comfortable level regarding current temperature. From the figure, we can see that the percentage of respondents who rated the temperature as a “much too warm” does not exceed (0.3%) even the temperature was not rated as a “much too warm” in most spaces within the library. Moreover, (9.1%) of respondents rated the temperature as a “too warm” within the collaborative area, which was the highest percent among the different spaces. However, (37.3%) was the lowest percent among spaces to rate the temperature as a “comfortable”, which was in the open space in level three (3), and (29.3%) was the lowest percent among spaces to rate the temperature as a “comfortably cool” in collaborative area. Even though, in collaborative area, (10.7%) of respondents rated the temperature as a “too warm”, and (12.8%) of respondents rated the temperature as a “comfortably warm”, so this

area was the respondents most variable on choosing the comfortable level, where they were the most spread out on as measured by std. deviation on Table 5-30.

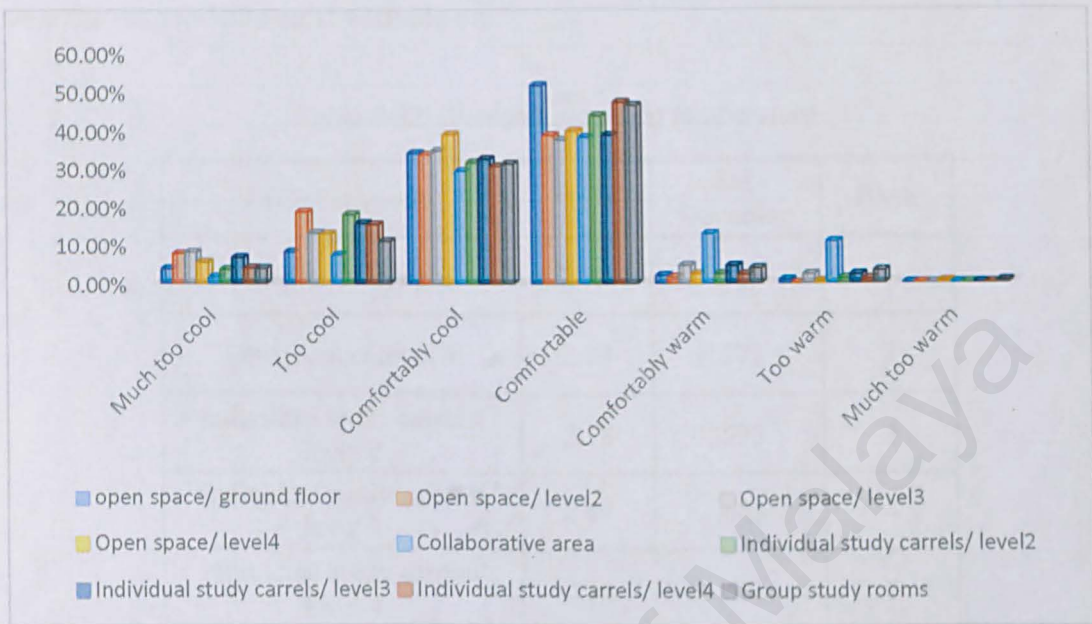


Figure 5-4: Classification of current temperature within different spaces

5.5.4 Changed regarding temperature

Table 5-32 represents the change that should happen regarding to the temperature within different spaces in the building from the respondents' perspective. In this case, the mean was either equal to one (1) in case of all respondents desired to make the temperature cooler than before, two (2) in case of all respondents thought that there is no need to change the temperature, or three (3) in case of all respondents craved to make the temperature warmer.

From Table 5-32, the mean of changed regarding temperature within open space in level two (2) was the highest with (2.32) and the (std.=0.575), which means the majority of respondents did not think there is any need to change the temperature within this space, but a good number of respondents believed that the temperature should be warmer. However, changed temperature regarding collaborative area were got the lowest mean and highest std. deviation (M=1.79, std.=0.65), which means that there were a huge number of

respondents who want to make the temperature within this area cooler than before, and according to the std. deviation, the answers about changed temperature within this area were the respondents most variable on.

Table 5-32: Changed regarding temperature

Different spaces	Mean	Std. Deviation	Rank
Open space/ level 2	2.32	.575	1
Open space/ level 4	2.19	.572	2
Individual study carrels/ level 2	2.18	.593	3
Individual study carrels/ level 3	2.17	.643	4
Individual study carrels/ level 4	2.16	.601	5
Open space/ level 3	2.14	.614	6
Group study rooms	2.10	.592	7
Open space/ ground floor	2.07	.462	8
Collaborative area	1.79	.647	9

From Figure 5-5, the decisions regarding change temperature within collaborative area were divided into “cooler” with (33.9%) and “no change” with (53.7%) of total respondents. In addition, there was a clear variability in the answers regarding open space in level two (2) between “no change” and “warmer”, where the respondents whose desire to keep the temperature unchanged (57.1%), and the respondents who wanted to make the temperature cooler (37.2%).

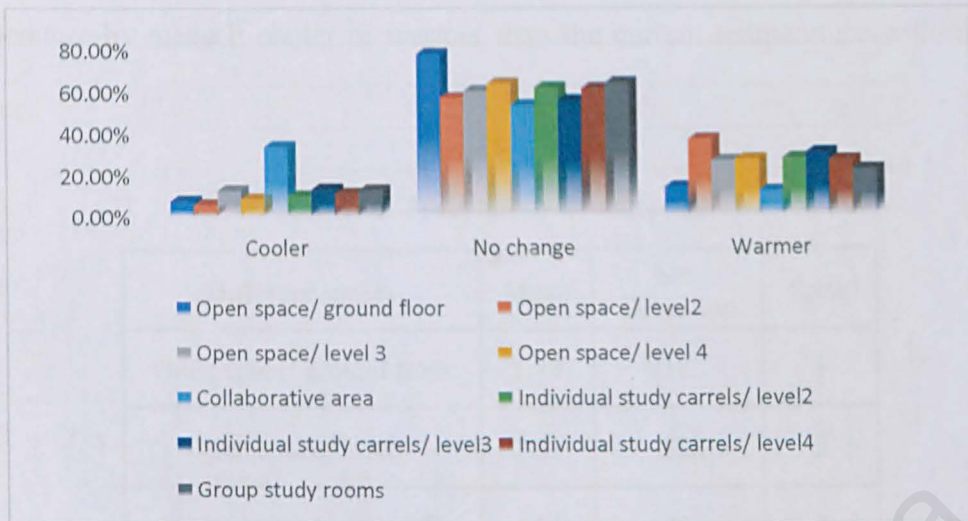


Figure 5-5: Changed regarding temperature

5.5.5 Acceptability of temperature

Table 5-33 shows the overall level of acceptability regarding to current temperature within different spaces in the building. The range of mean in this table is one (1), where the minimum value of mean equals one (1) and the maximum is two (2). If the mean equaled one (1), that means the temperature were not acceptable according to the answer of all respondents. However, if all respondents accepted the current temperature, the mean would equal two (2).

From Table 5-33, the mean in different spaces was between ($M=1.82$) within open space in ground floor and ($M=1.70$) within collaborative area and individual study carrels in level two (2), which means that the majority of respondents were overall satisfied with current temperature.

Even though, the level of acceptability of current temperature got from the respondents within different spaces in the Main Library did not mean that there is no need to change the temperature in some areas. That means the majority of the respondents adapted with the current temperature and considered it acceptable, but they look ahead to improve the

temperature by make it cooler or warmer than the current temperature within different spaces.

Table 5-33: Acceptability of temperature

Different spaces	Mean	Std. Deviation	Rank
Open space/ ground floor	1.82	.382	1
Open space/ level 4	1.81	.392	2
Group study rooms	1.81	.397	3
Individual study carrels/ level 4	1.79	.408	4
Open space/ level 2	1.77	.420	5
Open space/ level 3	1.77	.420	6
Individual study carrels/ level 3	1.73	.444	7
Collaborative area	1.70	.458	8
Individual study carrels/ level 2	1.70	.459	9

Figure 5-6 shows the overall acceptability of the temperature within different spaces in the Main library. The percentage of respondents who considered the temperature acceptable within open space in ground floor was the highest (82.40%), and the lowest percentage was (70.20%) within collaborative area and individual study carrels in level two (2). Even though, the percentage of respondents who believed that the temperature not acceptable did not exceed (30.00%), where the highest percentage was within collaborative area and individual study carrels in level two (2) with (29.80%).

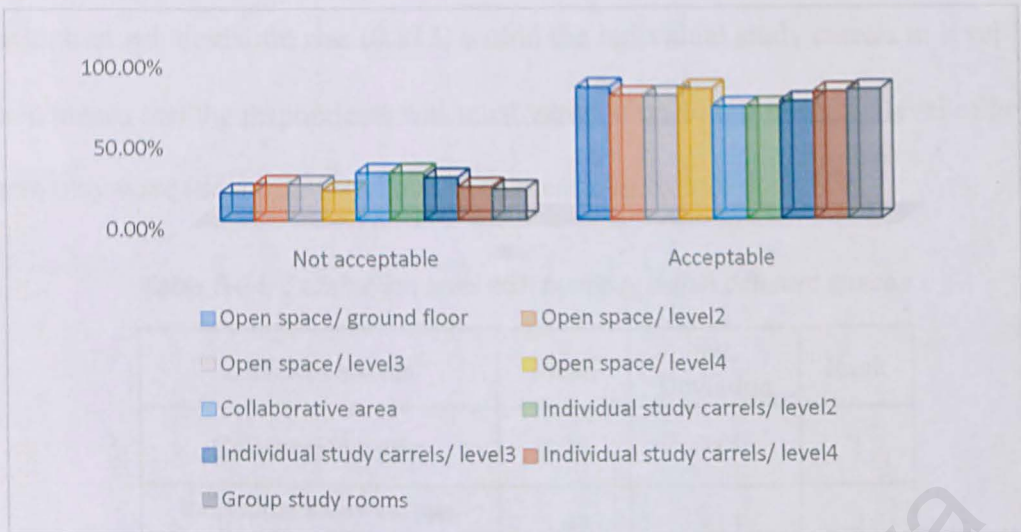


Figure 5-6: Acceptability of current temperature

5.5.6 Satisfaction level regarding humidity within different spaces

Table 5-34 represents the satisfaction level with humidity within different spaces in the Main Library. This table explains the mean and std. deviation of the level of comfortable regarding humidity within different spaces, and these spaces arranged in this table regarding to the highest mean. The mean would be one (1) if all respondents considered the humidity is “much too dry”, seven (7) if all respondents chose “much too humid” to mention the humidity, and the mean would equal four (4) if all respondents considered the humidity is “just right”.

Collaborative area, individual study carrels in level two (2), and individual study carrels in level four (4) got the highest amount of mean with (3.94, 3.93, & 3.92), which means the majority of respondents believed that the humidity within these areas was almost “just right”. Therefore, the respondents were satisfied with the level of humidity within these areas. However, the lowest mean of humidity was within open space in ground floor with (3.86), which also means that the majority of respondents were almost satisfied with the humidity within this area.

The highest std. deviation was (0.813) within the individual study carrels in level two (2), which means that the respondents was most variable on determining the level of humidity, where they were the most spread out on as measured by std. deviation.

Table 5-34: Satisfaction level with humidity within different spaces

Different spaces	Mean	Std. Deviation	Rank
Collaborative area	3.94	.715	1
Individual study carrels/ level 2	3.93	.813	2
Individual study carrels/ level 4	3.92	.765	3
Open space/ level 4	3.92	.724	4
Open space/ level 2	3.88	.745	5
Open space/ level 3	3.87	.716	6
Individual study carrels/ level 3	3.87	.807	7
Group study rooms	3.87	.764	8
Open space/ ground floor	3.86	.664	9

5.6 Satisfaction level with arrangement of different facilities within the building

From Table 5-35, the reliability is (0.75), so we can consider it as measured by Cronbach's alpha for the satisfaction level with arrangement of different facilities within the main library to be good.

Table 5-35: Reliability analysis of satisfaction level regarding arrangement of different facilities

Reliability Statistics	
Cronbach's Alpha	N of Items
0.753	5

From Table 5-36, the mean of the factor number two (2), which is “Shelves of books & journals” was the highest with (3.63), so the question that focuses on the satisfaction level with arrangement of the shelves of books and journals got the highest answer from the respondents. Moreover, the std. deviation of the factor number five (5), which is “Drink/ Snack area” was the highest with (1.03), so this factor was the respondents most variable on, where they were the most spread out on as measured by std. deviation.

Table 5-36: The mean & std. deviation for different factors contributed to satisfaction level with arrangement of different facilities

Different facilities	Mean	Std. Deviation	N
Interaction area	3.55	0.788	286
Shelves of books & journals	3.63	0.810	286
Printing facilities	2.77	1.014	286
Toilets	3.50	0.983	286
Drink/ Snack area	3.09	1.025	286

Table 5-37 displays the average mean of total factors, which are five (5) factors. The minimum mean would be five (5), if respondents answered all questions by strongly disagree, and the maximum mean would be (25), if respondents answered all questions by strongly agree. According to table (average), the average mean of factors was (16.53), so we can say that overall the respondents were approximately neutral with the arrangement of different facilities within the building.

Table 5-37: The average mean of satisfaction level with arrangement of different facilities with Main Library

Mean	Variance	Std. Deviation	N of Items
16.53	10.875	3.298	5

Table 5-38 demonstrates if item deleted, what the alpha would have been if the item was not included in the scale, and we can know which is the item by looking at the last column, where the highest number mentions the factor that did not help in term of coefficient alpha. In this study and according to Table 5-38, the factor that did not actually contribute to the satisfaction level with arrangement of different facilities was factor number four (4), which is “Toilets”, so we can delete this question from the study.

Table 5-38: Cronbach's Alpha if Item Deleted related to arrangement of different facilities

Different facilities	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Interaction area	12.98	7.943	0.520	0.712
Shelves of books & journals	12.90	7.520	0.607	0.683
Printing facilities	13.76	6.968	0.537	0.703
Toilets	13.03	7.785	0.387	0.758
Drink/ Snack area	13.44	6.731	0.581	0.685

In Table 5-39, factors contributed in the satisfaction level with arrangement of different facilities within the Main Library building were arranged from the highest mean until the lowest. The arrangement of shelves of books and journals got the highest mean (3.63), which means that the majority of respondents were satisfied with the arrangement of shelves of books and journals. Even though, the arrangement of printing facilities got the lowest mean (2.77), which means that the majority of respondents were almost dissatisfied with the arrangement of printing facilities.

The std. deviation of the arrangement of printing facilities and drink/ snack area were the highest with (1.014, & 1.025), which mean these two factors were the respondents most variable on, where they were most spread out on as measured by std. deviation.

Table 5-39: Mean & Std. deviation of different factors orderly regarding arrangement different facilities

Different facilities	Mean	Std. Deviation	Rank
Shelves of books & journals	3.63	.810	1
Interaction area	3.55	.788	2
Toilets	3.50	.983	3
Drink/ Snack area	3.09	1.025	4
Printing facilities	2.77	1.014	5

5.7 Relationship between level of study and use of different spaces

Table 5-40 shows that there was a statistically significant difference in use of collaborative area and PCs lab among level of study because ($P < 0.05$), while there was not significant difference in use of other areas among level of study.

Table 5-41 represents the relationship between the level of study and the use of different spaces within the Main Library. The mean whether equals one (1) if the students used the area or zero (0) if students did not use it. From the table, it is clear to see that the mean of bachelor students who used the collaborative area was (0.92), which means (92%) of total of bachelor students, and the percentage of master students used collaborative area was (78%). Even though, the percentage of Ph.D students who used the collaborative area did not exceed (70%) with ($M=0.67$), which equaled (9.1%) of total students used this area.

In the term of the use of group study rooms, (75%) of diploma students used this area with (M=0.75). However, (61.7%) of total students used this area was bachelor students with (M=0.58, & std.= 0.496). Even though, less than (50%) of postgraduate students used the group study rooms, where the mean and std. of master students were (M=0.48, & std.=0.503), and the mean and std. of Ph.D students equaled (M=0.48, & std.=0.508). Therefore, the percentage of postgraduate students who utilized this area did not exceed (35%) of total users.

Moreover, Ph.D students who used the individual study carrels was (76%) of total Ph.D students, and (73%) of master students used this area. However, less than (50%) of foundation students used this area with (M=0.45, & std.=0.522). The use of the quiet/ silent area was almost (100%), where (94%) of bachelor students was the less percentage of students who used this area.

Lastly, postgraduates were the most use of PCs lab, where the mean and std. of masters (M=0.75, & std.=0.434) and Ph.D (M=0.61, & std.=0.496), but less than (50%) of bachelor students used PCs lab with (M=0.48).

Table 5-40: Kruskal-Wallis Test of relationship between level of study and use of different spaces

Test Statistics ^{a,b}					
	Use of collaborative area	Use of group study rooms	Use of individual study carrels	Use of quiet/ silent area	Use of pcs lab
Chi-Square	22.070	3.348	4.270	3.180	17.774
Df	4	4	4	4	4
Asymp. Sig.	.000	.501	.371	.528	.001

a. Kruskal Wallis Test

b. Grouping Variable: Level of Study

Table 5-41: Relationship between level of study & use of different spaces

Level of study		Use of collaborative area	Use of group study rooms	Use of individual study carrels	Use of quiet/silent area	Use of PCs lab
Bachelor	Mean	0.92	0.58	0.67	0.94	0.48
	N	165	165	165	165	165
	Std. Deviation	0.270	0.496	0.471	0.239	0.501
Master	Mean	0.78	0.48	0.73	0.96	0.75
	N	73	73	73	73	73
	Std. Deviation	0.417	0.503	0.449	0.200	0.434
Ph.D	Mean	0.67	0.48	0.76	1.00	0.61
	N	33	33	33	33	33
	Std. Deviation	0.479	0.508	0.435	0.000	0.496
Foundation	Mean	0.64	0.45	0.45	1.00	0.45
	N	11	11	11	11	11
	Std. Deviation	0.505	0.522	0.522	0.000	0.522
Diploma	Mean	1.00	0.75	0.75	1.00	0.25
	N	4	4	4	4	4
	Std. Deviation	0.000	0.500	0.500	0.000	0.500
Total	Mean	0.85	0.54	0.69	0.95	0.56
	N	286	286	286	286	286
	Std. Deviation	0.361	0.499	0.464	0.209	0.497

5.8 Differences in satisfaction level within different spaces among level of study

Investigation on the distinctions in the level of satisfaction level within various spaces in the Main Library among the level of study is done utilizing Kruskal-Wallis test to decide among which bunches the genuine contrasts lie in light of the way that the individual factors are normally distributed. The outcomes are introduced and examined in the succeeding segments.

5.8.1 Comparison satisfaction level within collaborative area among level of study

Table 5-42 shows that there was statically not significant difference in satisfaction level with different variables within collaborative area among level of study.

Table 5-42: Kruskal-Wallis Test of satisfaction level within COLA among level of study

Test Statistics ^{a,b}			
	Chi-Square	df	Asymp. Sig.
Find space	1.071	4	0.899
Space is convenient	5.455	4	0.244
Space is too noisy	1.966	4	0.742
Interior design increases productivity	7.633	4	0.106
Furniture is comfortable	5.113	4	0.276
Furniture is movable	1.230	4	0.873
There is a place to use own laptop	2.321	4	0.677
Close to books	4.398	4	0.355
Near to printing facilities	4.590	4	0.332

a. Kruskal Wallis Test

b. Groping Variable: Level of Study

Table 5-43 presents the outcomes of the comparison of mean among various levels of study. In the satisfaction level with find space, diploma students were more satisfied with mean (M=3.50). however, foundation and master students were less satisfied with mean (M=3.27). In the term of if the space is convenient, diploma students were most satisfied (M=4.25), but foundation students were less satisfied (M=3.45). Moreover, foundation students considered collaborative area as a noisy area with (M=2.82), where other students considered this area was not noisy and even was not quiet. In the part of interior design

increases the productivity, bachelor students were more satisfied ($M=3.70$), and diploma students were less satisfied ($M=3.00$). Furthermore, diploma students were more satisfied in the term of furniture is comfortable and movable ($M=4.25, 3.75$), and foundation students were less satisfied ($M=3.55, 3.27$). In the factor of there is a place to use own laptop, bachelor students were most satisfied ($M=4.12$), while diploma students were most satisfied with this area is close to books ($M=4.00$). Finally, students from different levels of study were unsatisfied with the term of this area is near to printing facilities, and diploma students were most unsatisfied with ($M=2.25$).

Table 5-43: Mean & Std. Deviation of satisfaction level within COLA among level of study

Different factors		Bachelor	Master	Ph.D	Foundation	Diploma	Total
	N	165	73	33	11	4	286
Find space	Mean	3.38	3.27	3.42	3.27	3.50	3.35
	Std. Deviation	1.117	1.083	1.062	0.905	1.291	1.091
Space is convenient	Mean	3.76	3.63	3.61	3.45	4.25	3.70
	Std. Deviation	0.891	0.890	0.899	0.820	0.957	0.890
Space is too noisy	Mean	3.18	3.12	3.27	2.82	3.25	3.16
	Std. Deviation	1.120	1.142	1.008	0.874	0.957	1.100
Interior design increases productivity	Mean	3.70	3.48	3.52	3.09	3.00	3.59
	Std. Deviation	0.879	1.002	0.795	1.044	0.816	0.916
Furniture is comfortable	Mean	4.01	3.89	3.85	3.55	4.25	3.95
	Std. Deviation	0.811	0.951	0.972	0.820	0.957	0.871
Furniture is movable	Mean	3.50	3.49	3.33	3.27	3.75	3.47
	Std. Deviation	0.979	0.915	1.051	0.786	0.957	0.961
There is a place to use own laptop	Mean	4.12	3.99	4.06	4.09	3.75	4.07
	Std. Deviation	0.844	0.935	0.899	0.831	0.500	0.868
Close to books	Mean	3.59	3.48	3.36	3.27	4.00	3.53
	Std. Deviation	0.930	0.959	0.929	0.786	1.155	0.935
Near to printing facilities	Mean	2.58	2.84	2.76	2.45	2.25	2.66
	Std. Deviation	1.071	0.958	1.032	0.934	0.500	1.030

5.8.2 Comparison satisfaction level within quiet/ silent area among level of study

Table 5-44 elaborates that the that there was statically not significant difference in satisfaction level with different variables within quiet/ silent area among level of study except “find space” variable, where there was statically significant difference among level of study because P-value less than (0.05).

Table 5-44: Kruskal-Wallis Test of satisfaction level within quiet/ silent area among level of study

Test Statistics ^{a,b}			
	Chi-Square	df	Asymp. Sig.
Find space	11.444	4	0.022
Space is convenient for individual study	4.332	4	0.376
Space is too noisy	2.932	4	0.569
Interior design increases productivity	3.617	4	0.460
Furniture is comfortable	4.795	4	0.309
There is a place to use own laptop	5.117	4	0.276
Close to books	3.777	4	0.437
Near to printing facilities	2.678	4	0.613

a. Kruskal Wallis Test

b. Groping Variable: Level of Study

Table 5-45 represents the results of the comparison of mean among numerous levels of study. In the satisfaction level with find space, Ph.D students were more satisfied with mean (M=3.75). however, diploma students were not satisfied and even unsatisfied with mean (M=3.00). in the term of if the space is convenient for individual study, master students were most satisfied (M=4.11), but diploma students were less satisfied (M=3.75). Also, students from different levels of study did not consider the quiet/ silent area as a noisy space. In the part of interior design increases the productivity, bachelor and Ph.D students were more satisfied (M=3.55), and diploma students were less satisfied (M=3.00). Moreover, bachelor students were more satisfied in the term of furniture is comfortable

(M=3.76), and diploma students were less satisfied (M=3.00). In the factor of there is a place to use own laptop, Ph.D students were most satisfied (M=3.97), while diploma students were most satisfied with this area is close to books (M=3.75). Finally, students from different levels of study were unsatisfied with the term of this area is near to printing facilities, and master students were most unsatisfied with (M=2.55), while diploma students did not consider this area is near to printing facilities or not.

Table 5-45: Mean & Std. Deviation of satisfaction level within quiet area among level of study

Different factors		Bachelor	Master	Ph.D	Foundation	Diploma	Total
	N	165	73	33	11	4	286
Find space	Mean	3.56	3.75	3.97	3.09	3.00	3.63
	Std. Deviation	1.026	0.954	0.847	1.044	0.816	0.999
Space is convenient for individual study	Mean	3.93	4.11	4.06	3.82	3.75	3.99
	Std. Deviation	0.835	0.809	0.659	0.603	0.957	0.803
Space is too noisy	Mean	3.68	3.86	3.88	3.55	3.75	3.74
	Std. Deviation	1.036	0.962	0.893	0.820	0.957	0.992
Interior design increases productivity	Mean	3.55	3.37	3.55	3.27	3.00	3.48
	Std. Deviation	0.822	0.979	1.003	0.647	0.816	0.881
Furniture is comfortable	Mean	3.76	3.58	3.70	3.73	3.00	3.70
	Std. Deviation	0.847	0.927	1.045	1.009	0.816	0.899
There is a place to use own laptop	Mean	3.80	3.95	3.97	3.64	3.50	3.85
	Std. Deviation	0.905	0.911	0.847	0.809	0.577	0.893
Close to books	Mean	3.57	3.42	3.58	3.18	3.75	3.52
	Std. Deviation	0.892	0.832	1.062	0.874	0.957	0.897
Near to printing facilities	Mean	2.75	2.55	2.82	2.64	3.00	2.71
	Std. Deviation	1.056	1.041	1.185	0.924	0.816	1.059

5.9 Comparison satisfaction level regarding lighting among level of study

From Table 5-46, the reliability is (0.66), so we can consider it as measured by Cronbach's alpha for the satisfaction level with lighting within the main library to be satisfied.

Table 5-46: Reliability Analysis of satisfaction level regarding lighting

Reliability Statistics	
Cronbach's Alpha	N of Items
.661	9

Table 5-47 highlights that there was not statically significant because P-Value more than (0.05) in satisfaction level with lighting among level of study.

Table 5-47: Kruskal-Wallis Test of satisfaction level with lighting among level of study

Test Statistics ^{a,b}			
	Chi-Square	df	Asymp. Sig.
Ground floor	5.892	4	0.207
Open space level 2	0.216	4	0.995
Open space level 3	1.134	4	0.889
Open space level 4	5.948	4	0.203
Collaborative area	3.242	4	0.518
Individual carrels level 2	4.855	4	0.302
Individual carrels level 3	1.881	4	0.758
Individual carrels level 4	1.043	4	0.903
Group study rooms	2.072	4	0.722

- a. Kruskal Wallis Test
- b. Groping Variable: Level of Study

Table 5-48 explains the results of the comparison of mean among different levels of study. In the satisfaction level with lighting at ground floor, bachelor and Ph.D students were most satisfied with mean (M=3.79). Master students were more satisfied with lighting on open space at level two (2) (M=3.80). Moreover, foundation students were most satisfied with lighting on open space at level three (3) (M=3.91), while diploma students were most satisfied with lighting on open space at level four (4) (M=4.33). In collaborative area, master students were most satisfied with (M=3.82). Also, bachelor students were very satisfied with lighting on individual carrels at level two (2) (M=3.77), while Ph.D students were exceedingly satisfied on individual carrels at level three (3) (M=3.91), and diploma students

were more satisfied on individual carrels at level four (4) (M=4.00). Finally, diploma students were most satisfied on group rooms with (M=4.00).

Table 5-48: Mean & Std. Deviation of satisfaction level with lighting among level of study

Different spaces		Bachelor	Master	Ph.D	Foundation	Diploma	Total
Ground floor	N	144	60	28	9	3	244
	Mean	3.79	3.65	3.79	3.78	3.00	3.75
	Std. Deviation	0.678	0.633	0.738	0.833	1.000	0.686
Open space level 2	N	137	65	30	11	4	247
	Mean	3.74	3.80	3.73	3.73	3.75	3.75
	Std. Deviation	0.770	0.733	0.740	0.467	0.500	0.738
Open space level 3	N	149	63	33	11	4	260
	Mean	3.82	3.76	3.76	3.91	3.50	3.80
	Std. Deviation	0.726	0.615	0.830	0.539	1.000	0.709
Open space level 4	N	145	64	32	11	3	255
	Mean	3.83	3.69	3.81	4.09	4.33	3.81
	Std. Deviation	0.739	0.774	0.644	0.539	0.577	0.731
Collaborative area	N	152	57	22	7	4	242
	Mean	3.76	3.82	3.77	3.43	4.25	3.78
	Std. Deviation	0.752	0.805	0.869	0.787	0.500	0.773
Individual carrels level 2	N	98	40	24	3	3	168
	Mean	3.77	3.75	3.63	3.00	3.67	3.73
	Std. Deviation	0.797	0.809	0.770	0.000	0.577	0.787
Individual carrels level 3	N	100	50	22	4	3	179
	Mean	3.75	3.80	3.91	3.50	4.00	3.78
	Std. Deviation	0.796	0.639	0.610	0.577	0.000	0.721
Individual carrels level 4	N	100	48	21	5	3	177
	Mean	3.80	3.79	3.67	3.80	4.00	3.79
	Std. Deviation	0.765	0.743	0.730	0.447	1.000	0.746
Group rooms	N	95	35	16	5	3	154
	Mean	3.68	3.80	3.81	3.40	4.00	3.72
	Std. Deviation	0.775	0.797	0.834	0.548	1.000	0.780

5.10 Comparison satisfaction level regarding temperature among level of study

From Table 5-49, the reliability is (0.69), so we can consider it as measured by Cronbach's alpha for the satisfaction level with lighting within the main library to be satisfied.

Table 5-49: Reliability Analysis of satisfaction level regarding temperature

Reliability Statistics	
Cronbach's Alpha	N of Items
.686	9

Table 5-50 shows that there was statically not significant because P-Value more than (0.05) in satisfaction level with temperature among level of study.

Table 5-51 explains the outcomes of the comparison of mean among different levels of study. In the satisfaction level with temperature at ground floor, foundation students were most satisfied with mean (M=3.89). Diploma students were more satisfied with temperature on open space at level two (2) (M=3.50). Furthermore, Ph.D students were most satisfied with temperature on open space at level three (3) (M=3.58), while foundation students were most satisfied with temperature on open space at level four (4) (M=3.55). In collaborative area, diploma students were most satisfied with (M=4.25). Also, diploma students were very satisfied with temperature on individual carrels at level two (2) (M=4.00), while Ph.D students were exceedingly satisfied on individual carrels at level three (3) (M=3.59), and diploma students were more satisfied on individual carrels at level four (4) (M=4.00). Finally, diploma students were most satisfied on group rooms with (M=4.00).

Table 5-50: Kruskal-Wallis Test of satisfaction level with temperature among level of study

Test Statistics ^{a,b}			
	Chi-Square	df	Asymp. Sig.
Ground floor	4.783	4	0.310
Open space level 2	2.832	4	0.586
Open space level 3	2.460	4	0.652
Open space level 4	2.411	4	0.661
Collaborative area	1.363	4	0.851
Individual carrels level 2	2.058	4	0.725
Individual carrels level 3	3.694	4	0.449
Individual carrels level 4	1.343	4	0.854
Group study rooms	3.632	4	0.458

a. Kruskal Wallis Test

b. Grouping Variable: Level of Study

Table 5-51: Mean & Std. Deviation of satisfaction level with temperature among level of study

Different spaces		Bachelor	Master	Ph.D	Foundation	Diploma	Total
Ground floor	N	144	60	28	9	3	244
	Mean	3.40	3.48	3.57	3.89	3.25	3.42
	Std. Deviation	0.802	0.987	0.634	1.167	0.500	0.850
Open space level 2	N	137	65	30	11	4	247
	Mean	3.02	3.08	3.25	3.11	3.50	3.08
	Std. Deviation	0.992	0.878	1.078	1.054	0.577	0.970
Open space level 3	N	149	63	33	11	4	260
	Mean	3.17	3.26	3.58	3.00	3.25	3.24
	Std. Deviation	1.057	1.086	1.200	0.943	0.957	1.079
Open space level 4	N	145	64	32	11	3	255
	Mean	3.23	3.24	3.09	3.55	3.50	3.23
	Std. Deviation	0.926	1.066	0.843	0.820	0.577	0.942
Collaborative area	N	152	57	22	7	4	242
	Mean	3.82	3.88	3.86	4.00	4.25	3.85
	Std. Deviation	1.122	1.181	1.207	1.155	0.500	1.132

Different spaces		Bachelor	Master	Ph.D	Foundation	Diploma	Total
Individual carrels level 2	N	98	40	24	3	3	168
	Mean	3.25	3.23	3.39	3.00	4.00	3.27
	Std. Deviation	0.880	1.068	0.988	1.000	0.000	0.944
Individual carrels level 3	N	100	50	22	4	3	179
	Mean	3.17	3.27	3.59	3.40	3.00	3.25
	Std. Deviation	1.111	1.036	1.054	0.548	0.000	1.064
Individual carrels level 4	N	100	48	21	5	3	177
	Mean	3.28	3.33	3.43	3.33	4.00	3.32
	Std. Deviation	0.946	0.929	0.992	0.577		0.936
Group rooms	N	95	35	16	5	3	154
	Mean	3.45	3.51	3.31	3.80	4.00	3.47
	Std. Deviation	1.079	0.919	1.195	0.447	0.000	1.030

5.11 Comparison satisfaction level regarding humidity among level of study

From Table 5-52, the reliability is (0.67), so we can consider it as measured by Cronbach's alpha for the satisfaction level with lighting within the main library to be satisfied.

Table 5-52: Reliability Analysis of satisfaction level regarding relative humidity

Reliability Statistics	
Cronbach's Alpha	N of Items
.671	9

Table 5-53 illustrates that there was statically not significant because P-Value more than (0.05) in satisfaction level with humidity among level of study.

Table 5-54 represents the results of the comparison of mean among different levels of study. At ground floor, bachelor students considered humidity right with mean (M=3.91). Students from different levels considered the humidity right on open space at level two (2), where foundation students got the high mean (M=4.11). Furthermore, students considered the

humidity right on open space at level three (3), while foundation students considered it almost slightly humid (M=4.30), while students considered humidity right on open space at level four (4) with mean around four (4). In collaborative area, humidity was right according to students from different levels. Also, students considered humidity right on individual carrels at level two (2) with mean around four (4), while foundation students deemed humidity slightly dry on individual carrels at level three (3) and individual carrels at level four (4) with (M=3.20, 3.00). Finally, diploma students rated humidity as a slightly dry on group rooms with (M=3.00).

Table 5-53: Kruskal-Wallis Test of satisfaction level with humidity among level of study

Test Statistics ^{a,b}			
	Chi-Square	df	Asymp. Sig.
Ground floor	5.650	4	0.227
Open space level 2	3.204	4	0.524
Open space level 3	5.148	4	0.272
Open space level 4	2.719	4	0.606
Collaborative area	2.981	4	0.561
Individual carrels level 2	2.330	4	0.675
Individual carrels level 3	4.699	4	0.320
Individual carrels level 4	2.590	4	0.629
Group study rooms	6.079	4	0.193

a. Kruskal Wallis Test

b. Grouping Variable: Level of Study

Table 5-54: Mean & Std. Deviation of satisfaction level with humidity among level of study

Different spaces		Bachelor	Master	Ph.D	Foundation	Diploma	Total
Ground floor	N	144	60	28	9	3	244
	Mean	3.91	3.85	3.68	3.89	3.25	3.86
	Std. Deviation	0.627	0.674	0.819	0.333	0.957	0.664
Open space level 2	N	137	65	30	11	4	247
	Mean	3.82	3.94	3.94	4.11	4.00	3.88
	Std. Deviation	0.839	0.687	0.504	0.333	0.000	0.745
Open space level 3	N	149	63	33	11	4	260
	Mean	3.89	3.80	3.85	4.30	3.75	3.87
	Std. Deviation	0.733	0.651	0.667	1.059	0.500	0.716
Open space level 4	N	145	64	32	11	3	255
	Mean	3.85	4.02	4.06	3.82	4.00	3.92
	Std. Deviation	0.758	0.528	0.933	0.603	0.000	0.724
Collaborative area	N	152	57	22	7	4	242
	Mean	3.93	4.05	3.86	3.71	3.75	3.94
	Std. Deviation	0.701	0.718	0.889	0.488	0.500	0.715
Individual carrels level 2	N	98	40	24	3	3	168
	Mean	3.88	4.06	3.91	3.67	4.00	3.93
	Std. Deviation	0.907	0.639	0.793	0.577	0.000	0.813
Individual carrels level 3	N	100	50	22	4	3	179
	Mean	3.85	4.00	3.77	3.20	4.00	3.87
	Std. Deviation	0.869	0.692	0.612	1.304	0.000	0.807
Individual carrels level 4	N	100	48	21	5	3	177
	Mean	3.91	4.04	3.83	3.00	4.00	3.92
	Std. Deviation	0.798	0.638	0.650	1.732	0.000	0.765
Group rooms	N	95	35	16	5	3	154
	Mean	3.84	4.06	3.81	3.80	3.00	3.87
	Std. Deviation	0.704	0.802	0.834	1.095	1.000	0.764

5.12 Comparison satisfaction of arrangement of different facilities among level of study

Table 5-55 highlights that there was statically not significant difference because P-Value more than (0.05) in satisfaction level with arrangement of interaction area, shelves of books

and journals, and toilets among level of study, whereas there was statically significant difference in satisfaction level with arrangement of printing facilities and drink & snack are because P-value less than (0.05).

Table 5-55: Kruskal-Wallis Test of satisfaction level with arrangement of different facilities among level of study

Test Statistics ^{a,b}					
	Interaction area	Shelves of books & journals	Printing facilities	Toilets	Drink & Snack area
Chi-Square	7.849	6.248	14.051	4.793	14.195
Df	4	4	4	4	4
Asymp. Sig.	.097	.181	.007	.309	.007

- a. Kruskal Wallis Test
- b. Groping Variable: Level of Study

Table 5-56 clarifies the score of the comparison of mean among various levels of study. In the satisfaction level with arrangement of interaction area, diploma students were most satisfied with mean (M=4.00). However, Ph.D students were less satisfied (M=3.45). Foundation students were more satisfied in arranging shelves of books and journals (M=3.91), and diploma students were less satisfied (M=3.00). Moreover, students from different levels expect foundation students were unsatisfied with arrangement of printing facilities, and diploma students were most unsatisfied (M=2.00), while foundation students were satisfied (M=3.73). Also, students from different levels of study were satisfied with arrangement of toilets. Finally, master students were satisfied with arrangement of drink and snack area (M=3.29), and diploma students were unsatisfied (M=2.00).

Table 5-56: Mean & Std. Deviation of satisfaction level with arrangement of different facilities among level of study

Different facilities		Bachelor	Master	Ph.D	Foundation	Diploma	Total
	N	165	73	33	11	4	286
Interaction area	Mean	3.47	3.71	3.45	3.82	4.00	3.55
	Std. Deviation	0.816	0.736	0.711	0.874	0.000	0.788
Shelves of books & journals	Mean	3.58	3.73	3.64	3.91	3.00	3.63
	Std. Deviation	0.828	0.768	0.822	0.831	0.000	0.810
Printing facilities	Mean	2.72	2.86	2.58	3.73	2.00	2.77
	Std. Deviation	0.980	1.084	0.867	1.104	0.000	1.014
Toilets	Mean	3.47	3.49	3.42	4.09	3.50	3.50
	Std. Deviation	0.934	1.107	1.032	0.539	1.000	0.983
Drink & snack area	Mean	3.02	3.29	2.94	2.73	2.00	3.09
	Std. Deviation	1.003	1.047	0.966	1.104	0.000	1.025

5.13 Improvements of library spaces

The fourth section within the questionnaire was about how spaces in the Main Library could be improved from users' perspective. Figure 5-7 shows that the improvements that users needed. It is evident to see that the majority of respondents asked for more printing facilities, and drink and snack area, while (11) respondents from the total respondents said that there is no need for improvements.

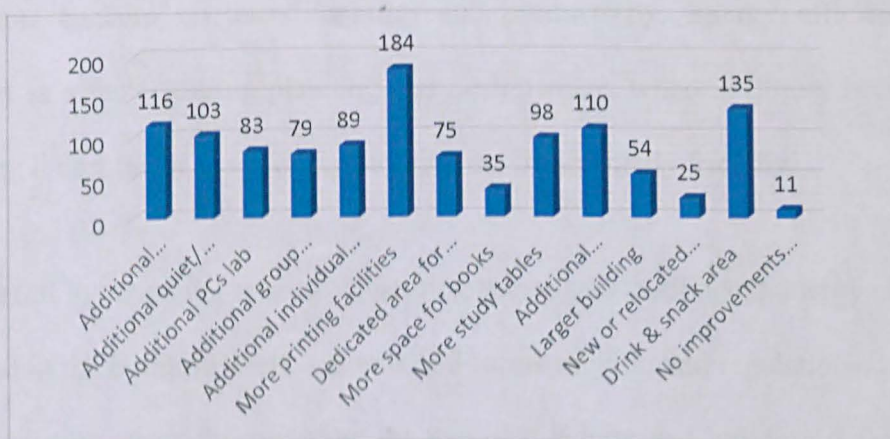


Figure 5-7: Improvements of library space from users' perspective

5.14 Interviews' data analysis

Feedback got from the interview has been analyzed to assess the differences between actual implementation and planned implementation, barriers, and improvements to enhance space management concerning users' satisfaction and energy efficiency. Semi structured interview was conducted with FM team within UM and deputy chief library. Thematic analysis was utilized to analyze the data because this kind of review utilizes strict and precise methods to collect the outcomes of essential research keeping in mind the end goal to give dependable responses to specific inquiries (Cooper et al., 2009; Higgins & Green, 2011; Petticrew & Roberts, 2006).

Group of five (5) themes was established to achieve the objectives of the interview. Themes are factors considered in managing spaces, barriers faced in managing spaces, replacement and maintenance of furniture and facilities, type of electrical systems used, and improvements of current practice.

Factors that has been considered by library and architecture department focused on the term of users' satisfaction more than energy efficiency, where the requirements include security; safety; easy access to books and journals; and function of building, and the previous requirements concern on users' comfort and productivity. Energy efficiency was not considered as a factor during planning and design stage, whereas library becomes slowly considering it as a factor to make the building environmentally friendly.

Barriers faced in managing spaces concerning users' satisfaction and energy efficiency can be grouped in the building itself, systems and infrastructure, and regulations. In the term of building, existing structure condition; the age of building; and building defects especially

leakage consider the main barriers. Moreover, arrangement of shelves of books and journals; number of printing facilities and difficulties of finding suppliers; number of plugs that is inadequate in some spaces; and the air condition system are the main barriers in the term of system and infrastructure. Finally, there are no regulations that ensure that each space works as managed and planned, guidelines to maintain or replace furniture and determine the number of plugs affect the level of users' satisfaction and energy efficiency.

Replacement and maintenance involve four main groups, which are furniture; lighting system; air conditioning system; and facilities. FM team replaced the chairs and tables within the Main Library in the previous semester, which means around six months ago to ensure users' satisfaction. Furthermore, moving from conventional lighting bulbs to LED ensure users' comfort and energy efficiency. Maintenance of air conditioning system done monthly to avoid any breakdown in the system. Lastly, FM team maintain and repair defects on the facilities within the building.

Electrical systems used in this building are divided into groups that lighting system and air conditioning system. Ensuring users' satisfaction and energy efficiency are essential. Therefore, type of luminaires utilized is conventional luminaires, while LED implemented at level two (2) and FM team will change all luminaires to LED in whole area within the library because LED lighting products produce light approximately 90% more efficiently than incandescent light bulbs. Unlike incandescent bulbs, LED "lifetime" is established on a prediction of when the light output decreases by 30 percent. LED light bulbs use only (2-17) watts of electricity (1/3rd to 1/30th of Incandescent or CFL). Therefore, moving toward LED luminaires help FM team in reducing the energy usage. In the term of air conditioning system, centralized chiller system is the air conditioning system utilized in this building because this

type of systems is the best for the large buildings, where the choose of air conditioning system depends on the capacity, load, and the area of the building. The number of chillers that used in this system are three (3) chillers. Also, the operational hours of chillers are from (8.00AM) until (9.30PM), which means that the chillers work (30) minutes before opening hour and shut down (30) minutes before closing the Main Library. Two chillers run in the same time and the third one in the standby mode. Moreover, Operative temperature within the Main Library is 24 c, which is still same during the whole day, because changing the temperature will affect the equipment itself that increase the maintenance cost. Moreover, the FM team follows the Malaysian standard in determining the temperature inside the Main Library, which should be between (24 and 26).

Finally, improvements to enhance the current practice contains the biggest impact; plan implemented; and future plan. The biggest impacts to enhance current space concerning users' satisfaction and energy efficiency are old system of air condition; building's defects; and shelves of books and journals. However, the plan implemented can be summarized in replacing furniture and moving from conventional luminaires to LED. Also, increasing the capacity within the Main Library by moving the books and articles that are not used so much and storage them in a room in the old building of faculty of engineering and increasing the number of chairs and tables; making the reading area close to windows instead of making the offices area closing to windows, because this will reduce the electrical usage in the term of lighting by benefiting from the sunlight; utilizing roof insulation also helps in maintaining the temperature stability, which will lead to reduce the electrical usage of air conditioning system and moving towards achieving the energy efficiency; changing AC system to make the use of energy more efficient; and lastly library plan to build a new building contains seven (7) stories as a new library building, and this plan under the 11th Malaysian plan.

5.15 Empirical measurement data analysis

The empirical measurement data has been used to compare between the actual temperature, relative humidity, and lighting with the planned ones regarding the standards used and client requirements. The analysis will be based on historical measurement data of temperature, relative humidity, and lighting by using Hobo Data Logger equipment. The location of the equipment at each level appears on the floor plan in Appendix 'F'.

To analyze the data came from the empirical measurement, day was divided into three groups to get the average temperature; relative humidity; and light intensity, and then compare the results with satisfaction level of respondents came from the questionnaire survey and standards used in this building. The three groups are morning time from 8.30AM until 12.00PM; afternoon time from 12.05PM till 4.00PM; and the last group from 4.05PM until 10.00PM.

Table 5-57 shows the actual temperature, RH, and light intensity in different spaces within the Main library. From the table, the highest temperature recorded in collaborative area with average temperature more than (24°C), the highest temperature was almost (26°C), and the lowest was (23.8°C). However, average temperature in open space at level two (2) was the lowest with (20.5°C), the highest temperature in this area was (24.77°C) and the lowest was (20.4°C). Therefore, average temperature does not correspond with temperature according Malaysian standard, and results came from the empirical measurement coincide the results of questionnaire, where the majority of respondents said the temperature was cool in this space. Moreover, the average temperature in other spaces was around (22°C), which did not meet the requirements of Malaysian standard.

In addition, from Table 5-57, the average of relative humidity within different spaces in different time of day was around (70%) except the average RH within collaborative area, which equaled around (63.50%) on the morning and afternoon period and (62.50%) after (4.00PM). Furthermore, the range of relative humidity should be between (25% to 60%) to be comfortable of the building's users, while when the relative humidity was below (25%) feel dry, and when it was above (60%) feel humid. Therefore, the relative humid within collaborative area considered as an acceptable, and this correspond with the questionnaire outcomes, whereas the relative humidity within other areas considered as comfortably humid, so the library and FM team should work to make the RH in the acceptable range because it will affect the users' comfort and health, organic materials within the library, and interior surfaces of the building.

Light intensity should be between (200-500) lux to ensure a high level of comfort for users. From Table 5-57, it is evident to say that the light intensity of second and fourth floor was the best and more comfortable for users, where LED luminaires were installed at the second floor. However, the level of light intensity within collaborative area was the worst as a reading area, where the light intensity did not exceed (100 Lux) on the morning and afternoon time, and it was around (70 lux) after (4.00PM) because the natural lighting will equal zero at night and the artificial lighting with this area was not enough to meet the requirements of light intensity within libraries and reading areas. Moreover, light intensity within third floor was likewise less than the requirements, where it equaled less than (160 lux) at the whole day. Light intensity within ground floor was around (115 Lux) on the morning, which was less than the requirements that is (200 Lux) for support area, while the light intensity in this area at afternoon and evening did not exceed (100 Lux).

Table 5-57: Actual temperature, relative humidity & light intensity within different spaces

Different spaces	Different time	Temperature (°C)			Relative Humidity (%)			Light Intensity (Lux)		
		Max: Temp (°C)	Min: Temp (°C)	Avg: Temp (°C)	Max: RH (%)	Min: RH (%)	Avg: RH (%)	Max (Lux)	Min (Lux)	Avg (Lux)
Ground Floor	8.30AM-12.00PM	24.629	22.298	22.709	69.967	61.189	68.181	177.400	74.900	114.116
	12.05PM-4.00PM	22.689	22.130	22.512	71.261	68.484	70.077	135.200	67.000	95.696
	4.05PM-10.00PM	23.088	22.034	22.436	71.288	67.779	69.998	145.000	51.200	88.698
Second Floor	8.30AM-12.00PM	24.774	20.412	20.956	72.728	56.947	69.200	208.900	185.300	196.889
	12.05PM-4.00PM	20.841	20.507	20.653	73.524	71.710	72.556	264.100	185.300	224.854
	4.05PM-10.00PM	20.817	20.341	20.533	72.955	71.864	72.263	256.200	240.500	247.957
Third Floor	8.30AM-12.00PM	25.574	21.079	21.603	71.169	55.126	67.855	161.600	145.800	152.868
	12.05PM-4.00PM	21.485	21.151	21.271	71.549	70.152	70.990	161.600	145.800	154.688
	4.05PM-10.00PM	21.659	21.175	21.412	72.171	70.419	71.185	161.800	145.800	157.191
Fourth Floor	8.30AM-12.00PM	25.162	21.724	22.226	73.582	60.536	71.204	248.300	224.700	232.595
	12.05PM-4.00PM	22.274	22.011	22.109	73.792	71.471	72.585	232.600	216.800	227.992
	4.05PM-10.00PM	23.857	21.939	22.143	73.799	67.634	72.054	248.300	201.000	217.929
COLA	8.30AM-12.00PM	25.841	23.881	24.200	65.815	58.596	63.697	106.400	82.800	93.168
	12.05PM-4.00PM	24.146	23.857	24.021	66.116	60.943	63.231	122.116	43.400	91.485
	4.05PM-10.00PM	24.605	24.002	24.118	65.116	60.417	62.495	65.116	43.400	70.726

5.16 Research Findings

Based on the analysis of questionnaire; interview; and empirical measurement, research findings are signified regarding research objectives of the study.

5.16.1 Background of Respondents

The analysis of background of the respondents, which covers age, gender, nationality, level of study, frequent use of library, reasons of visiting library, and frequent use of different spaces within the Main Library show that the questionnaire was completely distributed. An adjusted commitment of males and females from three gatherings of age and diverse levels of study makes a steady commitment of results from two (2) gender sort. Additionally, (57.69%) of respondents are bachelor students, whereas postgraduate students count (37.06%) of total respondents. Moreover, (46.5%) of total respondents visited the library daily.

5.16.2 Learning spaces within the Main Library

Questionnaire results demonstrate that end users were overall satisfied within collaborative area; quiet/ silent area; and PCs lab. Moreover, respondents were most satisfied with place to use own laptop within collaborative area. Similarly, the space is convenient for individual study was the most satisfying factor for respondents within quiet/ silent area. Furthermore, the factor that respondents were more satisfied within PCs lab is the space is convenient for individual study. However, factor mentioned where the spaces in near to printing facilities or no was the unsatisfying factor for respondents within collaborative area; quiet/ silent area; and PCs lab. This leads to the focus that should be more in providing more printing facilities near to each space within the Main Library. Also, respondents were dissatisfied with PCs lab is convenient for group study and the term of find space within

PCs lab. Factor focuses on find space within the Main Library was not got a high level of satisfaction from the respondents, where the respondents were almost neither satisfied nor dissatisfied. Therefore, the library should give more attention for the capacity of collaborative area, and extend this area to meet the users' satisfaction. Respondents focused more in their feedback from the open-ended question on increasing the number of chairs and tables within collaborative area, and increasing the capacity in this area. Moreover, respondents in open-ended question focused on increasing the number of plugs in quiet/ silent area, and make the interior design of this area more productive. Finally, respondents asked to increase the number of computers in the PCs lab, and increase the capacity of lab.

5.16.3 lighting system, thermal comfort, and arrangement of different facilities

Questionnaire results show that the end users were overall satisfied with lighting within different spaces in the Main Library, where the lighting on open space at level four (4) was the most satisfying for respondents followed by lighting on open space at level three (3). However, respondents were satisfied with lighting within the building, respondents still need more improvements in the term of lighting and make the space brighter to meet the users' expectations. However, the empirical measurement showed that second and fourth floor is the best in the term of lighting because lighting provided meet the requirements for reading area and libraries, while other areas did not achieve the recommended level and needs for more improvements according to Malaysian standard requirements (MS 1525, 2014).

Moreover, the respondents were comfortable with temperature within collaborative area, and considered this area is the best for users in the term of temperature, while respondents considered the temperature as a comfortably cool on open space at level two (2). Therefore,

respondents seek to make the temperature warmer. In addition, those results correspond with the results collected from the empirical measurement, where the temperature within the collaborative area was identical with the temperature requirements of Malaysian standard (MS 1525, 2014), which recommend the temperature of nonresidential building (24° C to 26° C), while other spaces need to be warmer than now to meet the users' satisfaction and Malaysian standard.

Furthermore, in the term of humidity, respondents considered the humidity almost right within all spaces in the Main Library, where the collaborative area got the best situation regarding humidity followed by individual study carrels at level two (2). Even though, regarding empirical measurement of relative humidity, RH was considered as a comfortable within the collaborative area, while it was considered as comfortably humid within other areas according requirements of Malaysian standard, where the range of RH have to be between (50% and 70%) (MS 1525, 2014).

In the term of arrangement of different facilities, the respondents were almost neither satisfied nor dissatisfied with overall arrangement of different facilities. Even though, respondents were almost satisfied with arrangement of shelves of books and journals followed by arrangement of interaction area, whereas respondents were dissatisfied with arrangement of printing facilities within the Main Library.

5.16.4 Barriers and improvements of current space within the Main Library

From the interview with deputy chief library and FM team within UM, the main barriers faced are the building itself, which means the condition of the structure; building's defects; and the age of building, where this building have been constructed for more than (40) years, the systems used and infrastructure especially the old centralized air conditioning system; limited number of plugs in some areas; and proper arrangement of shelves of books

and journals to increase the capacity within the building, and the last barrier is there is no regulation and rule to monitor and control use of different spaces within the library. However, many plans were established to improve the space concerning the users' satisfaction and energy efficiency, some of them was implemented such as replacing the conventional bulbs, and future plans, for instance, storage books and journals that are not used so much by users and increase the capacity; changing air conditioning system to improve the energy efficiency term; and finally, a plan to build a new library building.

5.17 Summary

This chapter demonstrates the analysis of the questionnaire survey to the respondents. Moreover, the second part elucidates the analysis of the interview outcomes to the interviewer from FM team within the university and deputy chief library. The third section within this chapter dissects the analysis of the empirical measurement done in the Main Library to measure the temperature; relative humidity; and light intensity. Furthermore, the final part expounds the findings of three methods used in this study, links between the results from different method, and compares the results to the requirements of Malaysian standards. In chapter (6), conclusion of the research, recommendations to improve the current practice, and recommendations of further studies are demonstrated.

CHAPTER 6 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study has given an overview of the scenario of space management in the university's libraries and its impact on users' satisfaction and energy efficiency. Investigation on space management processes performance of energy efficiency along with the impact of space management of users and energy efficiency are accomplished. The finding shows an overall satisfaction with different spaces within the Main Library, and suggests to provide more printing facilities in each space or floor and provide more space or increase the capacity within collaborative area and PCs lab. Moreover, the respondents were almost satisfied with lighting, temperature, and relative humidity, while they asked to make the temperature cooler in some areas and warmer in other spaces. Even though, the empirical measurement implemented in this study shows that library and FM team did not meet the requirements and standard of temperature, relative humidity, and light intensity in various spaces.

This study has shown that there are many barriers face library and FM team in managing spaces within the Main library efficiently, some of them related to the building itself and others related to equipment and regulations that did not implemented regularly. However, library try to improve the interior space to meet users' satisfaction and affect the energy efficiency positively. For instance, changing the luminaires to increase users' comfort and reduce energy usage, trying to increase the capacity by moving unimportant books and articles for users.

Moreover, the study has shown a high impact of space management on the users' satisfaction and energy efficiency, for example, arranging of shelves of books and journals efficiently will increase the satisfaction level of users and contribute to energy efficiency in the term of lighting and air conditioning, also designing the interior space will affect energy usage and help to achieve energy efficiency requirements, and arranging of various facilities within the building such as toilets and printing facilities will affect users' satisfaction positively or negatively.

In addition, this research mentioned that controlling and monitoring space management processes is essential to ensure that its impacts on users and energy will be done beneficially, to enable client to perceive the strengths and weaknesses of strategies implemented to manage different in various styles to obtain the objectives of users' satisfaction and energy efficiency, and allow FM team and library to do a proactive maintenance for building: facilities, and equipment. Therefore, implementing the specific regulations to ensure that the space works as managed is a very important to increase the users' satisfaction.

6.2 Recommendations

The recommendations will be divided into three (3) groups, which are low cost/ no cost recommendations; medium cost recommendations; and high cost recommendations.

In the term of low cost/ no cost recommendations to enhance the spaces management Concerning users' satisfaction and energy efficiency can be summarized in following providing printing facilities in different space within the Main Library, where the supplier is the library itself, so the library will recoup the amount paid in the printers from the printing fees and thus the printers will be an additional source of income for the library. Second

recommendation is following standards in term of temperature, relative humidity, and light intensity will lead to reduce the energy usage especially electrical usage of air conditioning system and increase satisfaction level of users. Another recommendation is to increase the light intensity in the areas of shelves of books and journals, which will contribute in the energy efficiency part.

The medium cost recommendations are moving books and journals that are not used to much, which will lead to provide more reading spaces. Another recommendation is making wall shelves of books and journals within each area that also provide more reading spaces and increase the users' satisfaction. providing more comfortable seating and tables in the formal and informal areas which will increase the capacity of the Main Library is a third recommendation. Another recommendation is use of insulating materials for windows that reduce the heat emission inside the building and allow the sunlight.

Finally, the high cost recommendations are replacing the centralized chiller system by VRF or VRV air conditioning, which are extremely efficient, reliable, and easy to control, capable of meeting larger buildings' complete heating and cooling requirements. Another point is increasing the capacity of collaborative area or making another larger place for COLA. Providing more PCs labs is another recommendation that allow students to use them any time and for all levels of study. Using roof and wall isolation will contribute in saving energy and reduce the electrical consumption of air conditioning system is another recommendation. Utilization of vacuum glass can altogether enhance the comfort level and give a calmer reading condition. Finally, considering the effects of direct daylight to indoor space, to introduce mechanized sun based control blinds on the dormer window.

6.3 Recommendations for further study

Each of main variables used in this research shows that there are opportunities for further studies in this field. This research focuses on how effective space management will affect the users' satisfaction and energy efficiency positively. Further studies could firm a framework for space management that concern more on energy efficiency in library buildings. Moreover, further studies should examine the effect of using various types of spaces within the HE libraries on the users' satisfaction and energy efficiency. Furthermore, further studies could establish the major factors that ensure the space meet the requirements of energy efficiency and in the same time users' satisfaction.

6.4 Summary

This chapter provides a conclusion of the research, and gives some recommendations to improve the current practice of space management concerning energy efficiency and users' satisfaction. finally, in this chapter, the author recommends some indicators for further studies that may help in providing efficient space management of HE libraries to achieve energy efficiency and users' satisfaction.

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Appendix A: Questionnaire survey

Space management in university libraries and its impact on users' satisfaction

Dear sir/madam,

I am a graduate student at University of Malaya. For my master's dissertation, I am currently investigating the impact of space management on users' satisfaction and productivity in university libraries. Being the user of the Main Library, I am inviting you to participate in this research by completing this questionnaire. I place great value on your time, so this questionnaire should take less than 20 minutes to complete. There is no compensation for responding nor is there any known risk.

In this questionnaire, there are four (4) sections:

- 1) a general information about you;
- 2) your opinion on the learning spaces within the Main Library
- 3) your perception on lighting system and thermal comfort of learning spaces within the Main Library
- 4) your view on how spaces in the Main Library could be improved.

If you choose to participate in this project, please answer all questions as honestly as possible. There is no right or wrong answer to any of these questions. Participation is strictly voluntary and you may refuse to participate at any time.

Your cooperation is highly appreciated and will contribute to the success of this study.

Thank you very much for your participation.

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* Required

General information

1. Age? *

2. Gender? *

Mark only one oval

Male

Female

3. Nationality? *

4. Level of study? *

Mark only one oval

Bachelor

Master

Ph.D

Other: -----

5. Approximately, how often do you visit the Main Library? *

Mark only one oval

Daily

Weekly

Bi-monthly

Monthly

6. How many hours do you spend in the Main Library every day when you visit it? *

Mark only one oval

Less than 1 hour

1 – 2 hours

3 – 4 hours

More than 5 hours

7. What is the reason that you visit the Main Library to obtain? *

Check all that apply

Books, journals, and articles.

- Internet surfing
- Study for exams
- Do assignments
- Group discussion and meeting

8. How often do you use the following types of study space in the Main Library? *

Mark only one oval per row

	Daily	Weekly	Bi-monthly	Monthly
Collaborative area				
Group study rooms				
Individual study carrels				
Quiet/ Silent area				
PCs lab				

Learning space within the Main Library

In this part of the questionnaire, select your level satisfaction to each question that focuses on the capacity of each space and its comfort.

9. How would you rate your agreement level with the following statements regarding Main Library collaborative area (includes open space and group study rooms)? *

Mark only one oval per row

	<i>STRONGLY DISAGREE</i>	<i>DISAGREE</i>	<i>NEUTRAL</i>	<i>AGREE</i>	<i>STRONGLY AGREE</i>
<i>I CAN ALWAYS FIND SPACE IN THIS AREA WHEN I WANT IT</i>					
<i>THIS SPACE IS CONVENIENT FOR GROUP STUDY</i>					
<i>THIS SPACE IS TOO NOISY FOR ME TO STUDY EFFECTIVELY</i>					
<i>THE INTERIOR DESIGN AND DECOR IN THIS AREA HELPS TO INCREASE PRODUCTIVITY</i>					
<i>THE FURNITURE IN THIS AREA IS COMFORTABLE TO SIT FOR A LONG TIME</i>					
<i>THE FURNITURE IS MOVABLE TO SUIT DIFFERENT GROUP MEETINGS AND DISCUSSIONS</i>					
<i>THERE IS A PLACE TO USE MY OWN LAPTOP</i>					
<i>THIS AREA IS CLOSE TO BOOKS OR JOURNALS</i>					
<i>THIS AREA IS NEAR TO PRINT FACILITIES</i>					

10. If you have any other comments regarding the Collaborative area within the Main Library please provide them below: (Optional)

11. How would you rate your agreement level with the following statements regarding Library quiet/ silent area (includes open spaces and individual study carrels)? *

Mark only one oval per row

	<i>STRONGLY DISAGREE</i>	<i>DISAGREE</i>	<i>NEUTRAL</i>	<i>AGREE</i>	<i>STRONGLY AGREE</i>
<i>I CAN ALWAYS FIND SPACE IN THIS AREA WHEN I WANT IT</i>					
<i>THIS SPACE IS CONVENIENT AND MORE PRODUCTIVE FOR INDIVIDUAL STUDY THAN COLLABORATIVE AREA</i>					
<i>THIS SPACE IS TOO NOISY FOR ME TO STUDY EFFECTIVELY</i>					
<i>THE INTERIOR DESIGN AND DECOR IN THIS AREA HELPS TO INCREASE PRODUCTIVITY</i>					
<i>THE FURNITURE IN THIS AREA IS COMFORTABLE TO SIT FOR A LONG TIME</i>					
<i>THERE IS A PLACE TO USE MY OWN LAPTOP</i>					
<i>THIS AREA IS CLOSE TO BOOKS OR JOURNALS</i>					
<i>THIS AREA IS NEAR TO PRINT FACILITIES</i>					

12. If you have any other comments regarding the quiet/ silent area within the Main Library please provide them below: (Optional)

13. How would you rate your agreement level with the following statements regarding Library PCs lab? *

Mark only one oval per row

	<i>STRONGLY DISAGREE</i>	<i>DISAGREE</i>	<i>NEUTRAL</i>	<i>AGREE</i>	<i>STRONGLY AGREE</i>
<i>I CAN ALWAYS FIND SPACE IN THIS AREA WHEN I WANT IT</i>					
<i>THE FURNITURE IN THIS AREA IS COMFORTABLE TO SIT FOR A LONG TIME</i>					
<i>THIS SPACE IS CONVENIENT FOR GROUP STUDY</i>					
<i>THIS SPACE IS CONVENIENT FOR INDIVIDUAL STUDY</i>					
<i>THIS SPACE IS TOO NOISY FOR ME TO STUDY EFFECTIVELY</i>					
<i>THE INTERIOR DESIGN AND DECOR IN THIS AREA HELPS TO INCREASE PRODUCTIVITY</i>					
<i>COMPUTERS MEET MY NEEDS</i>					
<i>THIS AREA IS NEAR TO PRINT FACILITIES</i>					

14. If you have any other comments regarding the PCs lab within the Main Library please provide them below: (Optional)

Opinion about the infrastructure facilities of library

This part will focus on lighting services, thermal comfort and arrangement of library resource

15. How would you rate the lighting in different spaces within the library? (choose "Not applicable" if you have not used any area before) *

Mark only one oval per row

	<i>POOR</i>	<i>SUBSTANDARD</i>	<i>ACCEPTABLE</i>	<i>GOOD</i>	<i>EXCEPTIONAL</i>	<i>NOT APPLICABLE</i>
<i>OPEN SPACE/ GROUND FLOOR</i>						
<i>OPEN SPACE/ LEVEL 2</i>						
<i>OPEN SPACE/ LEVEL 3</i>						
<i>OPEN SPACE/ LEVEL 4</i>						
<i>COLLABORATIVE AREA</i>						
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 2</i>						
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 3</i>						
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 4</i>						
<i>GROUP STUDY ROOMS</i>						

16. If you have any other comments regarding the Lighting within the Main Library please provide them below: (Optional)

17. How do you feel about the temperature in different spaces within the library? (choose "Not applicable" if you have not used any area before) *

Mark only one oval per row

	<i>COLD</i>	<i>COOL</i>	<i>SLIGHTLY COOL</i>	<i>NEUTRAL</i>	<i>SLIGHTLY WARM</i>	<i>WARM</i>	<i>HOT</i>	<i>NOT APPLICABLE</i>
<i>OPEN SPACE/ GROUND FLOOR</i>								
<i>OPEN SPACE/ LEVEL 2</i>								
<i>OPEN SPACE/ LEVEL 3</i>								
<i>OPEN SPACE/ LEVEL 4</i>								
<i>COLLABORATIVE AREA</i>								
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 2</i>								
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 3</i>								
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 4</i>								
<i>GROUP STUDY ROOMS</i>								

18. Do you feel comfortable with the current temperature in different spaces within the library? (choose "Not applicable" if you have not used any area before) *

Mark only one oval per row

	<i>MUCH TOO COOL</i>	<i>TOO COOL</i>	<i>COMFORTABLY COOL</i>	<i>COMFORTABLE</i>	<i>COMFORTABLY WARM</i>	<i>TOO WARM</i>	<i>MUCH TOO WARM</i>	<i>NOT APPLICABLE</i>
<i>OPEN SPACE/ GROUND FLOOR</i>								
<i>OPEN SPACE/ LEVEL 2</i>								
<i>OPEN SPACE/ LEVEL 3</i>								
<i>OPEN SPACE/ LEVEL 4</i>								
<i>COLLABORATIVE AREA</i>								
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 2</i>								
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 3</i>								
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 4</i>								
<i>GROUP STUDY ROOMS</i>								

19. What could be changed regarding temperature? (choose "Not applicable" if you have not used any area before) *

Mark only one oval per row

	<i>COOLER</i>	<i>NO CHANGE</i>	<i>WARMER</i>	<i>NOT APPLICABLE</i>
<i>OPEN SPACE/ GROUND FLOOR</i>				
<i>OPEN SPACE/ LEVEL 2</i>				
<i>OPEN SPACE/ LEVEL 3</i>				
<i>OPEN SPACE/ LEVEL 4</i>				
<i>COLLABORATIVE AREA</i>				
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 2</i>				
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 3</i>				
<i>INDIVIDUAL STUDY CARRELS/ LEVEL 4</i>				
<i>GROUP STUDY ROOMS</i>				

20. How would you rate the overall acceptability of the temperature? (choose "Not applicable" if you have not use any area before) *

Mark only one oval per row

	ACCEPTABLE	NOT ACCEPTABLE	NOT APPLICABLE
OPEN SPACE/ GROUND FLOOR			
OPEN SPACE/ LEVEL 2			
OPEN SPACE/ LEVEL 3			
OPEN SPACE/ LEVEL 4			
COLLABORATIVE AREA			
INDIVIDUAL STUDY CARRELS/ LEVEL 2			
INDIVIDUAL STUDY CARRELS/ LEVEL 3			
INDIVIDUAL STUDY CARRELS/ LEVEL 4			
GROUP STUDY ROOMS			

21. How do you feel about the air humidity in different spaces within the library?
(choose "Not applicable" if you have not used any area before) *

Mark only one oval per row

	MUCH TOO DRY	TOO DRY	SLIGHTLY DRY	JUST RIGHT	SLIGHTLY HUMID	TOO HUMID	MUCH TOO HUMID	NOT APPLICABLE
OPEN SPACE/ GROUND FLOOR								
OPEN SPACE/ LEVEL 2								
OPEN SPACE/ LEVEL 3								
OPEN SPACE/ LEVEL 4								
COLLABORATIVE AREA								
INDIVIDUAL STUDY CARRELS/ LEVEL 2								
INDIVIDUAL STUDY CARRELS/ LEVEL 3								
INDIVIDUAL STUDY CARRELS/ LEVEL 4								
GROUP STUDY ROOMS								

22. If you have any other comments regarding the thermal comfort within the Main Library please provide them below: (Optional)

23. How satisfied are you with the arrangement of the following facilities? *

Mark only one oval per row

	<i>STRONGLY DISSATISFIED</i>	<i>DISSATISFIED</i>	<i>NEUTRAL</i>	<i>SATISFIED</i>	<i>STRONGLY SATISFIED</i>
<i>INTERACTION AREA (WHERE YOU CAN INTERACT WITH LIBRARY STAFF)</i>					
<i>SHELVES OF BOOKS AND JOURNALS</i>					
<i>PRINTING FACILITIES</i>					
<i>TOILETS</i>					
<i>DRINK & SNACK AREA</i>					

Improvement of the library spaces

If the Library has plans to refurbish its building. Which of the following should be your top priority?

24. Mark all the areas in which you believe the library should improve its facility *

Check all that apply

Additional collaborative area	<input type="checkbox"/>	More space for book	<input type="checkbox"/>
Additional quiet/silent study area	<input type="checkbox"/>	More study tables	<input type="checkbox"/>
Additional PCs lab	<input type="checkbox"/>	Additional comfortable seating	<input type="checkbox"/>
Additional group study rooms	<input type="checkbox"/>	Larger building	<input type="checkbox"/>
Additional individual study carrels	<input type="checkbox"/>	New or relocated building	<input type="checkbox"/>
More printing facilities	<input type="checkbox"/>	Drink/snack area	<input type="checkbox"/>
Dedicated area for postgraduates and researchers	<input type="checkbox"/>	No improvement needed	<input type="checkbox"/>

25. If you have any other comments or suggestions to improve the Main Library space please provide them below: (Optional)

Thank you very much for your participation

Appendix B: Open ended questions within questionnaire

Collaborative area

• If you have any other comments regarding the Collaborative area within the Main Library please provide them below:

1. No printing facilities.
2. Provide too many printers.
3. More interesting interior design.
4. Provide more chairs and tables with plugs.
5. Collaborative area is too noisy.
6. More plugs to charge devices (electronic charging facilities).
7. There is always insufficient sofa to sit.
8. It is quite limited area.
9. Add more tables to collaborative area that can increase the capacity of it, and increase the number of students within this area.
10. Collaborative area is quite useless since the area is used by students who want to study individually.
11. Curtain should be installed at windows that have tables facing them.
12. Many spaces within collaborative area are inaccessible to socket.
13. Should be more tables and plugs.
14. Some furniture is bad and should be changed.
15. The collaborative area is always full.
16. Add printing facilities.
17. Add more plugs.
18. It is difficult to find place in this area during peak hours.
19. Many students sleep in this area.
20. Add more plugs to charge laptops.
21. I suggest to improve the air conditioning in KOLA. It is not that good, always warm.
22. Collaborative area should not be around individual study carrels.

Quiet/ silent area

• If you have any other comments regarding the quite/ silent area within the Main Library please provide them below:

1. Sometimes, students use this area for group discussion instead of this area is for individual study and students in this area need more concentration.
2. Provide more electrical plugs to charge laptops.
3. More interesting interior design.
4. Some students use this area for group discussion, and that is too noisy.
5. Quiet area is generally cold.
6. The temperature is so cold within the quiet area.
7. Some chairs in third floor are making noises when there is any movement of those who are using. Probably repair or reduce them.
8. Some facilities are already broken.
9. More power socket should be installed.
10. Increasing the number of plugs.
11. This area needs more sockets to charge electrical devices.
12. There are issues in the furniture in this area.
13. Most chairs are too soft to sit for a long time and its unhealthy for the spine.
14. There is a limited number of plugs to charge laptops.
15. Add more plugs.
16. The interior design should be more fun and productive because the surrounding currently drives to sleep.
17. Add more plugs especially in level 2.
18. The number of plugs is low.
19. Many chairs are broken especially at level 3.
20. Many chairs are broken at level 3, and cause the noise for students.

PCs lab

• If you have any other comments regarding the PCs lab within the Main Library please provide them below:

1. More interesting interior design.
2. Should increase the number of computers.
3. Add more PCs labs for students.

4. Add more PCs labs.
5. Add more PCs.
6. There are not enough computers.
7. The number of computers is not enough.
8. Some computers got no mouse.

Lighting

• If you have any other comments regarding the Lighting within the Main Library please provide them below:

1. More power points.
2. Level 2 has differences in lighting.
3. Make it bright with natural light come via windows (sunlight).
4. Lighting in level 2 is insufficient.
5. Some areas are still too dark for comfortable study.
6. The spaces are too dark.

Thermal comfort

• If you have any other comments regarding the Thermal comfort within the Main Library please provide them below:

1. Make the library more fragrant.
2. Some rooms and spaces are so cold, and others are warm.
3. Collaborative area and individual carrels especially level 3 are hot.
4. Adjusting the temperature of air condition that is to be very cold sometimes when there is less users occupied the quiet area.
5. Most areas within the library are so cold.

Improvement of library spaces

• If you have any other comments or suggestions to improve the Main Library space please provide them below:

1. More parking spaces.
2. Add more plug especially in level 2.
3. Add more vending machines and comfortable seating in snack area.
4. Better coffee vending machines and more chairs in the snack area.
5. Better internet coverage.

6. Clean toilets and snack area.
7. Comfortable masala.
8. Add more plugs to charge laptops and handphones.
9. Make separate space for each gender.
10. The internet is so weak in the library, it should be stronger.
11. Wi-Fi is so slow, make it faster.
12. Toilets do not have toilet papers.
13. More ports for charging devices.
14. Improve the internet and rest rooms facilities.
15. There is a huge need to repair the elevator.
16. Bigger space for masala because the current space is too small.
17. Add more plugs.
18. More space for rest and comfortable.
19. More plugs in open spaces.
20. Improving the cleanliness of toilets facilities within the library.
21. Putting carpets in the area that is not covered by chairs and tables.
22. Repairing the toilets close to collaborative area.
23. Most toilet doors are broken and have drainage issues, so should repair them.
24. Toilets should be clearer.
25. Add more plugs.
26. Add more plugs near study tables to charge laptops.
27. The furniture should be changed particularly.
28. Add more plugs.
29. Add more plugs to charge laptops.
30. Masala should be bigger and more comfortable.
31. The internet is weak in many places within the library.
32. Additional sockets to charge laptops.
33. Add more plug points.
34. Wi-Fi should be improved.

35. Add more plugs.
36. Do maintenance of plugs frequently.
37. Checking the plugs and adding more.
38. Add more plugs and maintain the existing plugs.
39. Add more plugs.
40. Toilet facilities should be kept clean all times.
41. The internet is very weak.
42. The officer should improve their English.
43. Make the smell within the library better.
44. Provide more plugs.
45. Add more plugs especially at level 2.
46. Coffee vending in each floor.
47. Add more plugs.
48. Add more plugs.
49. Printing facilities should be existed in each floor.
50. Toilets do not have tissues at the afternoon.
51. The library should open until 12AM.
52. Add more plugs to charge laptops.
53. The snack area is so dirty.
54. The internet is weak.
55. Snacks\Coffee area should be ventilated because the smell there is irritating.

Appendix C: Interview's questions

- 1) Is the energy efficiency determined as a factor during managing spaces within the main library?
 - a) What are the factors that you have consider in managing spaces within the Main Library?
 - b) Is energy efficiency ever a factor? If yes, why? If no, why?
 - c) How does space management effect the energy usage, and how does energy efficiency effect space management?
- 2) What are the barriers the FM team faced in managing the space within the main library to meet the users' comfort and productivity?
- 3) What are the barriers that face the FM team in managing the space within the main library to meet energy efficiency requirements?
 - a) Have you considered the (users' comfort/ energy efficiency) during managing space?
 - b) If yes, have you faced any problems during managing space to meet users' comfort?
 - c) Have you faced any problems during managing spaces to achieve energy efficiency?
- 4) What are the methods used by the FM team to ensure that the space within the main library works as managed?
 - a) Have you implemented any regulation to ensure that the work spaces are managed (well/ as your plan)?
 - b) Does library staff monitor using library in different spaces to achieve the objectives of space management? (space management department/ Architecture/ Civil engineering department)
- 5) How frequently FM team maintain the furniture and facilities within different spaces in the main library?
 - a) When was the last time that FM team maintain the furniture and facilities within different spaces?

- b) Could you please explain the types of maintenance work involved and give an example? Do you and your team have a specific guideline for this maintenance work?
- c) When was the last time that FM team replace or change the furniture within different spaces?
- d) Do you and your team have a specific guideline for this (when to replace/change)?
- e) Is there any schedule to do this type of maintenance or replacement?
- f) How does FM team determine whether the maintenance or replacement is the best?
- 6) How can FM team reduce the electrical consumption in the term of lighting without affect the users' comfort within the main library?
- a) What are the types of luminaires used in this building, and why?
- b) In lighting system, does FM team focus on the term of energy efficiency and users' comfort?
- c) Have FM team tried to achieve both criteria "energy efficiency & users' comfort" in the term of lighting system and how?
- 7) How the FM team control the temperature during the whole day within the main library to meet users' comfort and energy efficiency?
- a) What are the types of Air conditioning systems used in the library building, and why?
- b) What is the operative temperature set in this building?
- c) Is the operative temperature still same during the whole day or changed?
- 8) What are the methods that FM team consider to improve the space management within the main library and make it more comfortable and productive for users and reduce the energy usage in the future?
- a) What has FM team implemented to enhance the space management practice?
- b) Which is the biggest and least impact of the FM team to enhance the practice?
- c) Is there any plan to extend the spaces within the main library or to build a new and larger building to make the library more comfortable and productive?

- d) Is there any regular plan or suggestion to improve space management?
- 9) How FM team manage the arrangement of different facilities within the main library?
 - a) What are the three most frequent feedback/ complaints about the facilities provided in this library? And why?
 - b) Is one printing facility located in level 2 enough?
 - c) Why FM team does not make a printing facility in each floor?
 - d) How can FM team enhance the drink/ snack area and make it more comfortable?
- 10) Number of plugs is low?
 - a) How does FM team decide on the number of plug points to be provided in each space / floor?
 - b) Is there any guideline/standard that you follow?
 - c) What are the standards FM team considered?

Appendix D: Interview's feedback

Director of development and estate maintenance

Energy efficiency does not consider as a factor in managing space within the Main Library because during the design stage the concept of energy efficiency did not exist.

The space management affects the energy efficiency within the Main library because the space in this building considers as a closed space without number of windows that allow natural light access to the building, and shelves of books and journals within the building needs a specific situation in the term of temperature and relative humidity, but arrangement of shelves of books and journals may lead to reduce the energy usage in the term of lighting.

The last time that FM team maintain and replace the furniture within the Main Library was in the previous semester, which means six to seven months ago, and this maintenance or replacement does not depend on the standards or guidelines, where the director of development and estates maintenance department within university of Malaya mentions that this work done almost every five years. Even though, there is not any schedule to maintain the furniture, but FM team depends on the complaints and feedbacks to do the maintenance.

Moreover, FM team tries to maintain the furniture firstly after that replace them if they do not work correctly.

In the term of air conditioning system, FM team maintains the chillers every month because the centralized chiller system used in the air conditioning system is an old one, and need maintenance monthly to avoid any breakdown in the system.

Even though, in the term of lighting system, FM team replaced the conventional type of bulbs by LED bulbs during the previous months in some areas. However, there is not any schedule or plan to do the maintenance, so FM team depends on the complaints to do the action.

Type of luminaires used in this building is conventional type, while LED used at level two (2), and will be used in other areas because LED lighting products produce light approximately 90% more efficiently than incandescent light bulbs. The useful life of LED lighting products is defined differently than that of other light sources, such as incandescent or compact fluorescent lighting (CFL). LEDs typically do not "burn out" or fail. Instead, they

experience 'lumen depreciation', wherein the brightness of the LED dims slowly over time. Unlike incandescent bulbs, LED "lifetime" is established on a prediction of when the light output decreases by 30 percent. Therefore, moving toward LED luminaires help FM team in reducing the energy usage.

The air conditioning system used in this building is a centralized chiller system because this type of systems is the best for the large buildings, where the choose of air conditioning system depends on the capacity, load, and the area of the building. Moreover, the operative temperature within the Main Library is 24 c, which is still same during the whole day, because changing the temperature will affect the equipment itself that increase the maintenance cost. Also, the operational hours of chillers are from 7AM until 10PM.

The biggest impact of the FM to enhance the practice within the Main Library is the air conditioning system.

The FM team has a plan to build a new library building beside the old building, and on the same time another plan to increase the capacity within the same building by reducing the number of shelves of books and journals, and increase the number of tables and chairs. This will happen by digitalizing the books and journals, and depends on a limited number of shelves of the important books and journals.

In the term of number of plugs, the standards used depend on the equipment. The number of plugs within the individual study carrels is 4 plugs, and 6 plugs within discussion rooms. However, the number of plugs within the open space depends on the client requirements.

Electrical department

There is one barometer to measure the electrical usage from the Air conditioning system and lighting system within the Main Library. However, in the next year, there will be a separate barometer to measure the electrical usage of air conditioning system. Air conditioning system consumes (60%) of the total electrical consumption in the Main Library. Furthermore, the lighting system is changed from the conventional system to LED, but the change has been done at the second floor. Changing luminaires at other floors will be done gradually. The reason beyond that is because the Main Library is a part of the project that aims to change the type of luminaires in all buildings within the campus. FM team has planned to change the

type of luminaires because LED "lifetime" is established on a prediction of when the light output decreases by 30 percent. LED light bulbs use only (2-17) watts of electricity (1/3rd to 1/30th of Incandescent or CFL). Therefore, moving toward LED luminaires help FM team in reducing the energy usage.

Changing the lighting system will contribute on achieving the energy efficiency, but the change will not be as supposed because the majority of electrical consumption is because the Air conditioning system.

Moreover, the FM team follows the Malaysian standard in determining the temperature inside the Main Library, which should be between (24 and 26).

One of the way to reduce the electrical consumption by increasing the temperature, but this will affect the users' satisfaction.

Mechanical department

The air conditioning system used in this building is a centralized chiller system because this type of systems is the best for the large buildings, where the choose of air conditioning system depends on the capacity, load, and the area of the building. The number of chillers that used in this system are three (3) chillers. Moreover, the operative temperature within the Main Library is 24 c, which is still same during the whole day, because changing the temperature will affect the equipment itself that increase the maintenance cost. Also, the operational hours of chillers are from 8AM until 9.3PM, which means that the chillers work (30) minutes before opening hour and shut down (30) minutes before closing the Main Library. Two chillers run in the same time and the third one in the standby mode.

Library staff

Deputy chief library

The factors that have been considered from the client perspective can be summarized by user satisfaction, easy access to books and journals, and try to make the building environmentally friendly. Even though, during design and planning stage, energy efficiency was not considered as a factor.

One of the problem faced the library in managing the space is shelves of books. Moving shelves of books is still slow because the library does not have a proper space to storage books.

Moreover, the regulation that library has implemented just to prevent students from bringing food and drink to the library. However, the library has not implemented any regulation to ensure that each space inside the Main library works as managed.

In the term of arrangement of different facilities, the library does not have any plan to increase the snack/ drink area because there are many stores outside the library that are adequate to meet the needs of students. Therefore, library considers the business value of increasing the snack area is not profitable. Moreover, library has tried to increase the number of printing facilities within the Main Library but the respond from the suppliers is poor.

In the term of number of plugs, during planning and design stage, the use of laptops was limited, so the library did not provide a large number of plugs within the building. Another reason is the building is old, so if the library wants to increase the number of plugs, there is a need to change the electrical system.

In the term of improvement, library has a plan to move the books and articles that do not use so much and storage them in a room in the old building of faculty of engineering. Therefore, the capacity of the Main Library will increase. Another plan which is under the 11th Malaysian plan is to build any building contains seven (7) stories as a new library building.

Architecture department

Head of architecture department

The factors that have been considered from the architecture team in managing the interior space of the Main library were security, safety, function of the building, and lastly the term of energy efficiency.

The problems faced architecture team in managing and renovating the spaces within the Main Library are the existing structure condition, the age of building, budget, and defects in the structure specially leakage.

In the term of suggestion to improve the interior spaces within the Main Library, the arrangement of different facilities is the best way. For instance, make the reading area close to windows instead of making the offices area closing to windows, because this will reduce the electrical usage in the term of lighting by benefiting from the sunlight. Even though, a lot of windows in the reading area will increase the temperature. Moreover, changing the air conditioning system will help in the term in making the use of energy within the Main Library is more efficient, and roof insulation also helps in maintaining the temperature stability, which will lead to reduce the electrical usage of air conditioning system and moving towards achieving the energy efficiency. Central lift can be used in the new building because it affects the energy usage.

University of Malaya

Appendix E: Empirical Measurement

Empirical measurement within Ground Floor

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 16:50:00.000	23.93	65.695	135.5
12/04/17 16:55:00.000	23.232	67.553	127.6
12/04/17 17:00:00.000	22.872	68.413	127.6
12/04/17 17:05:00.000	22.657	69.264	127.6
12/04/17 17:10:00.000	22.537	70.277	127.6
12/04/17 17:15:00.000	22.441	70.525	135.5
12/04/17 17:20:00.000	22.345	71.095	135.5
12/04/17 17:25:00.000	22.274	70.817	135.5
12/04/17 17:30:00.000	22.226	71.601	135.5
12/04/17 17:35:00.000	22.369	71.482	145.8
12/04/17 17:40:00.000	22.298	71.527	138
12/04/17 17:45:00.000	22.226	71.66	138
12/04/17 17:50:00.000	22.154	71.793	145.8
12/04/17 17:55:00.000	22.13	72.462	138
12/04/17 18:00:00.000	22.154	72.291	130.1
12/04/17 18:05:00.000	22.178	72.061	138
12/04/17 18:10:00.000	22.154	72.115	138
12/04/17 18:15:00.000	22.178	72.295	130.1
12/04/17 18:20:00.000	22.154	72.086	138
12/04/17 18:25:00.000	22.226	72.217	119.7
12/04/17 18:30:00.000	22.321	71.913	127.6
12/04/17 18:35:00.000	22.393	71.633	119.7
12/04/17 18:40:00.000	22.393	71.486	119.7
12/04/17 18:45:00.000	22.393	71.574	119.7
12/04/17 18:50:00.000	22.369	71.511	119.7
12/04/17 18:55:00.000	22.298	71.321	119.65
12/04/17 19:00:00.000	22.274	71.64	127.6
12/04/17 19:05:00.000	22.226	71.601	126.5
12/04/17 19:10:00.000	22.226	71.895	119.7
12/04/17 19:15:00.000	22.25	71.87	135
12/04/17 19:20:00.000	22.202	71.89	135
12/04/17 19:25:00.000	22.178	71.856	120.5
12/04/17 19:30:00.000	22.202	71.89	120.6
12/04/17 19:35:00.000	22.202	71.89	119.7
12/04/17 19:40:00.000	22.226	71.924	119.7
12/04/17 19:45:00.000	22.226	71.924	123
12/04/17 19:50:00.000	22.25	71.958	135

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 19:55:00.000	22.25	72.016	124
12/04/17 20:00:00.000	22.25	72.163	127.6
12/04/17 20:05:00.000	22.226	72.129	124.6
12/04/17 20:10:00.000	22.178	72.354	127
12/04/17 20:15:00.000	22.154	72.437	123.5
12/04/17 20:20:00.000	22.106	72.369	128
12/04/17 20:25:00.000	22.082	72.452	145.3
12/04/17 20:30:00.000	22.058	72.857	124.6
12/04/17 20:35:00.000	22.058	72.886	128.6
12/04/17 20:40:00.000	22.034	73.056	135
12/04/17 20:45:00.000	22.034	73.406	127.6
12/04/17 20:50:00.000	23.232	82.315	120
12/06/17 10:30:00.000	24.629	61.189	74.9
12/06/17 10:35:00.000	23.593	63.642	74.9
12/06/17 10:40:00.000	22.968	65.89	74.9
12/06/17 10:45:00.000	22.609	68.068	74.9
12/06/17 10:50:00.000	22.441	67.919	74.9
12/06/17 10:55:00.000	22.321	68.936	74.9
12/06/17 11:00:00.000	22.298	69.553	74.9
12/06/17 11:05:00.000	22.321	69.025	74.9
12/06/17 11:10:00.000	22.369	69.448	74.9
12/06/17 11:15:00.000	22.441	69.106	130.1
12/06/17 11:20:00.000	22.393	68.92	177.4
12/06/17 11:25:00.000	22.298	69.494	177.4
12/06/17 11:30:00.000	22.298	69.967	153.7
12/06/17 11:35:00.000	22.489	69.322	120.5
12/06/17 11:40:00.000	22.633	69.171	135
12/06/17 11:45:00.000	22.729	69.869	156
12/06/17 11:50:00.000	22.872	68.829	136
12/06/17 11:55:00.000	22.896	68.328	146
12/06/17 12:00:00.000	22.872	68.769	162
12/06/17 12:05:00.000	22.824	68.671	120
12/06/17 12:10:00.000	22.8	69.172	135.2
12/06/17 12:15:00.000	22.8	68.519	119.6
12/06/17 12:20:00.000	22.776	68.782	135
12/06/17 12:25:00.000	22.776	68.484	125.6
12/06/17 12:30:00.000	22.753	68.777	119.7
12/06/17 12:35:00.000	22.729	69.07	67
12/06/17 12:40:00.000	22.513	69.593	67
12/06/17 12:45:00.000	22.345	70.3	67
12/06/17 12:50:00.000	22.25	70.224	67

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 12:55:00.000	22.202	70.539	74.9
12/06/17 13:00:00.000	22.154	70.648	67
12/06/17 13:05:00.000	22.13	70.996	67
12/06/17 13:10:00.000	22.13	71.026	67
12/06/17 13:15:00.000	22.13	71.231	67
12/06/17 13:20:00.000	22.13	71.084	67
12/06/17 13:25:00.000	22.13	71.261	67
12/06/17 13:30:00.000	22.13	71.261	67
12/06/17 13:35:00.000	22.154	71.03	67
12/06/17 13:40:00.000	22.489	70.71	98.5
12/06/17 13:45:00.000	22.633	70.117	90.7
12/06/17 13:50:00.000	22.705	69.806	98.5
12/06/17 13:55:00.000	22.729	69.81	90.7
12/06/17 14:00:00.000	22.753	69.785	98.5
12/06/17 14:05:00.000	22.776	69.671	90.7
12/06/17 14:10:00.000	22.824	69.68	122.2
12/06/17 14:15:00.000	22.92	70.318	122.2
12/06/17 14:20:00.000	22.944	69.583	122.2
12/06/17 14:25:00.000	22.944	69.346	114.3
12/06/17 14:30:00.000	22.944	69.376	106.4
12/06/17 14:35:00.000	22.968	69.202	106.4
12/06/17 14:40:00.000	22.968	69.113	106.4
12/06/17 14:45:00.000	22.944	69.287	114.3
12/06/17 14:50:00.000	22.609	69.226	114.3
12/06/17 14:55:00.000	22.417	70.078	114.3
12/06/17 15:00:00.000	22.321	70.65	82.8
12/06/17 15:05:00.000	22.298	70.792	114.3
12/06/17 15:10:00.000	22.25	70.754	106.4
12/06/17 15:15:00.000	22.202	71.01	106.4
12/06/17 15:20:00.000	22.178	70.417	106.4
12/06/17 15:25:00.000	22.202	70.892	106.4
12/06/17 15:30:00.000	22.202	70.657	98.5
12/06/17 15:35:00.000	22.537	71.161	105.4
12/06/17 15:40:00.000	22.465	70.264	106.8
12/06/17 15:45:00.000	22.441	70.289	74.9
12/06/17 15:50:00.000	22.393	70.28	82.8
12/06/17 15:55:00.000	22.345	70.212	82.8
12/06/17 16:00:00.000	22.321	70.532	74.9
12/06/17 16:05:00.000	22.298	70.439	74.9
12/06/17 16:10:00.000	22.274	71.288	74.9
12/06/17 16:15:00.000	22.274	70.817	98.5

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 16:20:00.000	22.274	70.641	82.8
12/06/17 16:25:00.000	22.25	70.489	82.8
12/06/17 16:30:00.000	22.25	70.636	82.8
12/06/17 16:35:00.000	22.25	71.019	74.9
12/06/17 16:40:00.000	22.226	71.132	74.9
12/06/17 16:45:00.000	22.585	70.345	116.5
12/06/17 16:50:00.000	22.992	69.681	119.4
12/06/17 16:55:00.000	23.04	69.156	119.4
12/06/17 17:00:00.000	22.968	69.084	120.5
12/06/17 17:05:00.000	23.04	68.889	123.5
12/06/17 17:10:00.000	22.944	68.663	111.6
12/06/17 17:15:00.000	22.92	69.045	132
12/06/17 17:20:00.000	22.896	69.308	124.9
12/06/17 17:25:00.000	22.896	69.07	126.4
12/06/17 17:30:00.000	22.944	69.346	119.7
12/06/17 17:35:00.000	22.968	68.787	123.2
12/06/17 17:40:00.000	23.04	68.829	124
12/06/17 17:45:00.000	23.088	68.838	145
12/06/17 17:50:00.000	23.088	68.392	132.6
12/06/17 17:55:00.000	22.968	68.43	121.3
12/06/17 18:00:00.000	22.92	68.778	67
12/06/17 18:05:00.000	22.753	69.252	114.3
12/06/17 18:10:00.000	22.537	69.42	106.4
12/06/17 18:15:00.000	22.393	69.985	106.4
12/06/17 18:20:00.000	22.298	70.144	106.4
12/06/17 18:25:00.000	22.25	70.401	106.4
12/06/17 18:30:00.000	22.202	70.686	98.5
12/06/17 18:35:00.000	22.178	70.564	105.4
12/06/17 18:40:00.000	22.154	70.677	106.8
12/06/17 18:45:00.000	22.154	70.648	105.3
12/06/17 18:50:00.000	22.154	70.501	109.4
12/06/17 18:55:00.000	22.154	70.235	59.1
12/06/17 19:00:00.000	22.154	70.265	59.1
12/06/17 19:05:00.000	22.154	70.501	59.1
12/06/17 19:10:00.000	22.13	70.319	59.1
12/06/17 19:15:00.000	22.13	70.467	51.2
12/06/17 19:20:00.000	22.106	70.874	59.1
12/06/17 19:25:00.000	22.106	70.668	59.1
12/06/17 19:30:00.000	22.082	70.693	51.2
12/06/17 19:35:00.000	22.058	70.571	59.1
12/06/17 19:40:00.000	22.034	70.831	59.1

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 19:45:00.000	22.034	70.331	51.2
12/06/17 19:50:00.000	22.058	70.453	59.1
12/06/17 19:55:00.000	22.058	70.6	59.1
12/06/17 20:00:00.000	22.058	70.365	51.2
12/06/17 20:05:00.000	22.058	70.306	51.2
12/06/17 20:10:00.000	22.106	70.344	59.1
12/06/17 20:15:00.000	22.082	70.399	51.2
12/06/17 20:20:00.000	22.082	70.487	59.1
12/06/17 20:25:00.000	22.992	67.779	60.1

Empirical measurement within Second Floor

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 16:50:00.000	22.178	65.992	279.9
12/04/17 16:55:00.000	21.509	68.641	272
12/04/17 17:00:00.000	21.127	69.927	272
12/04/17 17:05:00.000	20.936	70.01	279.9
12/04/17 17:10:00.000	20.793	71.506	279.9
12/04/17 17:15:00.000	20.722	71.638	272
12/04/17 17:20:00.000	20.674	72.125	279.9
12/04/17 17:25:00.000	20.65	71.712	279.9
12/04/17 17:30:00.000	20.603	72.256	287.8
12/04/17 17:35:00.000	20.555	72.16	272
12/04/17 17:40:00.000	20.531	72.243	264.1
12/04/17 17:45:00.000	20.507	72.384	264.1
12/04/17 17:50:00.000	20.507	72.732	272
12/04/17 17:55:00.000	20.484	72.844	279.9
12/04/17 18:00:00.000	20.484	72.844	264.1
12/04/17 18:05:00.000	20.46	72.868	264.1
12/04/17 18:10:00.000	20.46	72.781	272
12/04/17 18:15:00.000	20.46	72.81	279.9
12/04/17 18:20:00.000	20.46	72.839	272
12/04/17 18:25:00.000	20.436	72.777	264.1
12/04/17 18:30:00.000	20.412	72.743	272
12/04/17 18:35:00.000	20.388	72.709	279.9
12/04/17 18:40:00.000	20.388	72.825	272
12/04/17 18:45:00.000	20.365	73.024	279.9
12/04/17 18:50:00.000	20.365	73.227	272
12/04/17 18:55:00.000	20.341	73.048	256.2
12/04/17 19:00:00.000	20.317	73.043	264.1

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 19:05:00.000	20.293	72.981	279.9
12/04/17 19:10:00.000	20.317	73.072	279.9
12/04/17 19:15:00.000	20.317	72.957	264.1
12/04/17 19:20:00.000	20.293	73.126	279.9
12/04/17 19:25:00.000	20.293	73.357	279.9
12/04/17 19:30:00.000	20.293	73.618	272
12/04/17 19:35:00.000	20.293	73.618	264.1
12/04/17 19:40:00.000	20.293	73.82	279.9
12/04/17 19:45:00.000	20.317	73.912	256.2
12/04/17 19:50:00.000	20.341	74.089	279.9
12/04/17 19:55:00.000	20.341	73.974	279.9
12/04/17 20:00:00.000	20.365	73.863	272
12/04/17 20:05:00.000	20.365	73.834	279.9
12/04/17 20:10:00.000	20.365	73.979	279.9
12/04/17 20:15:00.000	20.388	73.954	279.9
12/04/17 20:20:00.000	20.412	73.901	272
12/04/17 20:25:00.000	20.412	73.844	279.9
12/04/17 20:30:00.000	20.412	73.901	264.1
12/04/17 20:35:00.000	20.388	73.926	287.8
12/04/17 20:40:00.000	20.365	73.776	264.1
12/04/17 20:45:00.000	20.317	73.68	287.8
12/04/17 20:50:00.000	21.533	84.267	11.8
12/06/17 10:30:00.000	24.774	56.947	193.2
12/06/17 10:35:00.000	22.944	61.621	193.2
12/06/17 10:40:00.000	21.795	63.644	208.9
12/06/17 10:45:00.000	21.151	66.082	201
12/06/17 10:50:00.000	20.817	69.752	201
12/06/17 10:55:00.000	20.65	68.662	201
12/06/17 11:00:00.000	20.555	69.381	193.2
12/06/17 11:05:00.000	20.507	69.46	201
12/06/17 11:10:00.000	20.46	69.921	201
12/06/17 11:15:00.000	20.436	70.591	185.3
12/06/17 11:20:00.000	20.436	70.503	193.2
12/06/17 11:25:00.000	20.412	72.045	201
12/06/17 11:30:00.000	20.436	71.933	185.3
12/06/17 11:35:00.000	20.436	72.486	193.2
12/06/17 11:40:00.000	20.436	72.341	193.2
12/06/17 11:45:00.000	20.46	72.258	201
12/06/17 11:50:00.000	20.484	72.728	201
12/06/17 11:55:00.000	20.484	72.059	193.2
12/06/17 12:00:00.000	20.484	72.379	201

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 12:05:00.000	20.507	72.761	185.3
12/06/17 12:10:00.000	20.507	72.471	201
12/06/17 12:15:00.000	20.507	72.616	193.2
12/06/17 12:20:00.000	20.507	72.616	185.3
12/06/17 12:25:00.000	20.507	72.413	201
12/06/17 12:30:00.000	20.507	72.819	201
12/06/17 12:35:00.000	20.507	72.413	201
12/06/17 12:40:00.000	20.507	72.732	201
12/06/17 12:45:00.000	20.531	73.346	193.2
12/06/17 12:50:00.000	20.531	72.708	193.2
12/06/17 12:55:00.000	20.555	73.524	185.3
12/06/17 13:00:00.000	20.555	73.322	193.2
12/06/17 13:05:00.000	20.579	72.543	185.3
12/06/17 13:10:00.000	20.555	73.235	201
12/06/17 13:15:00.000	20.579	73.21	201
12/06/17 13:20:00.000	20.579	73.181	193.2
12/06/17 13:25:00.000	20.579	72.775	193.2
12/06/17 13:30:00.000	20.579	72.63	193.2
12/06/17 13:35:00.000	20.579	72.77	201
12/06/17 13:40:00.000	20.555	73.123	201
12/06/17 13:45:00.000	20.579	73.5	232.6
12/06/17 13:50:00.000	20.579	73.007	256.2
12/06/17 13:55:00.000	20.579	73.104	248.3
12/06/17 14:00:00.000	20.627	73.104	248.3
12/06/17 14:05:00.000	20.65	72.789	248.3
12/06/17 14:10:00.000	20.674	72.91	240.5
12/06/17 14:15:00.000	20.674	72.91	240.5
12/06/17 14:20:00.000	20.698	72.653	256.2
12/06/17 14:25:00.000	20.698	72.682	256.2
12/06/17 14:30:00.000	20.698	72.682	256.2
12/06/17 14:35:00.000	20.698	72.362	256.2
12/06/17 14:40:00.000	20.698	72.362	240.5
12/06/17 14:45:00.000	20.722	72.425	240.5
12/06/17 14:50:00.000	20.698	72.187	240.5
12/06/17 14:55:00.000	20.698	72.42	240.5
12/06/17 15:00:00.000	20.698	72.333	248.3
12/06/17 15:05:00.000	20.698	72.333	240.5
12/06/17 15:10:00.000	20.698	72.449	240.5
12/06/17 15:15:00.000	20.698	72.449	240.5
12/06/17 15:20:00.000	20.698	72.362	240.5
12/06/17 15:25:00.000	20.698	72.362	248.3
12/06/17 15:30:00.000	20.746	72.488	248.3
12/06/17 15:35:00.000	20.746	72.167	248.3
12/06/17 15:40:00.000	20.746	72.167	240.5
12/06/17 15:45:00.000	20.77	72.259	232.6
12/06/17 15:50:00.000	20.77	72.055	232.6
12/06/17 15:55:00.000	20.77	72.055	248.3
12/06/17 16:00:00.000	20.793	71.71	248.3
12/06/17 16:05:00.000	20.793	71.798	248.3
12/06/17 16:10:00.000	20.793	71.798	248.3
12/06/17 16:15:00.000	20.793	71.768	248.3

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 15:30:00.000	20.793	71.739	240.5
12/06/17 15:35:00.000	20.793	71.914	240.5
12/06/17 15:40:00.000	20.817	72.152	240.5
12/06/17 15:45:00.000	20.817	72.035	248.3
12/06/17 15:50:00.000	20.841	72.069	248.3
12/06/17 15:55:00.000	20.841	72.157	264.1
12/06/17 16:00:00.000	20.817	72.006	248.3
12/06/17 16:05:00.000	20.817	72.123	256.2
12/06/17 16:10:00.000	20.793	72.497	256.2
12/06/17 16:15:00.000	20.793	72.206	256.2
12/06/17 16:20:00.000	20.77	72.318	256.2
12/06/17 16:25:00.000	20.77	72.288	240.5
12/06/17 16:30:00.000	20.746	72.138	248.3
12/06/17 16:35:00.000	20.722	72.192	248.3
12/06/17 16:40:00.000	20.698	72.071	256.2
12/06/17 16:45:00.000	20.698	72.187	248.3
12/06/17 16:50:00.000	20.698	72.187	248.3
12/06/17 16:55:00.000	20.674	72.241	240.5
12/06/17 17:00:00.000	20.674	72.27	240.5
12/06/17 17:05:00.000	20.65	72.324	240.5
12/06/17 17:10:00.000	20.674	72.241	256.2
12/06/17 17:15:00.000	20.65	72.004	240.5
12/06/17 17:20:00.000	20.627	72.115	256.2
12/06/17 17:25:00.000	20.603	72.227	256.2
12/06/17 17:30:00.000	20.579	71.932	256.2
12/06/17 17:35:00.000	20.555	71.927	240.5
12/06/17 17:40:00.000	20.531	72.126	240.5
12/06/17 17:45:00.000	20.555	71.956	248.3
12/06/17 17:50:00.000	20.531	71.864	240.5
12/06/17 17:55:00.000	20.531	72.097	240.5
12/06/17 18:00:00.000	20.531	72.039	248.3
12/06/17 18:05:00.000	20.531	72.359	248.3
12/06/17 18:10:00.000	20.531	72.039	248.3
12/06/17 18:15:00.000	20.531	71.981	240.5
12/06/17 18:20:00.000	20.507	72.093	248.3
12/06/17 18:25:00.000	20.507	72.18	256.2
12/06/17 18:30:00.000	20.484	72.146	248.3
12/06/17 18:35:00.000	20.46	72.258	248.3
12/06/17 18:40:00.000	20.46	72.316	248.3
12/06/17 18:45:00.000	20.46	72.171	240.5
12/06/17 18:50:00.000	20.46	72.054	240.5

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 18:55:00.000	20.46	72.287	248.3
12/06/17 19:00:00.000	20.436	72.254	256.2
12/06/17 19:05:00.000	20.436	72.224	248.3
12/06/17 19:10:00.000	20.412	72.452	248.3
12/06/17 19:15:00.000	20.412	72.249	248.3
12/06/17 19:20:00.000	20.412	72.452	256.2
12/06/17 19:25:00.000	20.412	72.54	240.5
12/06/17 19:30:00.000	20.388	72.215	248.3
12/06/17 19:35:00.000	20.388	72.332	240.5
12/06/17 19:40:00.000	20.388	72.273	256.2
12/06/17 19:45:00.000	20.365	72.124	256.2
12/06/17 19:50:00.000	20.365	72.414	248.3
12/06/17 19:55:00.000	20.365	72.472	240.5
12/06/17 20:00:00.000	20.365	72.443	248.3
12/06/17 20:05:00.000	20.341	72.642	256.2
12/06/17 20:10:00.000	20.341	72.613	240.5
12/06/17 20:15:00.000	20.388	72.912	240.5
12/06/17 20:20:00.000	20.391	72.934	251
12/06/17 20:25:00.000	20.394	72.955	241.5

Empirical measurement within Third Floor

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 16:50:00.000	25.137	59.545	130.1
12/04/17 16:55:00.000	23.4	62.274	122.2
12/04/17 17:00:00.000	22.369	65.065	130.1
12/04/17 17:05:00.000	21.795	67.327	122.2
12/04/17 17:10:00.000	21.461	68.987	114.3
12/04/17 17:15:00.000	21.294	69.693	122.2
12/04/17 17:20:00.000	21.199	70.176	122.2
12/04/17 17:25:00.000	21.175	71.286	122.2
12/04/17 17:30:00.000	21.151	71.193	122.2
12/04/17 17:35:00.000	21.127	71.481	122.2
12/04/17 17:40:00.000	21.103	72.44	122.2
12/04/17 17:45:00.000	21.079	72.61	114.3
12/04/17 17:50:00.000	21.079	72.872	122.2
12/04/17 17:55:00.000	21.056	72.838	114.3
12/04/17 18:00:00.000	21.056	72.751	122.2
12/04/17 18:05:00.000	21.056	72.751	130.1
12/04/17 18:10:00.000	21.032	73.187	114.3
12/04/17 18:15:00.000	21.008	73.153	122.2
12/04/17 18:20:00.000	21.008	73.178	122.2

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 18:20:00.000	20.984	73.521	114.3
12/04/17 18:25:00.000	20.984	73.753	122.2
12/04/17 18:30:00.000	20.96	73.574	122.2
12/04/17 18:35:00.000	20.96	73.488	114.3
12/04/17 18:40:00.000	20.96	73.371	114.3
12/04/17 18:45:00.000	20.96	73.574	122.2
12/04/17 18:50:00.000	20.96	73.806	122.2
12/04/17 18:55:00.000	20.936	74.004	122.2
12/04/17 19:00:00.000	20.936	74.033	130.1
12/04/17 19:05:00.000	20.936	74.149	122.2
12/04/17 19:10:00.000	20.913	74	122.2
12/04/17 19:15:00.000	20.913	74.144	114.3
12/04/17 19:20:00.000	20.913	74.26	114.3
12/04/17 19:25:00.000	20.889	74.371	122.2
12/04/17 19:30:00.000	20.913	74.491	122.2
12/04/17 19:35:00.000	20.889	74.342	114.3
12/04/17 19:40:00.000	20.889	74.66	122.2
12/04/17 19:45:00.000	20.889	74.804	122.2
12/04/17 19:50:00.000	20.865	74.857	122.2
12/04/17 19:55:00.000	20.865	75.001	122.2
12/04/17 20:00:00.000	20.841	75.14	122.2
12/04/17 20:05:00.000	20.841	75.313	122.2
12/04/17 20:10:00.000	20.865	75.433	114.3
12/04/17 20:15:00.000	20.865	75.347	114.3
12/04/17 20:20:00.000	20.865	75.289	130.1
12/04/17 20:25:00.000	20.865	75.116	130.1
12/04/17 20:30:00.000	20.865	75.203	122.2
12/04/17 20:35:00.000	20.865	75.174	122.2
12/04/17 20:40:00.000	20.841	74.939	122.2
12/04/17 20:45:00.000	20.817	74.847	122.2
12/04/17 20:50:00.000	21.843	83.723	11.8
12/06/17 10:30:00.000	25.574	55.126	161.6
12/06/17 10:35:00.000	23.593	58.75	161.6
12/06/17 10:40:00.000	22.369	64.253	161.6
12/06/17 10:45:00.000	21.772	65.113	145.8
12/06/17 10:50:00.000	21.437	66.758	153.7
12/06/17 10:55:00.000	21.246	69.567	145.8
12/06/17 11:00:00.000	21.151	68.457	153.7
12/06/17 11:05:00.000	21.127	68.571	153.7
12/06/17 11:10:00.000	21.103	69.952	153.7
12/06/17 11:15:00.000	21.079	69.33	145.8

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 11:20:00.000	21.079	69.595	153.7
12/06/17 11:25:00.000	21.079	69.683	145.8
12/06/17 11:30:00.000	21.103	69.835	153.7
12/06/17 11:35:00.000	21.079	70.653	153.7
12/06/17 11:40:00.000	21.103	70.217	153.7
12/06/17 11:45:00.000	21.127	70.397	153.7
12/06/17 11:50:00.000	21.127	70.984	153.7
12/06/17 11:55:00.000	21.127	70.837	145.8
12/06/17 12:00:00.000	21.175	71.169	153.7
12/06/17 12:05:00.000	21.199	70.558	153.7
12/06/17 12:10:00.000	21.199	71.056	153.7
12/06/17 12:15:00.000	21.223	70.709	153.7
12/06/17 12:20:00.000	21.199	70.587	161.6
12/06/17 12:25:00.000	21.223	70.709	153.7
12/06/17 12:30:00.000	21.199	70.997	153.7
12/06/17 12:35:00.000	21.199	70.997	153.7
12/06/17 12:40:00.000	21.151	70.754	153.7
12/06/17 12:45:00.000	21.151	71.281	153.7
12/06/17 12:50:00.000	21.175	71.549	145.8
12/06/17 12:55:00.000	21.175	71.286	145.8
12/06/17 13:00:00.000	21.223	71.295	153.7
12/06/17 13:05:00.000	21.199	71.114	153.7
12/06/17 13:10:00.000	21.175	71.139	145.8
12/06/17 13:15:00.000	21.175	71.051	145.8
12/06/17 13:20:00.000	21.175	71.198	145.8
12/06/17 13:25:00.000	21.151	71.018	145.8
12/06/17 13:30:00.000	21.175	71.461	145.8
12/06/17 13:35:00.000	21.175	71.549	145.8
12/06/17 13:40:00.000	21.175	71.461	145.8
12/06/17 13:45:00.000	21.199	71.407	145.8
12/06/17 13:50:00.000	21.223	71.441	153.7
12/06/17 13:55:00.000	21.246	71.475	161.6
12/06/17 14:00:00.000	21.27	71.479	145.8
12/06/17 14:05:00.000	21.294	71.484	161.6
12/06/17 14:10:00.000	21.27	71.245	153.7
12/06/17 14:15:00.000	21.27	70.835	161.6
12/06/17 14:20:00.000	21.27	70.835	153.7
12/06/17 14:25:00.000	21.294	71.074	161.6
12/06/17 14:30:00.000	21.27	70.776	161.6
12/06/17 14:35:00.000	21.294	70.927	161.6
12/06/17 14:40:00.000	21.27	70.776	153.7

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 14:45:00.000	21.294	71.045	153.7
12/06/17 14:50:00.000	21.318	70.844	161.6
12/06/17 14:55:00.000	21.342	71.024	153.7
12/06/17 15:00:00.000	21.318	70.932	153.7
12/06/17 15:05:00.000	21.318	70.697	161.6
12/06/17 15:10:00.000	21.342	70.672	153.7
12/06/17 15:15:00.000	21.366	70.765	161.6
12/06/17 15:20:00.000	21.39	70.623	153.7
12/06/17 15:25:00.000	21.39	70.505	153.7
12/06/17 15:30:00.000	21.39	70.152	161.6
12/06/17 15:35:00.000	21.437	70.573	161.6
12/06/17 15:40:00.000	21.437	70.72	161.6
12/06/17 15:45:00.000	21.437	70.426	161.6
12/06/17 15:50:00.000	21.437	70.661	161.6
12/06/17 15:55:00.000	21.437	71.247	161.6
12/06/17 16:00:00.000	21.485	71.11	161.6
12/06/17 16:05:00.000	21.533	71.06	161.6
12/06/17 16:10:00.000	21.533	71.119	161.6
12/06/17 16:15:00.000	21.533	70.972	161.6
12/06/17 16:20:00.000	21.557	70.889	153.7
12/06/17 16:25:00.000	21.604	70.898	161.6
12/06/17 16:30:00.000	21.581	70.746	153.7
12/06/17 16:35:00.000	21.581	70.541	153.7
12/06/17 16:40:00.000	21.581	70.629	161.6
12/06/17 16:45:00.000	21.557	70.419	161.6
12/06/17 16:50:00.000	21.557	70.713	153.7
12/06/17 16:55:00.000	21.533	70.825	153.7
12/06/17 17:00:00.000	21.533	71.031	153.7
12/06/17 17:05:00.000	21.533	71.06	161.6
12/06/17 17:10:00.000	21.533	71.089	153.7
12/06/17 17:15:00.000	21.533	71.06	161.6
12/06/17 17:20:00.000	21.509	70.968	161.6
12/06/17 17:25:00.000	21.485	70.817	161.6
12/06/17 17:30:00.000	21.485	70.728	153.7
12/06/17 17:35:00.000	21.485	70.787	161.6
12/06/17 17:40:00.000	21.485	70.758	161.6
12/06/17 17:45:00.000	21.461	70.695	161.6
12/06/17 17:50:00.000	21.461	70.753	153.7
12/06/17 17:55:00.000	21.461	70.871	153.7
12/06/17 18:00:00.000	21.461	70.988	161.6
12/06/17 18:05:00.000	21.461	71.076	153.7

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 18:10:00.000	21.461	71.105	153.7
12/06/17 18:15:00.000	21.437	70.837	153.7
12/06/17 18:20:00.000	21.413	70.862	161.6
12/06/17 18:25:00.000	21.413	70.862	153.7
12/06/17 18:30:00.000	21.366	71.029	153.7
12/06/17 18:35:00.000	21.366	70.882	153.7
12/06/17 18:40:00.000	21.366	71.175	153.7
12/06/17 18:45:00.000	21.342	71.054	153.7
12/06/17 18:50:00.000	21.294	71.25	153.7
12/06/17 18:55:00.000	21.294	71.454	145.8
12/06/17 19:00:00.000	21.294	71.454	153.7
12/06/17 19:05:00.000	21.27	71.304	153.7
12/06/17 19:10:00.000	21.27	71.45	153.7
12/06/17 19:15:00.000	21.294	71.542	153.7
12/06/17 19:20:00.000	21.294	71.425	161.6
12/06/17 19:25:00.000	21.27	71.421	161.6
12/06/17 19:30:00.000	21.246	71.416	153.7
12/06/17 19:35:00.000	21.223	71.529	153.7
12/06/17 19:40:00.000	21.223	71.792	161.6
12/06/17 19:45:00.000	21.223	71.704	161.6
12/06/17 19:50:00.000	21.199	71.846	161.6
12/06/17 19:55:00.000	21.199	72.108	161.6
12/06/17 20:00:00.000	21.175	72.075	153.7
12/06/17 20:05:00.000	21.199	72.05	161.6
12/06/17 20:10:00.000	21.199	72.167	153.7
12/06/17 20:15:00.000	21.223	72.171	161.6
12/06/17 20:20:00.000	21.581	71.714	156.8
12/06/17 20:25:00.000	21.659	71.625	161.8

Empirical measurement within Fourth Floor

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 16:50:00.000	24.992	66.15	201
12/04/17 16:55:00.000	24.75	63.775	216.8
12/04/17 17:00:00.000	23.448	67.412	208.9
12/04/17 17:05:00.000	22.824	68.731	216.8
12/04/17 17:10:00.000	22.465	71.118	216.8
12/04/17 17:15:00.000	22.202	71.186	208.9
12/04/17 17:20:00.000	22.106	72.749	224.7
12/04/17 17:25:00.000	22.011	73.052	224.7
12/04/17 17:30:00.000	21.963	73.276	216.8

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 17:35:00.000	22.011	74.07	224.7
12/04/17 17:40:00.000	22.011	73.838	216.8
12/04/17 17:45:00.000	22.034	73.959	216.8
12/04/17 17:50:00.000	22.011	73.809	224.7
12/04/17 17:55:00.000	21.963	74.119	216.8
12/04/17 18:00:00.000	21.939	74.433	216.8
12/04/17 18:05:00.000	21.891	74.395	224.7
12/04/17 18:10:00.000	21.891	74.858	216.8
12/04/17 18:15:00.000	21.891	75.408	224.7
12/04/17 18:20:00.000	21.891	74.858	216.8
12/04/17 18:25:00.000	21.915	75.037	224.7
12/04/17 18:30:00.000	21.939	75.128	224.7
12/04/17 18:35:00.000	21.915	74.863	216.8
12/04/17 18:40:00.000	21.963	75.278	248.3
12/04/17 18:45:00.000	21.987	75.224	248.3
12/04/17 18:50:00.000	21.987	75.34	232.6
12/04/17 18:55:00.000	21.963	75.191	240.5
12/04/17 19:00:00.000	21.939	75.677	240.5
12/04/17 19:05:00.000	21.915	75.441	240.5
12/04/17 19:10:00.000	21.915	76.191	232.6
12/04/17 19:15:00.000	21.915	75.989	248.3
12/04/17 19:20:00.000	21.843	76.177	248.3
12/04/17 19:25:00.000	21.867	75.98	240.5
12/04/17 19:30:00.000	21.819	75.74	240.5
12/04/17 19:35:00.000	21.795	75.994	240.5
12/04/17 19:40:00.000	21.843	76.781	240.5
12/04/17 19:45:00.000	21.867	76.642	248.3
12/04/17 19:50:00.000	21.867	76.699	248.3
12/04/17 19:55:00.000	21.843	76.493	240.5
12/04/17 20:00:00.000	21.843	76.752	256.2
12/04/17 20:05:00.000	21.867	76.699	256.2
12/04/17 20:10:00.000	21.867	76.584	248.3
12/04/17 20:15:00.000	21.843	77.154	248.3
12/04/17 20:20:00.000	21.819	77.149	248.3
12/04/17 20:25:00.000	21.819	77.636	248.3
12/04/17 20:30:00.000	21.819	76.919	248.3
12/04/17 20:35:00.000	21.795	76.886	240.5
12/04/17 20:40:00.000	21.724	76.498	248.3
12/04/17 20:45:00.000	21.7	76.378	256.2
12/04/17 20:50:00.000	22.082	82.008	11.8
12/06/17 10:30:00.000	25.162	60.536	240.5

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 10:35:00.000	23.641	64.438	240.5
12/06/17 10:40:00.000	22.776	67.77	248.3
12/06/17 10:45:00.000	22.345	69.769	232.6
12/06/17 10:50:00.000	22.106	71.227	232.6
12/06/17 10:55:00.000	21.963	71.346	240.5
12/06/17 11:00:00.000	21.891	71.89	232.6
12/06/17 11:05:00.000	21.772	72.101	240.5
12/06/17 11:10:00.000	21.748	72.272	232.6
12/06/17 11:15:00.000	21.724	72.967	232.6
12/06/17 11:20:00.000	21.843	72.874	232.6
12/06/17 11:25:00.000	21.867	73.111	224.7
12/06/17 11:30:00.000	21.867	73.111	224.7
12/06/17 11:35:00.000	21.891	73.582	224.7
12/06/17 11:40:00.000	21.915	73.179	232.6
12/06/17 11:45:00.000	21.891	73.262	224.7
12/06/17 11:50:00.000	21.939	72.892	224.7
12/06/17 11:55:00.000	21.963	73.072	224.7
12/06/17 12:00:00.000	21.987	73.484	232.6
12/06/17 12:05:00.000	22.034	72.969	224.7
12/06/17 12:10:00.000	22.011	73.256	224.7
12/06/17 12:15:00.000	22.034	72.502	232.6
12/06/17 12:20:00.000	22.034	72.91	224.7
12/06/17 12:25:00.000	22.082	72.511	224.7
12/06/17 12:30:00.000	22.13	73.104	224.7
12/06/17 12:35:00.000	22.202	73.468	232.6
12/06/17 12:40:00.000	22.226	72.977	232.6
12/06/17 12:45:00.000	22.226	73.792	224.7
12/06/17 12:50:00.000	22.274	72.84	224.7
12/06/17 12:55:00.000	22.25	72.338	224.7
12/06/17 13:00:00.000	22.226	72.392	232.6
12/06/17 13:05:00.000	22.178	72.354	232.6
12/06/17 13:10:00.000	22.154	72.875	224.7
12/06/17 13:15:00.000	22.13	72.754	224.7
12/06/17 13:20:00.000	22.082	73.036	224.7
12/06/17 13:25:00.000	22.058	73.178	232.6
12/06/17 13:30:00.000	22.154	73.458	232.6
12/06/17 13:35:00.000	22.154	72.963	224.7
12/06/17 13:40:00.000	22.13	73.104	224.7
12/06/17 13:45:00.000	22.082	73.444	232.6
12/06/17 13:50:00.000	22.106	73.362	224.7
12/06/17 13:55:00.000	22.154	72.934	224.7

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 14:00:00.000	22.13	72.666	232.6
12/06/17 14:05:00.000	22.106	72.574	232.6
12/06/17 14:10:00.000	22.082	72.336	232.6
12/06/17 14:15:00.000	22.034	72.297	232.6
12/06/17 14:20:00.000	22.034	72.356	232.6
12/06/17 14:25:00.000	22.034	72.619	232.6
12/06/17 14:30:00.000	22.106	72.516	224.7
12/06/17 14:35:00.000	22.13	72.374	232.6
12/06/17 14:40:00.000	22.106	72.545	216.8
12/06/17 14:45:00.000	22.154	72.729	232.6
12/06/17 14:50:00.000	22.154	72.379	224.7
12/06/17 14:55:00.000	22.106	72.106	232.6
12/06/17 15:00:00.000	22.082	71.955	224.7
12/06/17 15:05:00.000	22.011	71.795	232.6
12/06/17 15:10:00.000	22.011	72.088	224.7
12/06/17 15:15:00.000	22.011	72.672	232.6
12/06/17 15:20:00.000	22.058	71.98	224.7
12/06/17 15:25:00.000	22.082	72.219	232.6
12/06/17 15:30:00.000	22.058	72.068	216.8
12/06/17 15:35:00.000	22.106	71.725	232.6
12/06/17 15:40:00.000	22.082	72.102	224.7
12/06/17 15:45:00.000	22.082	72.072	216.8
12/06/17 15:50:00.000	22.082	72.189	232.6
12/06/17 15:55:00.000	22.106	71.725	224.7
12/06/17 16:00:00.000	22.154	71.471	232.6
12/06/17 16:05:00.000	22.106	71.461	224.7
12/06/17 16:10:00.000	22.154	71.588	224.7
12/06/17 16:15:00.000	22.202	71.186	232.6
12/06/17 16:20:00.000	22.226	71.132	224.7
12/06/17 16:25:00.000	22.202	71.303	224.7
12/06/17 16:30:00.000	22.154	71.471	232.6
12/06/17 16:35:00.000	22.154	71.382	240.5
12/06/17 16:40:00.000	22.13	71.495	232.6
12/06/17 16:45:00.000	22.106	71.491	232.6
12/06/17 16:50:00.000	22.13	71.701	232.6
12/06/17 16:55:00.000	22.154	71.793	248.3
12/06/17 17:00:00.000	22.178	71.563	224.7
12/06/17 17:05:00.000	22.178	71.885	232.6
12/06/17 17:10:00.000	22.13	71.495	240.5
12/06/17 17:15:00.000	22.154	71.705	240.5
12/06/17 17:20:00.000	22.154	71.764	216.8

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 17:25:00.000	22.178	71.885	240.5
12/06/17 17:30:00.000	22.106	70.933	232.6
12/06/17 17:35:00.000	22.058	71.335	208.9
12/06/17 17:40:00.000	22.058	71.863	208.9
12/06/17 17:45:00.000	22.058	72.068	216.8
12/06/17 17:50:00.000	22.058	72.302	201
12/06/17 17:55:00.000	22.082	71.486	208.9
12/06/17 18:00:00.000	22.106	72.223	201
12/06/17 18:05:00.000	22.106	71.872	208.9
12/06/17 18:10:00.000	22.106	71.813	216.8
12/06/17 18:15:00.000	22.058	72.331	208.9
12/06/17 18:20:00.000	22.058	72.009	208.9
12/06/17 18:25:00.000	22.034	72.18	208.9
12/06/17 18:30:00.000	22.011	72.205	208.9
12/06/17 18:35:00.000	21.987	72.376	208.9
12/06/17 18:40:00.000	22.034	72.677	208.9
12/06/17 18:45:00.000	22.011	72.439	208.9
12/06/17 18:50:00.000	22.011	73.081	216.8
12/06/17 18:55:00.000	22.011	72.76	208.9
12/06/17 19:00:00.000	21.963	72.838	208.9
12/06/17 19:05:00.000	21.987	73.164	216.8
12/06/17 19:10:00.000	22.034	73.144	208.9
12/06/17 19:15:00.000	22.058	72.857	208.9
12/06/17 19:20:00.000	22.034	72.502	208.9
12/06/17 19:25:00.000	22.034	72.823	216.8
12/06/17 19:30:00.000	22.011	72.848	208.9
12/06/17 19:35:00.000	22.011	72.76	208.9
12/06/17 19:40:00.000	21.963	72.897	208.9
12/06/17 19:45:00.000	21.939	72.95	208.9
12/06/17 19:50:00.000	21.963	73.363	208.9
12/06/17 19:55:00.000	21.963	73.508	216.8
12/06/17 20:00:00.000	21.963	73.77	208.9
12/06/17 20:05:00.000	21.963	73.567	208.9
12/06/17 20:10:00.000	21.963	73.799	216.8
12/06/17 20:15:00.000	22.729	71.373	215.6
12/06/17 20:20:00.000	23.497	68.793	214.65
12/06/17 20:25:00.000	23.857	67.634	216.9

Empirical measurement within Collaborative area

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 16:50:00.000	25.866	59.845	358.7
12/04/17 16:55:00.000	25.065	59.75	130.1
12/04/17 17:00:00.000	24.532	62.276	319.3
12/04/17 17:05:00.000	24.267	62.964	130.1
12/04/17 17:10:00.000	24.074	63.723	106.4
12/04/17 17:15:00.000	24.026	65.349	82.8
12/04/17 17:20:00.000	23.978	63.464	82.8
12/04/17 17:25:00.000	23.881	65.083	74.9
12/04/17 17:30:00.000	23.905	65.419	74.9
12/04/17 17:35:00.000	23.857	64.384	90.7
12/04/17 17:40:00.000	23.905	65.721	90.7
12/04/17 17:45:00.000	23.905	64.513	90.7
12/04/17 17:50:00.000	23.833	65.166	74.9
12/04/17 17:55:00.000	23.881	65.897	67
12/04/17 18:00:00.000	23.881	64.479	67
12/04/17 18:05:00.000	23.881	66.258	59.1
12/04/17 18:10:00.000	23.93	65.544	59.1
12/04/17 18:15:00.000	23.833	65.166	59.1
12/04/17 18:20:00.000	23.833	66.4	67
12/04/17 18:25:00.000	23.857	66.765	59.1
12/04/17 18:30:00.000	23.881	66.949	59.1
12/04/17 18:35:00.000	23.905	66.863	51.2
12/04/17 18:40:00.000	23.93	67.317	59.1
12/04/17 18:45:00.000	23.857	65.109	59.1
12/04/17 18:50:00.000	23.809	66.366	51.2
12/04/17 18:55:00.000	23.857	67.065	51.2
12/04/17 19:00:00.000	23.905	67.343	51.2
12/04/17 19:05:00.000	23.93	67.168	51.2
12/04/17 19:10:00.000	23.93	67.347	51.2
12/04/17 19:15:00.000	23.93	66.417	51.2
12/04/17 19:20:00.000	23.905	66.052	51.2
12/04/17 19:25:00.000	23.905	67.223	51.2
12/04/17 19:30:00.000	23.905	66.713	51.2
12/04/17 19:35:00.000	23.905	66.142	51.2
12/04/17 19:40:00.000	23.809	66.156	51.2
12/04/17 19:45:00.000	23.833	67.33	51.2
12/04/17 19:50:00.000	23.881	67.459	51.2
12/04/17 19:55:00.000	23.905	67.133	51.2
12/04/17 20:00:00.000	23.93	66.808	51.2

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/04/17 20:05:00.000	23.93	67.258	51.2
12/04/17 20:10:00.000	23.905	66.353	51.2
12/04/17 20:15:00.000	23.881	67.159	51.2
12/04/17 20:20:00.000	23.881	67.309	51.2
12/04/17 20:25:00.000	23.881	67.519	51.2
12/04/17 20:30:00.000	23.857	66.314	51.2
12/04/17 20:35:00.000	23.809	67.146	51.2
12/04/17 20:40:00.000	23.809	67.206	51.2
12/04/17 20:45:00.000	23.857	66.645	51.2
12/04/17 20:50:00.000	23.93	74.271	11.8
12/06/17 10:30:00.000	25.841	59.345	90.7
12/06/17 10:35:00.000	25.404	58.596	98.5
12/06/17 10:40:00.000	24.798	61.032	98.5
12/06/17 10:45:00.000	24.363	62.095	90.7
12/06/17 10:50:00.000	24.195	63.773	90.7
12/06/17 10:55:00.000	24.146	64.705	90.7
12/06/17 11:00:00.000	24.002	63.164	90.7
12/06/17 11:05:00.000	23.93	64.154	90.7
12/06/17 11:10:00.000	23.978	65.793	90.7
12/06/17 11:15:00.000	23.93	63.941	82.8
12/06/17 11:20:00.000	23.881	65.325	90.7
12/06/17 11:25:00.000	23.905	64.906	90.7
12/06/17 11:30:00.000	23.905	64.846	90.7
12/06/17 11:35:00.000	23.93	65.815	98.5
12/06/17 11:40:00.000	23.954	64.127	106.4
12/06/17 11:45:00.000	23.881	64.327	106.4
12/06/17 11:50:00.000	23.905	65.63	90.7
12/06/17 11:55:00.000	23.954	64.249	90.7
12/06/17 12:00:00.000	23.905	64.422	90.7
12/06/17 12:05:00.000	23.954	65.578	90.7
12/06/17 12:10:00.000	23.93	63.82	90.7
12/06/17 12:15:00.000	23.857	64.656	106.4
12/06/17 12:20:00.000	23.93	66.116	90.7
12/06/17 12:25:00.000	23.93	63.79	106.4
12/06/17 12:30:00.000	23.905	65.057	98.5
12/06/17 12:35:00.000	23.954	65.005	59.1
12/06/17 12:40:00.000	23.881	63.448	82.8
12/06/17 12:45:00.000	23.905	65.087	82.8
12/06/17 12:50:00.000	23.93	64.214	82.8
12/06/17 12:55:00.000	23.881	63.842	106.4
12/06/17 13:00:00.000	23.93	65.273	74.9

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 13:05:00.000	23.954	63.612	114.3
12/06/17 13:10:00.000	23.954	64.491	82.8
12/06/17 13:15:00.000	23.978	63.525	114.3
12/06/17 13:20:00.000	23.93	63.577	82.8
12/06/17 13:25:00.000	24.002	65.345	122.2
12/06/17 13:30:00.000	24.026	63.593	82.8
12/06/17 13:35:00.000	24.002	63.65	74.9
12/06/17 13:40:00.000	24.05	63.81	98.5
12/06/17 13:45:00.000	24.026	62.681	74.9
12/06/17 13:50:00.000	24.026	64.321	90.7
12/06/17 13:55:00.000	24.05	63.446	90.7
12/06/17 14:00:00.000	24.002	62.25	106.4
12/06/17 14:05:00.000	24.05	63.901	82.8
12/06/17 14:10:00.000	24.05	62.898	82.8
12/06/17 14:15:00.000	24.002	62.799	74.9
12/06/17 14:20:00.000	24.05	63.506	90.7
12/06/17 14:25:00.000	24.026	62.193	114.3
12/06/17 14:30:00.000	24.074	63.601	98.5
12/06/17 14:35:00.000	24.074	62.232	82.8
12/06/17 14:40:00.000	24.05	62.959	82.8
12/06/17 14:45:00.000	24.146	62.304	43.4
12/06/17 14:50:00.000	24.074	61.376	90.7
12/06/17 14:55:00.000	24.074	62.78	114.3
12/06/17 15:00:00.000	24.146	62.487	106.4
12/06/17 15:05:00.000	24.098	61.319	122.2
12/06/17 15:10:00.000	24.098	62.815	90.7
12/06/17 15:15:00.000	24.122	61.659	114.3
12/06/17 15:20:00.000	24.074	61.223	82.8
12/06/17 15:25:00.000	24.098	63.18	114.3
12/06/17 15:30:00.000	24.098	61.502	82.8
12/06/17 15:35:00.000	24.05	60.943	67
12/06/17 15:40:00.000	24.074	62.293	59.1
12/06/17 15:45:00.000	24.146	62.06	67
12/06/17 15:50:00.000	24.146	60.989	106.4
12/06/17 15:55:00.000	24.074	61.712	106.4
12/06/17 16:00:00.000	24.122	62.148	106.4
12/06/17 16:05:00.000	24.074	61.284	90.7
12/06/17 16:10:00.000	24.05	61.8	74.9
12/06/17 16:15:00.000	24.122	62.697	130.1
12/06/17 16:20:00.000	24.122	61.537	114.3
12/06/17 16:25:00.000	24.098	62.113	114.3

Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 16:30:00.000	24.146	61.571	106.4
12/06/17 16:35:00.000	24.098	61.074	82.8
12/06/17 16:40:00.000	24.074	60.824	122.2
12/06/17 16:45:00.000	24.146	62.152	90.7
12/06/17 16:50:00.000	24.315	60.832	122.2
12/06/17 16:55:00.000	24.291	60.614	177.4
12/06/17 17:00:00.000	24.267	61.376	90.7
12/06/17 17:05:00.000	24.195	60.445	74.9
12/06/17 17:10:00.000	24.074	60.61	82.8
12/06/17 17:15:00.000	24.146	62.091	59.1
12/06/17 17:20:00.000	24.195	61.456	82.8
12/06/17 17:25:00.000	24.074	60.978	90.7
12/06/17 17:30:00.000	24.098	62.449	90.7
12/06/17 17:35:00.000	24.171	62.491	82.8
12/06/17 17:40:00.000	24.098	61.716	74.9
12/06/17 17:45:00.000	24.098	62.997	74.9
12/06/17 17:50:00.000	24.122	61.965	74.9
12/06/17 17:55:00.000	24.098	62.723	67
12/06/17 18:00:00.000	24.122	62.392	67
12/06/17 18:05:00.000	24.05	62.014	67
12/06/17 18:10:00.000	24.05	63.506	59.1
12/06/17 18:15:00.000	24.122	63.761	51.2
12/06/17 18:20:00.000	24.098	61.808	51.2
12/06/17 18:25:00.000	24.05	63.263	51.2
12/06/17 18:30:00.000	24.122	63.518	51.2
12/06/17 18:35:00.000	24.098	62.205	51.2
12/06/17 18:40:00.000	24.026	62.864	51.2
12/06/17 18:45:00.000	24.074	63.966	51.2
12/06/17 18:50:00.000	24.122	62.91	59.1
12/06/17 18:55:00.000	24.026	62.315	51.2
12/06/17 19:00:00.000	24.05	63.84	51.2
12/06/17 19:05:00.000	24.146	64.099	51.2
12/06/17 19:10:00.000	24.098	62.693	51.2
12/06/17 19:15:00.000	24.098	64.091	51.2
12/06/17 19:20:00.000	24.098	62.449	51.2
12/06/17 19:25:00.000	24.05	63.415	51.2
12/06/17 19:30:00.000	24.098	64.091	51.2
12/06/17 19:35:00.000	24.098	62.48	51.2
12/06/17 19:40:00.000	24.05	63.567	51.2
12/06/17 19:45:00.000	24.074	64.329	51.2
12/06/17 19:50:00.000	24.05	62.502	51.2

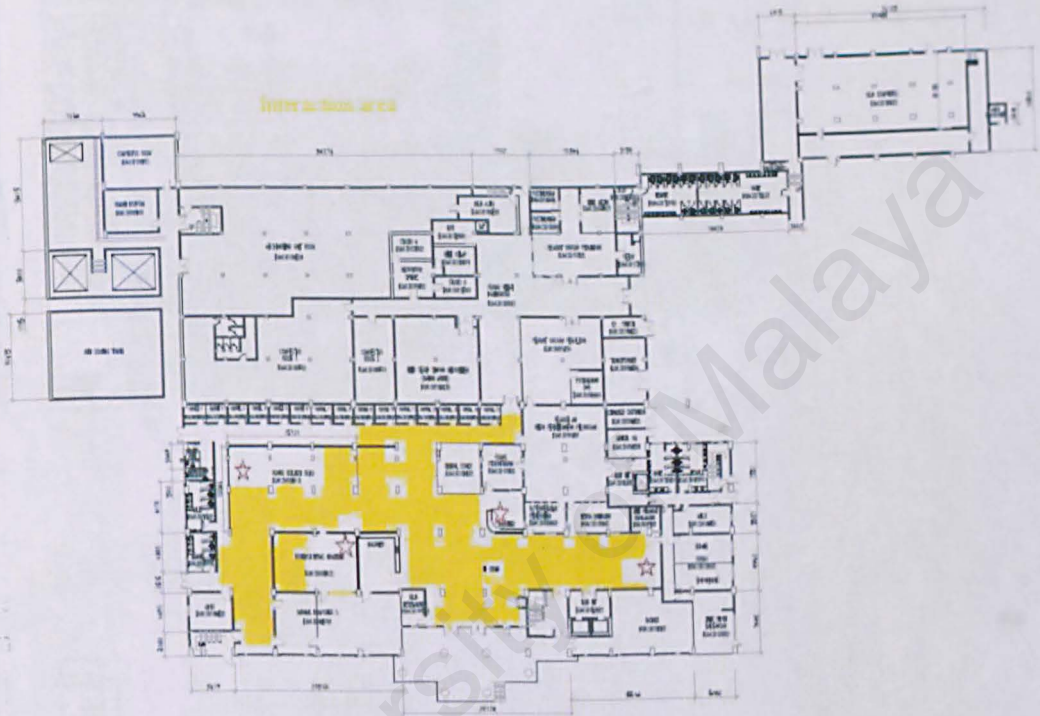
Date Time	Temp (°C)	RH (%)	Intensity (Lux)
12/06/17 19:55:00.000	24.026	63.563	51.2
12/06/17 20:00:00.000	24.05	64.689	51.2
12/06/17 20:05:00.000	24.074	65.116	51.2
12/06/17 20:10:00.000	24.05	62.868	43.4
12/06/17 20:15:00.000	24.002	63.984	51.2
12/06/17 20:20:00.000	24.388	61.732	51.1
12/06/17 20:25:00.000	24.605	60.417	52

University of Malaya

Appendix F: Floor Plans

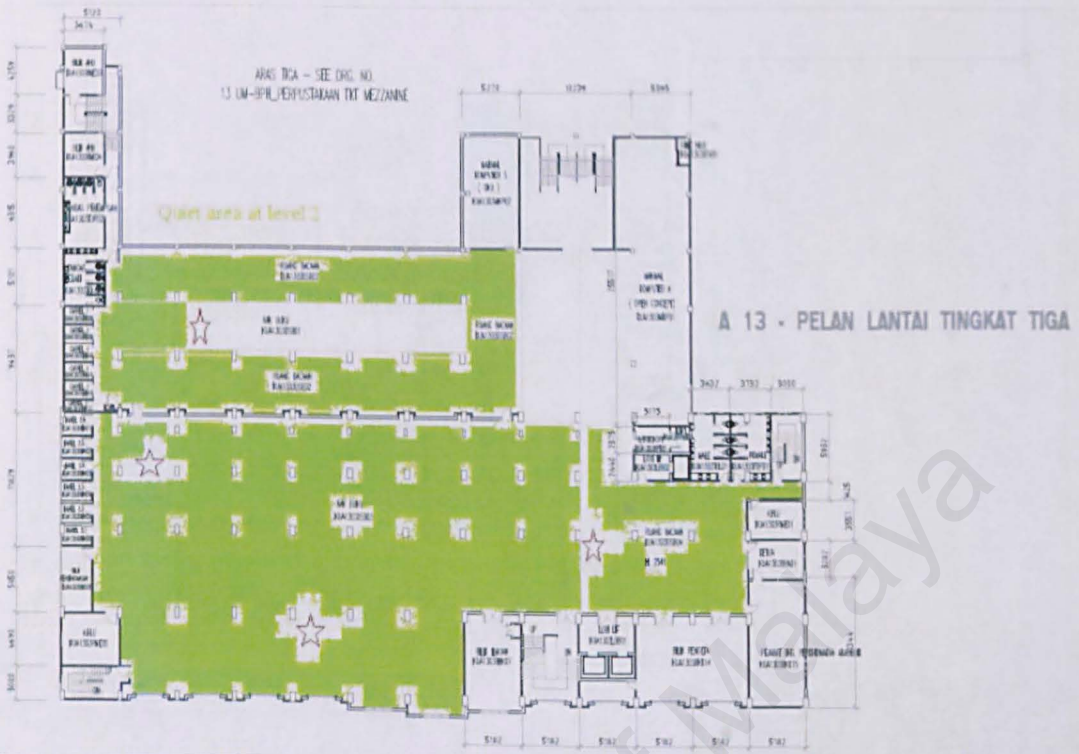
* mentions the location of Hobo Logger equipment to measure the temperature, relative humidity, and light intensity.

Ground Floor plan

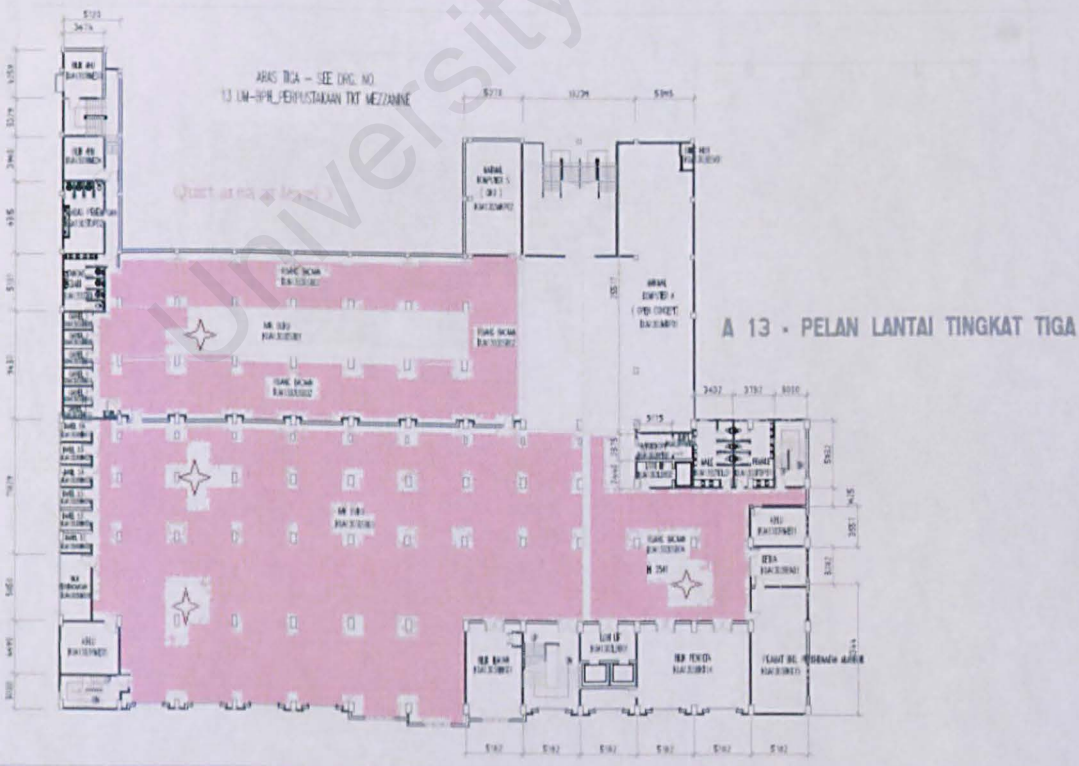


A 13 PELAN LANTAI TINGKAT SATU

Second Floor plan



Third Floor plan



Appendix G: Space information

Ground Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA1301TDL01	T/Men	214.98	19.98	
KUA1301MKP01	Computer lab	1214.05	112.83	
KUA1301BKK23	Academic Core Collection	787.42	73.18	
KUA1301BKK18	Book Collection Room	2260.25	210.06	
KUA1301DSB01	Reading Hall	6279.21	583.57	
KUA1301TDP02	T / Female	166.35	15.46	
KUA1301TDL02	T/Men	188.52	17.52	
KUA1301RME02	AHU Room	251.35	23.36	
KUA1301TKU01	OKU Toilet	48.64	4.52	
KUA1301TKU02	OKU Toilet	50.03	4.65	
KUA1301PPK02	Security Guard Post	131.92	12.26	
KUA1301LBB01	Lobby	1530.18	142.21	
KUA1301LBB02	Lift Lobby	172.16	16	
KUA1301BKK01	Locker room	893.51	83.04	
KUA1301BRD01	Staff lounge	429.22	39.89	
KUA1301SRU01	Surau	524.66	48.76	
KUA1301RME01	B/AHU	253.18	23.53	
KUA1301PPK01	B / Safety Charge	120.94	11.24	
KUA1301BBA02	Chairman of Bhgn	283.20	26.32	
KUA1301BBA03	B / Publication Supply	194.11	18.04	2
KUA1301BKK02	Digital Corner	332.59	30.91	
KUA1301PJT02	Registration Room	287.40	26.71	
KUA1301PJT01	Besides Customer Service	1269.46	117.98	
KUA1301LBB03	Lift Lobby	256.95	23.88	
KUA1301TDP01	T / Female	215.63	20.04	
KUA1301RME06	B / Switch	177.76	16.52	
KUA1301RME05	Electrical Room	153.11	14.23	
KUA1301BKK10	B. Carrel 8	61.12	5.68	
KUA1301BKK17	B. Carrel 15	61.12	5.68	
KUA1301BKK16	B. Carrel 14	61.12	5.68	
KUA1301BKK15	B. Carrel 13	61.12	5.68	
KUA1301BKK14	B. Carrel 12	61.12	5.68	
KUA1301BKK13	B. Carrel 11	61.12	5.68	
KUA1301BKK12	B. Carrel 10	61.12	5.68	
KUA1301BKK11	B. Carrel 9	61.12	5.68	
KUA1301BKK09	B. Carrel 7	61.12	5.68	
KUA1301BKK08	B. Carrel 6	61.12	5.68	
KUA1301BKK07	B. Carrel 5	61.12	5.68	
KUA1301BKK06	B. Carrel 4	61.12	5.68	
KUA1301BKK05	B. Carrel 3	61.12	5.68	
KUA1301BKK04	B. Carrel 2	61.12	5.68	
KUA1301BKK03	B. Carrel 1	64.78	6.02	
KUA1301BKK20	B / Cold Save Microfilm	1101.	102.34	

KUA1301BRF02	Compactus Room	2464.	229.05
KUA1301BRF01	Compactus Room	561.4	52.18
KUA1301BPK01	B / Associations	357.7	33.25
KUA1301BRF03	Compactus Room	598.6	55.64
KUA1301STD01	studio B	136.0	12.64
KUA1301PJT03	Office	252.4	23.46
KUA1301STD02	Studio A	166.6	15.49
KUA1301BKK19	B / Dark	174.7	16.24
KUA1301LBB04	Lobby	155.7	14.47
KUA1301RME08	AHU Room	267.4	24.86
KUA1301RME09	AHU Room	4263.	396.28
KUA1301RME04	B / Transfomer	433.0	40.25
KUA1301BBA04	PUSTAKAWAN(S48)	172.5	16.04
KUA1301PJT04	Bail Bonds	933.3	86.74
KUA1301RME03	B / Switch	133.7	12.43
KUA1301BRD02	Staff Lounge	2217.	206.06
KUA1301PJT05	Bail Bonds	706.9	65.7
KUA1301STR02	Store	156.9	14.59
KUA1301BBA05	Librarian	92.86	8.63
KUA1301BBA06	Librarian	98.88	9.19
KUA1301BKK21	Machine Room	244.6	22.74
KUA1301STR01	Store	39.06	3.63
KUA1301STR03	Store	30.67	2.85
KUA1301TDP03	T / Female	376.6	35
KUA1301TDL03	Men's toilet	606.4	56.36
KUA1301RME07	AHU Room	48.85	4.54
KUA1301BKK22	Computers' Room	1740.	161.76

Second Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA1302TDP02	Ladies toilet	235.21	21.86	
KUA1302TDL02	Men's toilet	190.56	17.71	
KUA1302BKK24	B/ Carrel 8	32.17	2.99	
KUA1302BKK23	B/ Carrel 7	32.17	2.99	
KUA1302BKK22	B/Carrel 6	32.17	2.99	
KUA1302BKK21	B/ Carrel 5	32.17	2.99	
KUA1302BKK20	B/ Carrel 4	32.17	2.99	
KUA1302BKK19	B/ Carrel 3	32.17	2.99	
KUA1302BKK18	B/ Carrel 2	32.17	2.99	
KUA1302BKK06	B/ Carrel 2.5	52.62	4.89	
KUA1302BKK05	B/ Carrel 2.4	51.22	4.76	
KUA1302BKK25	B/ Carrel	32.93	3.06	
KUA1302RPK03	B/Photocopy	56.81	5.28	
KUA1302BKK04	B/ Carrel 2.3	53.15	4.94	
KUA1302BKK03	B/ Carrel 2.2	50.46	4.69	
KUA1302BKK02	B/ Carrel 2.1	53.26	4.95	

KUA1302BKK01	Pro-Chancellor Furnace Room	139.9	13.01
KUA1302RME02	AHU Room	251.3	23.36
KUA1302BKK07	Book Collection Shelf	2314.	215.11
KUA1302DSB02	Reading Room	7685.	714.29
KUA1302DSB01	REPORTING DEWAN	1123	1,043.92
KUA1302BBA02	B / Librarian	209.0	19.43
KUA1302BBA01	B / Chairman Bhgn.	209.8	19.5
KUA1302STR02	Store	102.8	9.56
KUA1302LBB01	Lift Lobby	172.1	16
KUA1302PJT01	Pej.Am Acquisition (JOURNAL)	1171.	108.86
KUA1302RME01	AHU Room	182.0	16.92
KUA1302TDP01	T / Female	215.6	20.04
KUA1302TDL01	T/ Men	214.8	19.97
KUA1302LBB02	Lift Lobby	77.69	7.22
KUA1302RPK01	B/ Photocopy	89.31	8.3
KUA1302BKK08	B/Carrel 16	38.74	3.6
KUA1302BKK09	B/Carrel 15	39.49	3.67
KUA1302BKK10	B/Carrel 14	24.10	2.24
KUA1302BKK11	B/Carrel 13	39.81	3.7
KUA1302BKK12	B/Carrel 12	39.81	3.7
KUA1302BKK13	B/Carrel 11	39.81	3.7
KUA1302BKK14	B/Carrel 10	38.95	3.62
KUA1302BKK15	B/Carrel 9	39.81	3.7
KUA1302BKK16	B/Carrel 8	39.81	3.7
KUA1302BKK17	B/Carrel 7	41.43	3.85
KUA1302BBA04	B / Librarian Work	263.3	24.47
KUA1302PJT02	general Office	276.8	25.73
KUA1302RME03	B / Electrical	16.25	1.51
KUA1302STR01	Store	65.64	6.1
KUA1302PJT04	general Office	545.7	50.72
KUA1302RPK02	B. Photocopy	88.66	8.24
KUA1302BKK28	Book Stacks	1008	937.04
KUA1302RME04	AHU Room	143.1	13.3
KUA1302RME05	AHU Room	149.7	13.92
KUA1302BKK27	B/Carrel	336.7	31.3
KUA1302PJT05	Pej. Catalog Service	2368.	220.12
KUA1302BKK29	B/Carrel	64.88	6.03
KUA1302RME06	AHU	173.7	16.15
KUA1302TDL03	T/ Men	130.8	12.16
KUA1302TDP03	T/ Female	148.2	13.78
KUA1302BBA03	B / Chairman Bhgn	166.3	15.46
KUA1302BSV02	B/Server	244.2	22.7
KUA1302BSV01	B/Server	258.0	23.98
KUA1302LBB03	Hallway	4499.	418.21
KUA1302RME09	AHU Room	48.85	4.54
KUA1302RME07	Control Room	74.89	6.96
KUA1302STR03	Store	76.18	7.08

	Chief of Staff (Information)			
KUA1302RME08	Control Room	81.35	7.56	
KUA1302BKK30	Reading Room 24Jam	2504.	232.76	
KUA1302MKP01	Computer Lab	2395.	222.64	
KUA1302PJT06	Information System Office	1213.	112.81	

2.1 Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA132.1BRF01	Compactus Room	269.11	25.01	
KUA132.1BRD01	Staff Room	195.08	18.13	
KUA132.1BKK01	Carrel Room	72.31	6.72	
KUA132.1STR01	Store 2	49.60	4.61	
KUA132.1RME02	AHU Room	149.67	13.91	
KUA132.1RME01	AHU Room	143.11	13.3	
KUA132.1TDP01	Ladies toilet	235.21	21.86	
KUA132.1DSB01	Reading Hall	5223.33	485.44	

Third Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA1303RME03	AHU Room	149.56	13.9	
KUA1303RME04	AHU Room	143.11	13.3	
KUA1303TDP02	Ladies toilet	235.21	21.86	
KUA1303TDL02	Toilet (M)	190.56	17.71	
KUA1303BKK08	Carrel Room	42.72	3.97	
KUA1303BKK09	Carrel Room	42.72	3.97	
KUA1303BKK10	Carrel Room	42.72	3.97	
KUA1303BKK11	Carrel Room	42.72	3.97	
KUA1303BKK12	Carrel Room	42.72	3.97	
KUA1303BKK13	Carrel Room	28.94	2.69	
KUA1303BKK01	Carrel Room	54.77	5.09	
KUA1303RME06	Electrical Room	5.49	0.51	
KUA1303DSB03	Book Collection Shelf	10822.62	1,005.82	
KUA1303BKK07	SPK Room Ilmuan	453.21	42.12	
KUA1303LBB01	Lift Lobby	172.16	16	
KUA1303BKK14	Reverend room	824.75	76.65	
KUA1303BKK15	Pej. Aside from the Academic Services	601.05	55.86	
KUA1303DSB04	Reading Room	2253.57	209.44	
KUA1303BBA01	General Room	169.58	15.76	
KUA1303RME01	AHU Room	182.06	16.92	
KUA1303TDP01	Ladies toilet	215.63	20.04	
KUA1303TDL01	Men's Toilet	215.42	20.02	
KUA1303RME02	Electrical Room	40.89	3.8	

KUA1303LBB02	Lift Lobby	77.69	7.22	
KUA1303RPK01	Photocopy Room	75.54	7.02	
KUA1303LBB03	Route Space	802.27	74.56	
KUA1303DSB02	Reading Room	4436.13	412.28	
KUA1303MKP01	Computer Lab A	2359.67	219.3	40
KUA1303BSV01	Hub room	11.84	1.1	
KUA1303MPK02	OKU Computer Laboratory	543.49	50.51	
KUA1303RME05	AHU Room	251.35	23.36	
KUA1303BMS01	Discussion room	167.00	15.52	
KUA1303BKK06	Carrel Room	50.36	4.68	
KUA1303BKK04	Carrel Room	53.15	4.94	
KUA1303BKK05	Carrel Room	53.15	4.94	
KUA1303BKK03	Carrel Room	50.25	4.67	
KUA1303BKK02	Carrel Room	53.15	4.94	

3.1 Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA133.1DSB01	Bookcase	5020.51	466.59	
KUA133.1STR02	Store	195.08	18.13	
KUA133.1STR01	Store	140.85	13.09	
KUA133.1RME01	AHU Room	149.67	13.91	

Mezzanine Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA13MZRME01	AHU Room	149.67	13.91	
KUA13MZBKK04	Carrel Room	108.78	10.11	
KUA13MZBKK03	Carrel Room	79.73	7.41	
KUA13MZBKK02	Carrel Room	64.88	6.03	
KUA13MZDSB01	Reading Hall	10181.22	946.21	
KUA13MZBBA02	Chief Librarian Room	241.45	22.44	
KUA13MZBBA01	Chief Librarian Room	255.98	23.79	
KUA13MZBMS01	Cendikiawan Meeting Room	348.09	32.35	
KUA13MZTDL01	Men's Toilet	119.87	11.14	
KUA13MZTDP01	Ladies Toilet	59.83	5.56	
KUA13MZBKK01	Mail Room	149.67	13.91	
KUA13MZSTR01	Store	70.26	6.53	
KUA13MZPJT02	Chief Librarian's Office	177.43	16.49	
KUA13MZPJT01	General office	296.87	27.59	

Fourth Floor:

ROOM CODE	ROOM NAME	SQUARE FEET	SQUARE METER	CAPACITY
KUA1304BKK16	Reading Room	2601.98	241.82	
KUA1304BKK03	B / Savings (Dwn Exhibition)	177.22	16.47	
KUA1304BKK04	B / Savings (Dwn Exhibition)	476.88	44.32	
KUA1304STR02	B / UMmemory work	177.54	16.5	
KUA1304SRP01	Surau (P)	282.02	26.21	
KUA1304RPM01	Library Gallery	2120.90	197.11	
KUA1304TDL02	Toilet (M)	220.36	20.48	
KUA1304TDP02	Toilet (F)	271.47	25.23	
KUA1304RME03	AHU Room	165.81	15.41	
KUA1304RME04	Switch Room	8.72	0.81	
KUA1304SRL01	Surau (L)	498.19	46.3	
KUA1304BKK12	Carrel Room	55.52	5.16	
KUA1304BKK13	Carrel Room	55.95	5.2	
KUA1304BKK10	Carrel Room	55.41	5.15	
KUA1304BKK11	Carrel Room	52.51	4.88	
KUA1304BKK09	Carrel Room	54.23	5.04	
KUA1304BKK08	Carrel Room	56.38	5.24	
KUA1304BKK07	Discussion room	149.24	13.87	
KUA1304RME02	AHU Room	251.89	23.41	
KUA1304LBB02	Hallway	4417.84	410.58	
KUA1304MKP02	Computer Lab B	686.38	63.79	28
KUA1304DSB02	Bookcase	7379.21	685.8	
KUA1304BKK17	Media Collections Room	482.91	44.88	
KUA1304BKK18	Media Collections Room	452.46	42.05	
KUA1304STR01	Store (Studio)	102.87	9.56	
KUA1304LBB01	Lift Lobby	172.81	16.06	
KUA1304STD01	Auditorium (EMPLOYEES)	1258.81	116.99	
KUA1304BKK02	Media Work Room	169.58	15.76	
KUA1304PJT01	Media Unit Office	169.58	15.76	
KUA1304RME01	AHU Room	182.49	16.96	
KUA1304BKK15	Reading Room	1255.80	116.71	
KUA1304TDP01	Ladies Toilet	215.63	20.04	
KUA1304TDL01	Men's Toilet	216.60	20.13	
KUA1304LBB04	Lift Lobby	77.69	7.22	
KUA1304RPK01	Store	89.20	8.29	
KUA1304LBB03	Reading Room	1348.34	125.31	
KUA1304MKP01	Computer Lab C	589.33	54.77	20
KUA1304BBA01	Head librarian	283.10	26.31	
KUA1304BMS01	Scholar Meeting Room	539.72	50.16	

Appendix H: SPSS tables

Mean Rank of Kruskal Wallis test of use of different spaces within the Main Library among level of study

	Level of Study	N	Mean Rank
Use of collaborative area	Bachelor	165	154.23
	Master	73	134.16
	Ph.D	33	117.83
	Foundation	11	113.50
	Diploma	4	165.50
	Total	286	
Use of group study rooms	Bachelor	165	148.83
	Master	73	135.06
	Ph.D	33	135.83
	Foundation	11	131.50
	Diploma	4	173.75
	Total	286	
Use of individual study carrels	Bachelor	165	141.20
	Master	73	148.82
	Ph.D	33	153.33
	Foundation	11	110.00
	Diploma	4	152.25
	Total	286	
Use of quiet/ silent area	Bachelor	165	141.33
	Master	73	144.12
	Ph.D	33	150.00
	Foundation	11	150.00
	Diploma	4	150.00
	Total	286	
Use of pcs lab	Bachelor	165	131.97
	Master	73	171.24
	Ph.D	33	150.17
	Foundation	11	128.50
	Diploma	4	99.25
	Total	286	

Mean Rank of Kruskal Wallis test of satisfaction level within COLA among level of study

	Level of Study	N	Mean Rank
Find space	Bachelor	165	146.55
	Master	73	136.95
	Ph.D	33	145.67
	Foundation	11	131.59
	Diploma	4	152.00
	Total	286	
Space is convenient	Bachelor	165	149.56
	Master	73	136.08
	Ph.D	33	133.48
	Foundation	11	114.86
	Diploma	4	190.13
	Total	286	
Space is too noisy	Bachelor	165	144.66
	Master	73	140.46
	Ph.D	33	152.92
	Foundation	11	115.73
	Diploma	4	149.88
	Total	286	
Interior design increases productivity	Bachelor	165	151.81
	Master	73	137.04
	Ph.D	33	136.52
	Foundation	11	102.36
	Diploma	4	89.50
	Total	286	
Furniture is comfortable	Bachelor	165	148.82
	Master	73	140.03
	Ph.D	33	134.98
	Foundation	11	102.50
	Diploma	4	170.38
	Total	286	
Furniture is movable	Bachelor	165	145.18
	Master	73	145.14
	Ph.D	33	135.29
	Foundation	11	125.68
	Diploma	4	160.88
	Total	286	
There is a place to use own laptop	Bachelor	165	147.73
	Master	73	137.11
	Ph.D	33	142.35
	Foundation	11	141.45
	Diploma	4	100.75
	Total	286	
Close to books	Bachelor	165	148.84
	Master	73	141.31
	Ph.D	33	127.30
	Foundation	11	114.77
	Diploma	4	175.75
	Total	286	
Near to printing facilities	Bachelor	165	137.43
	Master	73	157.86
	Ph.D	33	150.38
	Foundation	11	130.73
	Diploma	4	110.13
	Total	286	

Mean Rank of Kruskal Wallis test of satisfaction level within Quiet area among level of study

	Level of Study	N	Mean Rank
Find space within quiet area	Bachelor	165	138.34
	Master	73	152.84
	Ph.D	33	170.12
	Foundation	11	100.00
	Diploma	4	85.88
	Total	286	
Space is convenient for individual study within quiet area	Bachelor	165	138.98
	Master	73	156.06
	Ph.D	33	148.98
	Foundation	11	121.32
	Diploma	4	116.25
	Total	286	
Space is too noisy within quiet area	Bachelor	165	138.93
	Master	73	152.48
	Ph.D	33	154.21
	Foundation	11	122.45
	Diploma	4	137.50
	Total	286	
Interior design increases productivity within quiet area	Bachelor	165	147.45
	Master	73	137.42
	Ph.D	33	150.67
	Foundation	11	119.91
	Diploma	4	97.25
	Total	286	
Furniture is comfortable within quiet area	Bachelor	165	147.96
	Master	73	134.80
	Ph.D	33	148.82
	Foundation	11	142.41
	Diploma	4	77.38
	Total	286	
There is a place to use own laptop within quiet area	Bachelor	165	139.44
	Master	73	153.34
	Ph.D	33	155.38
	Foundation	11	119.77
	Diploma	4	98.75
	Total	286	
Close to books/ quiet area	Bachelor	165	147.26
	Master	73	136.10
	Ph.D	33	151.26
	Foundation	11	108.18
	Diploma	4	156.75
	Total	286	
Near to printing facilities/ quiet area	Bachelor	165	147.30
	Master	73	131.44
	Ph.D	33	148.95
	Foundation	11	140.59
	Diploma	4	169.75
	Total	286	

Mean Rank of Kruskal Wallis test of satisfaction level with lighting among level of study

	Level of Study	N	Mean Rank
lighting ground floor	Bachelor	144	126.62
	Master	60	111.38
	Ph.D	28	129.11
	Foundation	9	129.39
	Diploma	3	65.00
	Total	244	
lighting open space level2	Bachelor	137	124.01
	Master	65	126.12
	Ph.D	30	121.92
	Foundation	11	118.23
	Diploma	4	120.63
	Total	247	
lighting open space level3	Bachelor	149	132.94
	Master	63	125.00
	Ph.D	33	129.27
	Foundation	11	138.50
	Diploma	4	114.38
	Total	260	
lighting open space level4	Bachelor	145	130.20
	Master	64	115.66
	Ph.D	32	129.56
	Foundation	11	153.00
	Diploma	3	176.83
	Total	255	
lighting collaborative area	Bachelor	152	120.05
	Master	57	125.55
	Ph.D	22	122.25
	Foundation	7	94.43
	Diploma	4	162.00
	Total	242	
lighting individual carrels level2	Bachelor	98	87.23
	Master	40	85.55
	Ph.D	24	78.65
	Foundation	3	33.50
	Diploma	3	79.17
	Total	168	
lighting individual carrels level3	Bachelor	100	88.73
	Master	50	90.74
	Ph.D	22	96.32
	Foundation	4	67.00
	Diploma	3	104.50
	Total	179	
lighting individual carrels level4	Bachelor	100	90.23
	Master	48	89.68
	Ph.D	21	80.19
	Foundation	5	88.50
	Diploma	3	99.83
	Total	177	
lighting group rooms	Bachelor	95	76.08
	Master	35	80.69
	Ph.D	16	82.81
	Foundation	5	57.50
	Diploma	3	90.33
	Total	154	

Mean Rank of Kruskal Wallis test of satisfaction level with temperature among level of study

	Level of Study	N	Mean Rank
ground floor/ temp comfort	Bachelor	141	119.73
	Master	62	129.73
	Ph.D	28	134.18
	Foundation	9	91.00
	Diploma	4	97.00
	Total	244	
open space level2/ temp comfort	Bachelor	138	120.38
	Master	64	121.73
	Ph.D	32	139.44
	Foundation	9	128.61
	Diploma	4	151.50
	Total	247	
open space level3/ temp comfort	Bachelor	143	127.34
	Master	70	131.95
	Ph.D	33	146.14
	Foundation	10	113.40
	Diploma	4	131.75
	Total	260	
open space level4/ temp comfort	Bachelor	145	129.00
	Master	62	126.50
	Ph.D	33	116.65
	Foundation	11	150.41
	Diploma	4	147.00
	Total	255	
collaborative area/ temp comfort	Bachelor	152	120.03
	Master	57	122.43
	Ph.D	22	119.07
	Foundation	7	134.36
	Diploma	4	154.88
	Total	242	
individual carrels level2/ temp comfort	Bachelor	93	83.38
	Master	47	84.81
	Ph.D	23	86.65
	Foundation	3	70.17
	Diploma	2	126.00
	Total	168	
individual carrels level3/ temp comfort	Bachelor	100	86.41
	Master	49	90.49
	Ph.D	22	106.91
	Foundation	5	94.90
	Diploma	3	69.50
	Total	179	
individual carrels level4/ temp comfort	Bachelor	105	86.67
	Master	45	91.67
	Ph.D	23	93.24
	Foundation	3	84.33
	Diploma	1	130.00
	Total	177	
group rooms/ temp comfort	Bachelor	95	75.86
	Master	35	81.19
	Ph.D	16	68.16
	Foundation	5	95.10
	Diploma	3	107.00
	Total	154	

Mean Rank of Kruskal Wallis test of satisfaction level with humidity among level of study

	Level of Study	N	Mean Rank
humidity ground floor	Bachelor	141	123.85
	Master	62	127.70
	Ph.D	28	110.29
	Foundation	9	124.11
	Diploma	4	76.00
	Total	244	
humidity open space level2	Bachelor	138	119.36
	Master	64	127.86
	Ph.D	32	128.33
	Foundation	9	147.00
	Diploma	4	136.00
	Total	247	
humidity open space level3	Bachelor	143	134.94
	Master	70	120.23
	Ph.D	33	127.00
	Foundation	10	155.85
	Diploma	4	116.88
	Total	260	
humidity open space level4	Bachelor	145	123.98
	Master	62	135.74
	Ph.D	33	133.65
	Foundation	11	116.73
	Diploma	4	138.00
	Total	255	
humidity collaborative area	Bachelor	152	119.63
	Master	57	130.23
	Ph.D	22	122.02
	Foundation	7	99.79
	Diploma	4	103.50
	Total	242	
humidity individual carrels level2	Bachelor	93	82.08
	Master	47	91.01
	Ph.D	23	82.87
	Foundation	3	66.50
	Diploma	2	90.00
	Total	168	
humidity individual carrels level3	Bachelor	100	88.09
	Master	49	98.38
	Ph.D	22	84.50
	Foundation	5	64.60
	Diploma	3	99.50
	Total	179	
humidity individual carrels level4	Bachelor	105	88.10
	Master	45	94.99
	Ph.D	23	84.35
	Foundation	3	64.17
	Diploma	1	95.50
	Total	177	
humidity group rooms	Bachelor	95	75.34
	Master	35	85.89
	Ph.D	16	78.50
	Foundation	5	81.10
	Diploma	3	36.67
	Total	154	

Mean Rank of Kruskal Wallis test of satisfaction level with arrangement of different facilities among level of study

	Level of Study	N	Mean Rank
Interaction area	Bachelor	165	136.42
	Master	73	157.06
	Ph.D	33	132.85
	Foundation	11	172.23
	Diploma	4	197.00
	Total	286	
Shelves of books & journals	Bachelor	165	140.11
	Master	73	150.05
	Ph.D	33	144.67
	Foundation	11	174.00
	Diploma	4	70.50
	Total	286	
Printing facilities	Bachelor	165	140.10
	Master	73	150.21
	Ph.D	33	129.53
	Foundation	11	216.45
	Diploma	4	76.00
	Total	286	
Toilets	Bachelor	165	140.50
	Master	73	145.72
	Ph.D	33	137.26
	Foundation	11	191.36
	Diploma	4	146.50
	Total	286	
Drink & Snack area	Bachelor	165	138.34
	Master	73	158.05
	Ph.D	33	130.68
	Foundation	11	196.09
	Diploma	4	52.00
	Total	286	