

VALUE GENERATION IN HIGHER EDUCATION SPACE MANAGEMENT  
THROUGH USER-CENTRIC DATA ANALYTICS

A Thesis

by

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## ABSTRACT

The space in universities is the most expensive asset. However, there is a clear lack in the literature regarding ‘serendipity’ areas or informal third-places (such as lounges), which host paramount activities in modern Higher Education Institutions (HEI), such as studying, research, teamwork, socializing and networking. This study is the first instance of studying space attributes of lounges and study rooms within universities. Through comparing the instances of low occupancy graduate lounges with the ones highly utilized, the goal is to find the significance of lounge spaces to graduate students, and the impact that proper design can make on their experience. According to this study, noise level and furniture (in terms of comfort and layout) are both the prime and almost equally significant factors to the users. This study identifies the potential to increase occupancy of lounge spaces within Texas A&M University up to three times through noise limitation and furniture improvement. Further studies are required for more accurate forecasting of the influence of such factors for decision making in higher education space management. This may help universities to allocate proper efficient serendipity spaces to their graduate students, which could bring value to both students and institutions, not only academically, but also financially.

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## NOMENCLATURE

FM	Facility Management
HEI	Higher Education Institutions
ICT	Information and Communication Technology
KPI	Key Performance Indicators

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## CHAPTER I

### INTRODUCTION

According to Abdullah et al. (2012) the space in universities and higher education is the most expensive asset for its significance to performance and efficiency of almost all the activities within an organization. Considering the rising construction cost, economic issues, and increasing enrolments, there is a critical need for higher education institutions to manage and optimize the efficiency of their existing spaces, prior to adding any expensive new spaces or buildings (Abdullah et al. 2012).

As derived from the literature (Ellis and Goodyear 2016), the focus of studies in educational spaces is on classrooms and primary learning spaces, which is no more the only foremost space in Higher Education Institution (HEI) facilities. As per understanding of the author, by reviewing the available literature, there is a clear lack of research in the newly born spaces and extensions to academia known as serendipity areas or informal third-places, which as opposed to their undermining title, host paramount activities in modern HEI, such as studying, research, teamwork, socializing and networking. These spaces include any secondary spaces out of classrooms, such as lounges, study rooms, meeting rooms, foyers and other spaces not clearly defined with titles or boundaries.

Besides, investment on graduate students and researchers in HEI is a seemingly costly intervention, which is a paramount necessity for the prosperity of nations.

Coupling the knowledge gap described, with the significance of graduate students' productivity in HEI, this study seeks the primary factors of space design and layout for creation of serendipity environments for graduate students. Through hybrid analysis on different types of space layouts and qualities in different departments of Texas A&M University, design alternatives are evaluated in terms of their influence on students' occupancy rate in such spaces, which make some design alternatives far more successful than the others.

With this regard, the graduate lounge in the Construction Science Department of Texas A&M University is an instance of low occupancy rate. On the other hand, this department has a considerably high ratio of enrolled students per unit of area, which adds to the significance of efficient space management within this department. Comparing the attributes and users' feedback of other graduate lounge spaces in the campus with the one in the Construction Science Department, this study not only tries to improve the space efficiency in the Texas A&M Construction Science Department (Francis Hall), but also tries to list and prioritize the factors which result in more efficient serendipity spaces, for graduate students.

## CHAPTER II

### BACKGROUND

#### **2.1. Literature Review**

##### *2.1.1. Space Management*

##### ***Space and Facility Management***

Space management is a crucial strategic planning that provides balanced, vital, and efficient function of a building, for a competitive and sustainable business (Abdullah et al. 2012). As Rogers (2013) defines, space management is about space allocation commensurate with specific users' needs or for a particular need. It is more than assessment of space needs, as it deals with precise calculation of number of users the facilities would sufficiently support. This serves as the input for achieving the most efficient and effective use of space, equipment, and furniture, over time. Besides, space management also refers to renovation and alterations of spaces (Lavy 2008).

Space planning and management is a key element in facility management (FM) and building performance management (Douglas 1996). The primary role of FM is resource management, at both strategic and operational level (Nutt 2000). While Loosemore and Hsin (2001) stated the requisite of agreement of space management with core objectives of the organization, as part of FM objectives, Schroeder et al. (1995) identified the effective, efficient space utilization and management as high priority to



both corporate and facility management. Besides, they underlined the significance of under-used (deficient) and over-used (surplus) spaces in this realm. To tackle this, the complex and widespread nature of space management reckons qualitative and quantitative analysis (Minior et al. 2001).

### ***Space Management Toolkit***

Prime facility performance measures utilize benchmarking, balanced scorecard approach, post occupancy evaluation, and key performance indicators (KPIs) (Lavy et al. 2014). Benchmarking, which is comparing the current performance of any facility with the best ones known in the area, is an effective indicator and tool for continuous improvement in FM decision making (Douglas 1996).

As far as space management is concerned, space utilization is a function of frequency and occupancy rates. Room Frequency (F) is  $(\text{Hours Used}/\text{Hours available}) * 100$ , and Room Occupancy (O) =  $(\text{Total Students}/\text{Capacity} * \text{Hours Used}) * 100$ . Ultimately, Utilization (U) is  $(\text{Room Frequency (F)} * \text{Room Occupancy (O)}) / 100$  (Incorporated 2009), which is the final index used in benchmarking methodology, for comparison with other partners. Eventually, Rogers (2013) ties up sophisticated data analysis and space planning as the two essentials for real increased efficiency.

Coupled with benchmarking, surveys could provide substantial information regarding user preferences. While this may initially assist for optimization of a current marketing product or service, its significant role on optimization of any future design,

should not be overlooked. In other words, the data from any case study or general survey, could be the milestone of any future efficient successful design (Lansdale et al. 2011).

### *2.1.2. Space Management in Higher Education Institutions (HEI)*

For the clarification in terminology used in this study, ‘space’ and ‘place’ are used with some nuances, firstly identified by Tuan (1977). In simple words, ‘space’ matters to leaders and managers, and ‘place’ relates to the sensation of the users. As explained by Law (2002), the nature of ‘space’ for a planner is different than the ‘place’ for a lecturer or students, in a classroom.

In the literature studies about improving the physical quality and efficiency of HEI spaces include topics such as architecture and environmental psychology (Winkel et al. 2009), research in learning sciences (Sawyer 2005), and research on virtual places and tools, which considers human–computer interaction (HCI) and computer-supported collaborative learning (CSCL). Besides, national and international guidelines for HEI, such as the recommendations developed by Newcastle University Space Management (2002), has been developed. This guideline is concerned about:

- Transparency of data to all users, to encourage fairness, efficiency and effectiveness.
- Significance of users’ education, and their influence on changing the efficiency of spaces through their proper utilization.

- Necessity of tailored standards, unique to the specific mission and condition of individual institutions, for the benefit of all stakeholders.
- Requisite of performance indicators such as space/student, staff/space and financial data/space for any efficiency comparison among different departments, faculties or research.
- Bolstering the culture of adaption to continuous change for higher efficiency, through unceasing staff engagement.
- Criteria of minimized traveling time between two rooms for effective efficiency.

These recommendations imply the need for adaptation and change for HEI to respond accordingly with more efficient and flexible spaces, which stems from the considerable evolution of higher education system within the last decade.

With this regard, Beckers et al. (2016) find the traditional higher education similar to a learning factory, treating the students in classrooms with treasure of information (Leland and Kasten 2002; Robinson 2010), as opposed to the modern style which supports self-directed learners, who take responsibility of their own learning (Marais 2011), and exploits the flexibilities of Information and Communication Technology (ICT) (Simons et al. 2000).

Regardless of the extra complexities of ICT, increasing student numbers, without comparable growth in the revenues, has put universities under pressure of improving space utilization (Committee] 2006; Dugdale 2009; Keppell and Riddle 2013). Strange

and Banning (2001) spotted that while student teaching and learning methods have substantially improved in theory and practice, the use of the physical space to provide proper environment for such learnings is perhaps the least understood and the most neglected. This was followed by Temple (2007) and Temple (2008), which still found space as a considerably under-researched topic in higher education, with a very widely and thinly distributed literature. Recently, Goodyear et al. (2014) underlined the shortage of knowledge for effective design and management of such complex and hybrid systems.

Having said these, it is not a surprise why many HEI still face low utilization rate in considerable portion of spaces, coupled with a mismatch of usage with its design (Abdullah et al. 2012). From the many different spaces in HIE, either academic and administrative, or commercial and student services, the author finds a clear lack of literature in the serendipity areas or informal third-places, which host paramount activities, ranging from research and study, to leisure and break, in modern HEI.

### ***Informal and Third-Place Spaces***

Informal physical space is a recently added space to academia, where students meet without any specific curriculum requirements, for informal learning (Ellis and Goodyear 2016). Some studies prove the efficacy of such spaces for students' retention in campus, referring to them as 'serendipity areas' or 'sticky campus' (Boys 2010; Harrison and Hutton 2013; Price et al. 2003). Other research also supports that coupling these informal areas, indirectly with the curriculum activities, could potentially improve

learning and productivity outcomes (Beagle et al. 2006). Noteworthy to mention that the consistency of such spaces, with a smooth and convenient movement to other primary spaces is of significance to their efficiency and success (Riddle and Souter 2012).

Eventually, Harrison (2002) abridges that any square meter of the built environment has the potential to support student's learning activities, only if it is designed with delicate care and keen eyes for understanding users' perception.

### *2.1.3. Concerns of Efficient Space Design in HEI*

Regarding the above, there is no doubt that poor design would restrain students to come to the university, and works against their retention (Harrison 2002). Some of primary considerations mentioned in the literature for quality design of informal learning spaces are:

#### *Functionality versus Aesthetics*

Related studies to learning spaces state that students are more concerned about the functional aspects (including comfort) of academic spaces than aesthetics (Chism 2006; Jessop et al. 2012; Mitchell 2003).

#### *Noise, Distraction, and Privacy*

As it might be expected, noise and busyness often diminish learning and efficiency of students (Gurung 2005; Matthews et al. 2011; Woolner et al. 2007; Yau

and Joy 2010). Increased noise in open plan spaces is a significant and critical issue, which could negatively affect cognitive, writing and reading abilities (Colle and Welsh 1976; Jones et al. 1990; Martin et al. 1988).

While Harrop and Turpin (2013) found that both privacy and quietness are the main priorities of students for rating quality of learning spaces, Price et al. (2003) and Beckers et al. (2016) only found silence as the primary requisite of students. They did not find any specific preference of students for privacy, and it seems the need for silence leads to any retreat.

### ***Collaboration, Interaction and Friendship***

Regardless of the knowledge and experience shared among peers, there is value to the emotional and moral support, which is the outcome of collaboration and interaction of students in open spaces (Baumeister and Leary 1995; Brooks 2011). Furthermore, as found by Ellis and Goodyear (2016), students have more tendency to prefer spaces with higher likelihood of meeting and interacting with their friends. All these imply the potential of students' retention at campus through collaboration and friendship. Other studies also support the impact of cooperative learning in HEI (Davidson et al. 2014; Johnson et al. 1998).

### ***Layout and Furniture***

Somerville and Collins (2008) underline the significance of flexible comfortable furniture. They also stated that while ease of movement within spaces is significant, the overall space layout plays a significant role in efficiency of work and learning outcomes. As per their study, students showed preference for open, unconfined environments.

Apart from flexibility and open-ness of open spaces, which is preferred to cubicle private units, open spaces provide possibility of multi-occupancy, which makes these options more cost effective (Lansdale et al. 2011). Besides, the emergence of hot-desking and temporary desk concept in open spaces, allows higher efficiency and utilization rate (Allen and Gerstberger 1973; Charles et al. 2004; Haynes et al. 2000; Nathan and Doyle 2002). However, there are still some critics and drawbacks to open spaces, which requires delicate consideration in management and design as following:

### ***Sense of Belonging***

Studies suggest that, users do not give up their allocated desk, even for considerably higher quality of non-territorial work environments (Elsbach 2003; Marmot and Eley 2000). Majority of people would like to keep their identity in study/work places, wherever possible (Brown 2009). (Lansdale et al. 2011) describes this index as a critical one to research-based activities at HEI.

### ***Time and Efficiency***

With hot desking and no presence of assigned permanent spot, there is always a considerable time lapsed per day, for setting up the desk, papers, notes and books, which all soon require re-packing (Lansdale et al. 2011).

Apart from the mentioned specific recommendations and concerns provided through literature for HEI design, this type of spaces and facilities share same attributes with schools and office spaces. Therefore, where applicable, HEI could exploit the knowledge available in such areas.

#### ***2.1.4. HEI versus Other Facilities***

##### ***HEI and schools***

Researchable phenomena in schools related to formal learning spaces share commonalities with HEI. Some of such instances in school related research from which HEI could learn are: Seminal socio-material study of the use of computer technology in school classrooms (Sørensen 2009); Multilevel empirical analysis on the relationships between designed characteristics of the built environment in primary schools and the students' learning outcomes (Barrett et al. 2013); Empirical inquiries into connections between attributes of built space, pedagogical practices and learning in schools (Woolner 2010; Woolner et al. 2007).

Conversely, informal learning spaces in HEI may not be clearly developed in schools (Ellis and Goodyear 2016), except for where innovative open-plan and student-



centered spaces could be used for researchers in HEI (see for example, (Yeoman and Carvalho 2014)). This highlights the significance of study in this area in serendipity areas, which are exclusive and limited to HEI.

### ***HEI and Office Environments***

Lansdale et al. (2011) considers the similarities of graduate research as a specific type of office work, with also significant differences with office work.

As Ellis and Goodyear (2016) elaborate on the distinction between ‘studying’ versus ‘learning’, the research graduates could be seen as general workers, when it comes to their research related activities. They conclude that the special ergonomic, human factors, workplace design and architecture which in the literature is available to improve workers’ productivity and well-being could be used on such cases for research-conducive spaces (Goodyear and Retalis 2010; Zandvliet and Fraser 2004).

#### ***2.1.5. Tailored Design and User-Centric Approach***

Regardless of the amount of literature available in HEI or research conducive spaces, Boys (2010) reminds that architectural models and ready-made solutions for HEI always require tailoring based on specific function of universities, their financial availabilities, their culture, size and other attributes.

Similarly, Abdullah et al. (2012) concludes no single solution may be ever possible for educational and academic purposes, stating that “...The value of a model is

in its utility, not its truth! no single model is likely to serve all current purposes. However, there is a compelling logic in the idea that the design, management and use of learning space should be a shared concern for all members of a university: a collective responsibility, the discharge of which can benefit all participants.”

The literature is abundant with the value of ‘user’ in the current business market, which is much more than its former credit as sole part of a linear value chain (Chen et al. 2012; Jaakkola et al. 2015; Lusch and Vargo 2014). The ‘costumer’, with its equivalent as ‘user’ in FM, could be proactively engaged in value creation for the organization, towards common aims and optimum efficiency in management and design (Jaakkola et al. 2014). Stemming from the successful stories, the overarching concept of user/costumer engagement has been long enough introduced (Brodie et al. 2011; Van Doorn et al. 2010).

However, FM in HEI is far behind the business market, as far as user engagement is concerned. Matthews et al. (2011) underline the lack of understanding students’ preferences for HEI practices. In other words, the value of users’ engagement, which is considered significant in business, is not yet well intertwined in physical environment decision-making of academic spaces. As Ellis and Goodyear (2016) say, actual observation of students is the best way of finding the optimum design solution. As they conclude, the combination of observational and experimental data is yet rare and infant, but crucial. Several other studies (Fisher and Newton 2014; Harrop and Turpin 2013; Jessop et al. 2012) urge involving students’ voice in physical environment

decision-making. It should not be forgotten that, user involvement is one of the key elements of success in FM projects, only if it goes hand in hand with the other necessary actions.

Lansdale et al. (2011) concludes that while proper design could provide sufficient ground for achieving a successful productive serendipity spaces, the organizational incentives and academic related planning and engagement plays a vital role, as a catalyst for a collaborative and sustainable research community in HEI.

#### *2.1.6. Graduate versus Undergraduate Students*

Graduate students take variety of responsibilities at universities rather than a mere student. They take teaching and research assistantship and are part of the scholarly community. According to Rempel et al. (2011), who underline the aforementioned differences of graduate students with undergraduates, unique service and care are required from universities to obviate undue stress and frustration for the graduate students. McCarthy et al. (2010) define it as the pressure of more responsibilities which go hand in hand with more isolation.

Considering the case, Kayongo and Helm (2010) evaluated the potential of libraries to offer graduate students. This is followed by Rempel et al. (2011), which conclude the special care for graduate students goes far beyond what libraries can offer alone. They urge further studies within other spaces of HEI, to address this issue. Also,

McCarthy et al. (2010) highlight the main focus of HEI on undergraduate level, and invite further research in the graduate domain.

## **2.2. *Problem Statement***

As far as the literature is concerned, classrooms and formal learning spaces are the main focus of research which are no more the only prime means of learning in HEI (Ellis and Goodyear 2016). Instead, there is a group of newly born spaces which host paramount activities in modern HEI, including research, teamwork and individual studies, such as serendipity areas, such as lounges, study rooms, meeting rooms, for which not a rich knowledge in literature exists (Ellis and Goodyear 2016).

Based on overall observation of the author, as one of the graduate students of Construction Science Department of Texas A&M University, the graduate lounge in this department faces low occupancy and utilization rate. For this serendipity space in Francis Hall, while seemingly sufficient space, furniture, and light exposure are provided, the reason for its low occupancy is yet unknown.

On a larger scale, knowing the significance of efficient space management in HEI, the impacting factors towards successful places with high utilization rate of such serendipity spaces in universities are not clearly established in the literature. For instance, there is no clear answer why almost same space allocation per person would result in different utilization rate and occupancy in different serendipity areas within universities. As to the knowledge and understanding of the author, to find the obstacles of successful serendipity spaces, variety of questions need to be answered. Otherwise,

they would remain as vacant forgotten spaces, which only burden cost and demand supply of energy.

### 2.3. *Research Objective*

To address the knowledge gap described earlier, this study aims to provide information in two major areas, with a focus on serendipity spaces. It aims to add to the body of knowledge, which helps improving the performance and quality of such spaces, not only in Francis Hall (The Construction Department of Texas A&M University), but also as a general tool for other universities. To achieve this, the main objectives of this study are as below:

- 1- Examine the sensitivity of different spatial qualities and their relevance to occupancy and utilization rate of graduate lounge areas, as successful sticky spots in students' retention
- 2- Optimize the layout and design of graduate lounge in Francis Hall, improve its users' satisfaction, and boost its utilization
- 3- Examine how widely users are engaged in the decision-making process of serendipity areas in HEI.

#### **2.4.        *Research Hypothesis***

To the experience of the author, supported with the literature, the main hypothesis in this research is that proper allocation of spaces to graduate students (which excludes temporary spaces available through libraries or other facilities in HEI), could be beneficial to their stay and retention at school, which ultimately leads in their higher efficiency and productivity.

Regarding the perceived low utilization rate of the graduate lounge in Francis Hall, as the case study of this research, the author believes with not necessarily costly arrangements and interventions, a more efficient and proper space could be provided. This could include better furniture layout, providing lockers, shelves, dividers, or hangers, in addition to a need for a kitchen area in the department.

Similarly, there are more impacting factors on successful space management, rather than mere play with numbers in planning. The author believes not necessarily costly interventions could change low occupancy in graduate lounge spaces to well-occupied flourishing spaces, through keen observation and engagement of users in decision making.



## 2.5. *Research Assumptions*

- 1- Specific culture and attributes of Texas A&M University traditions, does not have any specific influence on the results. Therefore, the data obtained across different departments could be generalized to HEI.
- 2- Interviewees were not biased in providing ideas and information, regarding their experience in different type of serendipity spaces in the campus.
- 3- Academic performance level, intelligence level, or any other attribute of students in different departments has not influenced the results, as per the assumptions of normal distribution properties.

## **2.6.        *Research Questions and Limitations***

This study only limits its case studies to the departments within the Texas A&M University, with a concentration on Francis Hall. Besides, the outcome of this study is limited to preferences and critics to the current conditions, and uses available data in forecasting the future improvement of spaces. Therefore, another study would be required to monitor the improvements after implementation of findings in this study, whether in Francis Hall or other similar case studies. As the afore-mentioned objectives, this study tries to answer the following questions:

- 1- How well the graduate students are generally engaged in decision-making process of space allocation for their assigned spaces?
- 2- Is the concept of having graduate lounge perceived a useful idea by the graduate students in Francis Hall?
- 3- Is the concept of having graduate lounge perceived a useful idea by the graduate students over the campus?
- 4- What are the key parameters due to which graduate students in Francis Hall prefer to spend their time in other spaces, rather than their allocated lounge?
- 5- What are the key parameters due to which graduate students around the campus prefer to spend their time in other spaces, rather than their allocated lounge?
- 6- What are the specific prioritized needs and proposal of graduate students for higher occupancy and efficiency of graduate lounge in Francis Hall?

- 7- What are the specific prioritized needs and proposal of graduate students for higher occupancy and efficiency of graduate lounge over the campus?
- 8- What is the influence of gender and nationality on the distribution of the results?

CHAPTER III  
RESEARCH METHODS

**3.1.      *Data Collection***

As already discussed, this study is divided in two sections. While the first part of the study examines the reasons due to which the occupancy and utilization rate of graduate lounge in Francis Hall is low, the second track examines the influencing factors on success or failure of similar spaces in other departments within the campus. As far as statistics are concerned, as per the requirements of adequate sample size of the first part, considering the limited number of graduate students in the Construction Sceicne Department (lower than 50), their contribution was highly required. Through the four-month period of data collection, almost 50% of this eligible candiadtes participated in the study.

For the second part of the study, based on the population portion equation (Wonnacott and Wonnacott 1990) with 95% confidence level, and confidence interval of 0.05, 140 to 380 response were necessary, depending on the poulation proportion (the number of members in the population with a particular attribute divided by the number of members in the population) from 50% to 90%. The study tried to involve as many as students' possible to bolster the strength of the conclusions. Eventually, during the four-month period of data collection, all the graduate students of Civil Engineering,

Mechanical Engineering, Liberal Art (English and Anthropology), Agricultural Engineering and Construction Science were invited to participate. From almost the population size of 750 graduate students, precise participation of 140 was hit by volunteers. To increase the number of possible participation in this study, data is obtained from both master and Ph.D students is included in this study.

The main sources of data collection in this study is survey, supported by author's observation. The questionnaire was set based on the guidance from Sudman and Bradburn (1983) with multiple choice questions, divided in different sub-parts as following:

- General: Demographic information
- Students academic attributes: Questions include aspects such as students' frequency of space use, students' perception of their allocated lounge spaces, etc.
- Critics and Suggestions: List of prioritized issues, requests and suggestions, having which resolved and applied, the student would use the space more often.

In addition to the questionnaires, there is a need for actual observation of spaces under study. Pairing this with the results from the survey, a comprehensive analysis could be achieved.

Noteworthy to mention that, as federally mandated for any human subject research, this study was approved by Texas A&M University Institutional Review Board

(IRB) prior to the commencement of data collection. After the approval, data collection started through online survey, a copy of which is attached in the Appendix A.

### **3.2. *Data Analysis***

As it might be clear from the data collection methods, data analysis would be quantitative. With Yes/No (Agree, Disagree) questions in this survey, the data is not only categorical, but also divided in only two groups. In such a case, mean, median or standard deviation is not useful method of data translation. Apart from the questions where proportion of the two groups is mostly self explanatory and indicative, hypothesis test for proportions (through Z score and P-Values) help to identify significant differences (Fleiss et al. 2013). Where significant differences exist, mean P-Values are less than 0.01, logistic regression is used to identify relationship between the two categorical variables (Menard 2018).

## CHAPTER IV

### FINDINGS AND ANALYSIS

The questionnaire is divided in different sections, each addressing a specific aspect of the study. The first section is mainly concerned about demographics, as well as students' academic attributes such as office ownership, and their frequency of spending time in their dedicated lounge (usage pattern). The next section mainly delves into the major types of activities in the lounge, followed by individuals' perception and their critics of such spaces. Finally, the last section is designed to seek solutions and recommendations for higher satisfaction of lounge users, and for higher utilization of such assets within the campus.

The following explains the results obtained from 140 participants, which voluntarily took the survey from few selected departments within the campus. Also, the correlation of answers among different sections and questions are discussed.

#### ***4.1. Demographics and Occupancy Frequency***

##### *4.1.1. Departments*

Figure 5 shows the distribution of participants among the different departments within Texas A&M University. Below are the details on each department whose graduate students are invited and included in this survey:

Civil Engineering graduate lounge (Figure 1) is the biggest lounge included in this study (1,500 SF), dedicated to almost 350-400 graduate students, depending on the semester. It is a quiet open space (with no access restrictions) at the ground level of the Civil Engineering Department. As per observation of the author, the space is mostly occupied with students throughout the semester. It offers wide range of furniture styles and layouts (both chairs and comfort sofas), as well as a kitchenette at the end. Sixty-two graduate students of civil engineering major, 46% of the participants, and four individuals from the Ocean-Engineering major are from this department. Table 1 summarizes the Civil Engineering graduate lounge physical properties.

Table 1 - Civil Engineering Graduate Lounge - Physical Properties

Physical properties	Description
<b>AREA (SF)</b>	~ 1,500 SF
<b>STUDENTS</b>	~ 350-400
<b>SHAPE</b>	Rectangle
<b>ACCESS</b>	Open
<b>TABLES</b>	~ 25
<b>CHAIRS</b>	~ 80
<b>SOFAS</b>	~ 40
<b>KITCHENETTE</b>	Yes



Figure 1 - Civil Engineering Graduate Lounge



Mechanical Engineering students include 24% of participants (32 students). Their lounge (Figure 2) is smaller than civil engineering lounge (750 SF), though with exclusive access of 250 graduate students within the department. Wide range of sitting styles, as well as comfort chairs and sofas are also provided within the space. Table 2 summarizes the Mechanical Engineering graduate lounge physical properties.

Table 2 - Mechanical Engineering Graduate Lounge - Physical Properties

Physical properties	Description
<b>AREA (SF)</b>	~ 750 SF
<b>STUDENTS</b>	~ 250
<b>SHAPE</b>	Square
<b>ACCESS</b>	Restricted
<b>TABLES</b>	~ 30
<b>CHAIRS</b>	~ 60
<b>SOFAS</b>	~ 35
<b>KITCHENETTE</b>	No

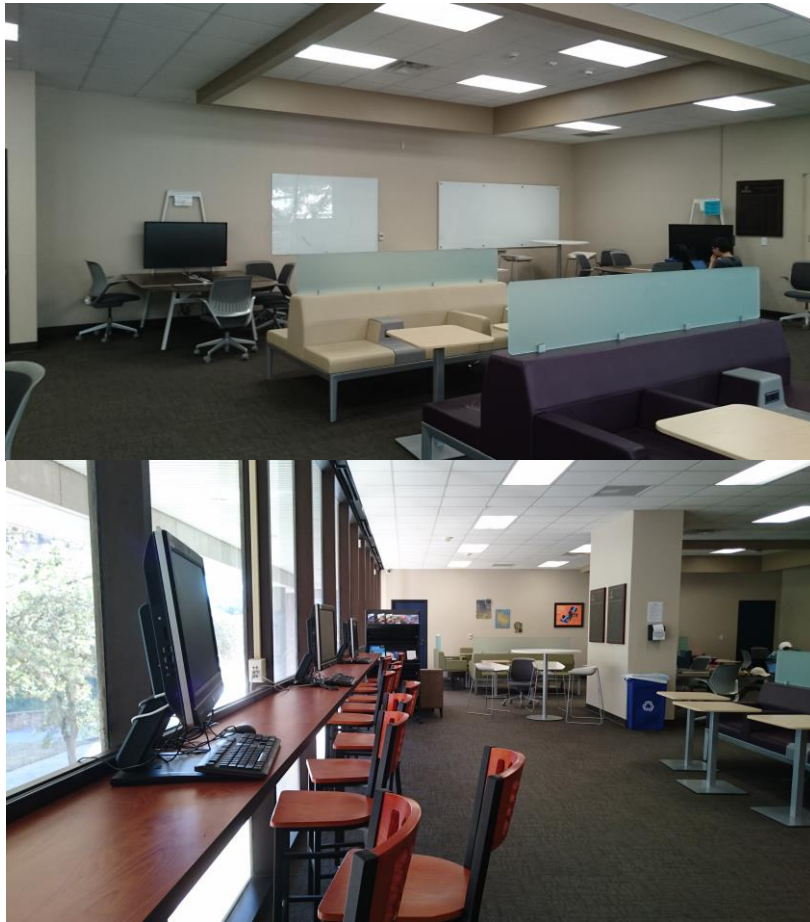


Figure 2 - Mechanical Engineering Graduate Lounge (Above: View to interior and furniture; Below: IT facilities within the lounge)

Construction Science graduate students are almost 40-50 in total (depending on the semester) from which 18 have participated in this survey. Their lounge (Figure 3) is also exclusive to graduate students, though only basic chairs and tables are provided. Recently a microwave is also provided in the room. As already mentioned, although adding to the body of knowledge for university evidence-based design is the by-product of this study, improving the space quality of this graduate lounge is the main target. Table 3 summarizes the Construction Science graduate lounge physical properties.

Table 3 - Construction Science Graduate Lounge - Physical Properties

Physical properties	Description
<b>AREA (SF)</b>	~ 150 SF
<b>STUDENTS</b>	40-50
<b>SHAPE</b>	Rectangle
<b>ACCESS</b>	Restricted
<b>TABLES</b>	14
<b>CHAIRS</b>	22
<b>SOFAS</b>	6
<b>KITCHENETTE</b>	No – Microwave Only

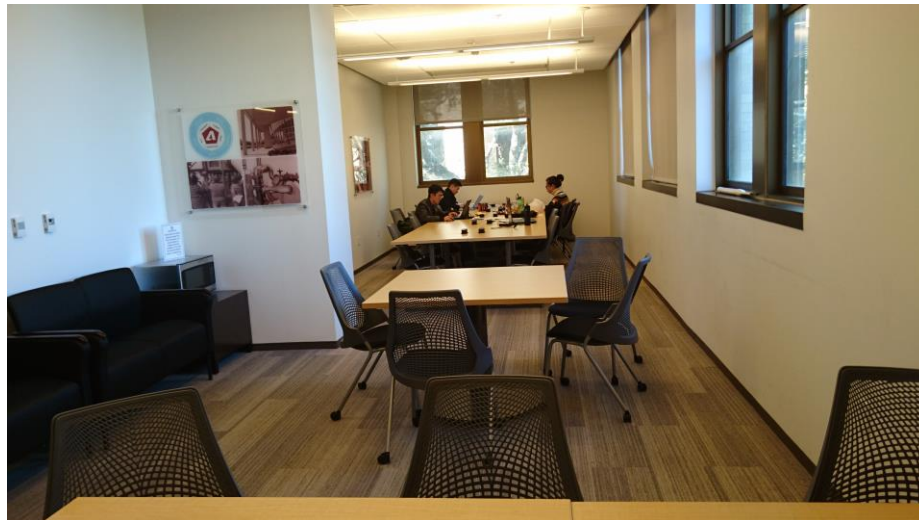


Figure 3 - Construction Science Graduate Lounge

Anthropology and English are two different departments of Liberal Arts. The English unit is located in the main modern building, where a distinct graduate lounge (Figure 4), with cozy furniture, is dedicated to graduate student. Smaller than the other three aforementioned spaces, though it seems enough for less than 40 students. The Anthropology unit is far located at the other side of the campus, in the old building, where their computer lab is used as a lounge. 8% and 6%, totally 19 students from these

two departments have participated in the study. Table 4 summarizes the Liberal Art graduate lounge physical properties.

Table 4 – Liberal Art (English Major) Graduate Lounge - Physical Properties

Physical properties	Description
<b>AREA (SF)</b>	~150 SF
<b>STUDENTS</b>	40
<b>SHAPE</b>	Square
<b>ACCESS</b>	Restricted
<b>TABLES</b>	2
<b>CHAIRS</b>	6
<b>SOFAS</b>	7
<b>KITCHENETTE</b>	No



Figure 4 - Liberal Arts Graduate Lounge

Overall, Civil Engineering, Mechanical Engineering and Construction Science Departments are the major players in this study with 46%, 24%, and 13% of the answers, respectively. Both Civil and Mechanical Engineering lounge spaces are successful instances of lounge space design, the results of which could help with improving the

Construction Science Department, as well as other departments within the campus, dealing with vacant or low-occupancy issues. Figure 5 summarizes the departments participation distribution for this survey.

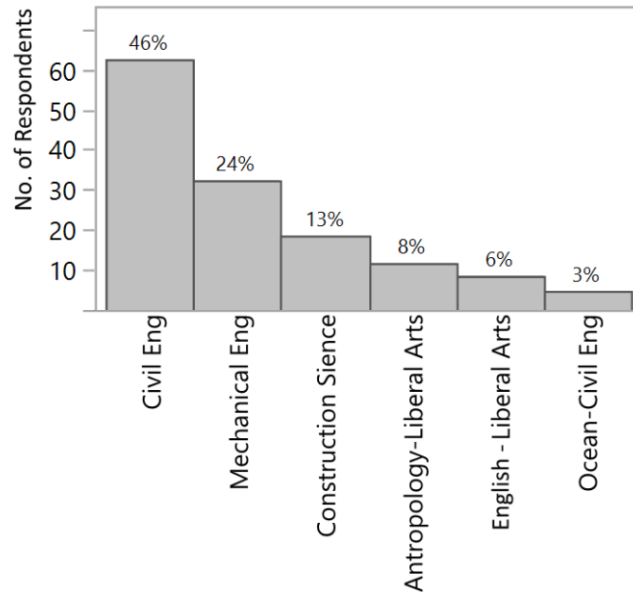


Figure 5 - Departments Participation Distribution

#### 4.1.2. Academic Level, School Registration Time, Age, Gender, and Nationality

Apart from two missing participants, and two undergraduates, 58% of graduate students are Masters’ level, and 41% are PhDs (Figure 6). students. 64% of these students are at least one semester old in their department, compared to the other 36% who are new students (Figure 7). The author’s hypothesis is being at least one semester old in the department may change students’ attitude toward using their lounge. Therefore, this item has been also investigated through the survey.

The students are divided in three age groups, below 25, 25-30, and over 30. The age group distribution among participants are 46%, 38%, and 16%, respectively (Figure 8). Besides, the ratio between males and females is 69% to 31% (Figure 9). Also, almost the same ratio applies to being international versus domestic with 66% to 34%. The following histograms summarize all the information (Figure 10).

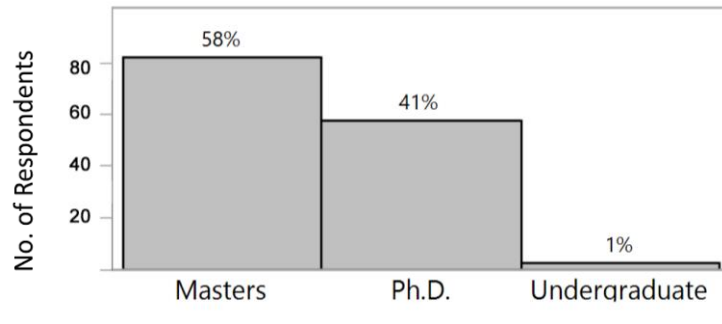


Figure 6 - Academic level distribution

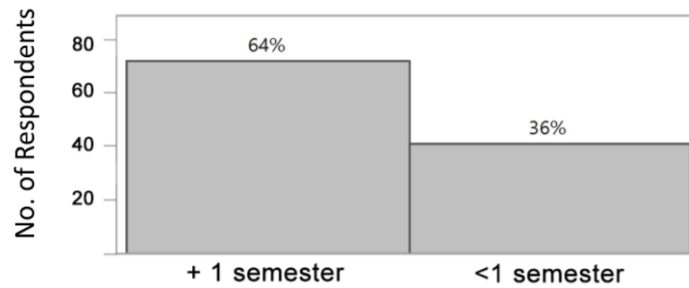


Figure 7 - Registration time distribution

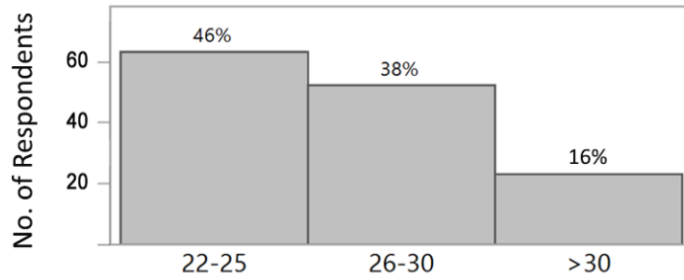


Figure 8 - Age group distribution

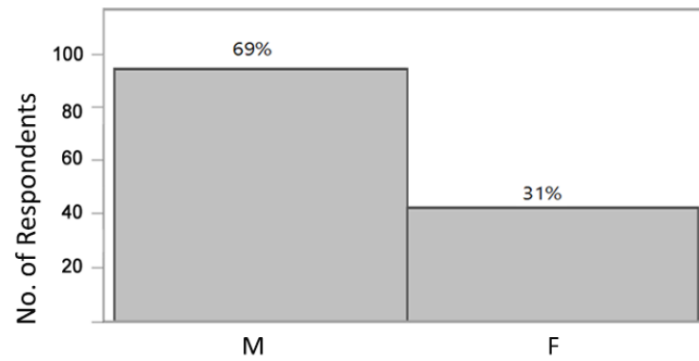


Figure 9 - Gender distribution

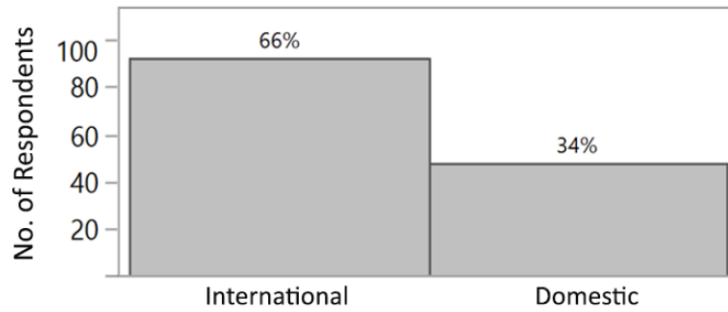


Figure 10 - Nationality distribution

#### 4.1.3. Office Ownership and Lounge Frequency of Use (Usage Pattern)

The other hypothesis is whether giving any type of office space to student (shared or private) could influence not only frequency of lounge space, but also the type of

activities for which lounge spaces are used. Further analysis within this study confirms the difference. However, for this part of study, it is enough to note the almost equal ratio between the ones with an office space, and the ones without any office or dedicated desk (51% to 49% - Figure 11). Since it is possible that having office or not could play role on students' attitude and perception toward graduate lounge spaces, it is critical to have equal number of both types, so that the results obtained from the survey could be accepted as being from a fair and random sample.

The same applies to the frequency of lounge usage among participants (52% of frequent users versus 48% non-frequent users). The survey gives them the option to choose from wide range of 3-4 days per week (known as high frequency of usage) to very rare users, through 6 different groups. As shown by Figure 12, the distribution is almost even among these groups, which again indicates fair and random sample. Considering the number of participants in each group for analysis, the students are grouped into two major categories for further studies, known as frequent users (the first three high frequency groups), and non-frequent users (the other three low frequency groups). As illustrated in Figure 13, the ratio between these two groups is 52% to 48% which makes it again a fair distribution for further analysis.

On the other hand, since the study shows only 16% of participants use their lounge spaces during weekends (Figure 14), this element is excluded from any further analysis.



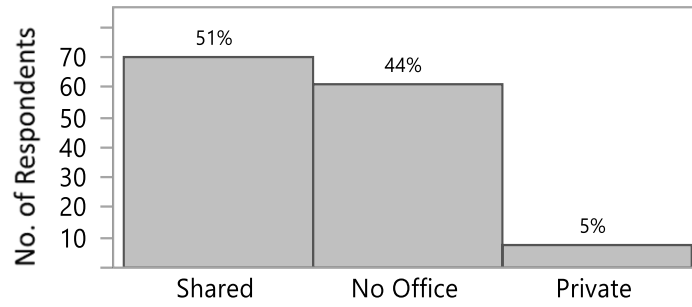


Figure 11 - Office ownership distribution

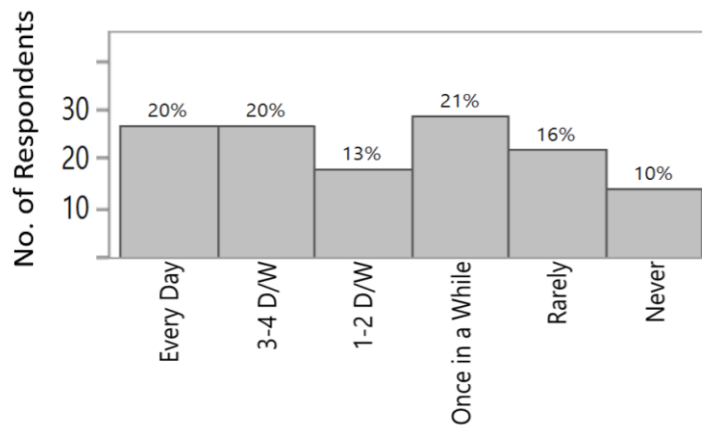


Figure 12 - Frequency distribution of using dedicated graduate lounge, during the working days

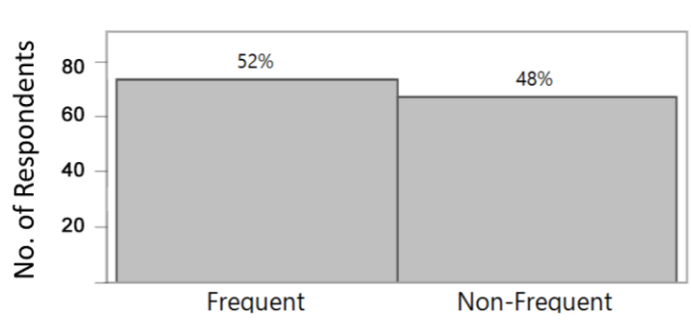


Figure 13 - Frequent versus non-frequent users of graduate lounge, during working days (Derived from Figure 12)

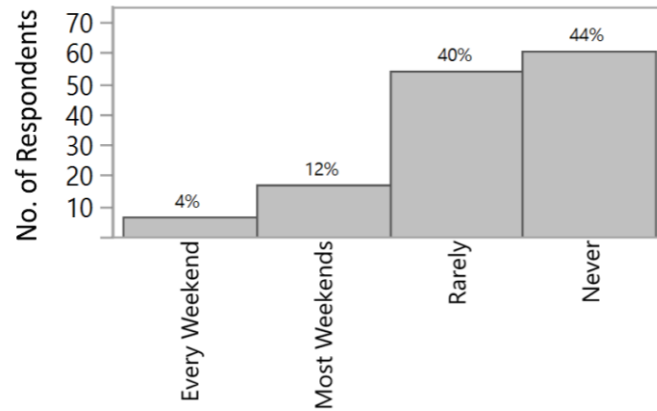


Figure 14 - Frequency distribution of using dedicated graduate lounge, during weekends

## 4.2. Major activities in the lounge

### 4.2.1. Frequency Distribution of Individual Study in The Lounge

Almost 40% of participants mostly or often use the graduate lounge for studying and others indicated this activity a rare or never happening (Figure 15). One should note that the 60% of vote for “rare” or “never” not only includes frequent users who use the lounge for activities other than individual study, but also encompasses all the non-frequent users who rarely use the space for any type of activity. Therefore, for a true analysis of this section, and better understanding the case, the answers given by frequent users and non-frequent users should be separated. As clearly seen in Figure 16, individual study is selected as a major activity by 65% of frequent users, which stands just below 15% for non-frequent users.

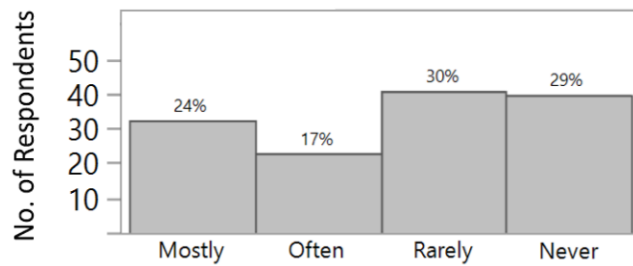


Figure 15 - Frequency Distribution of Individual study in the lounge, for all the participants combined

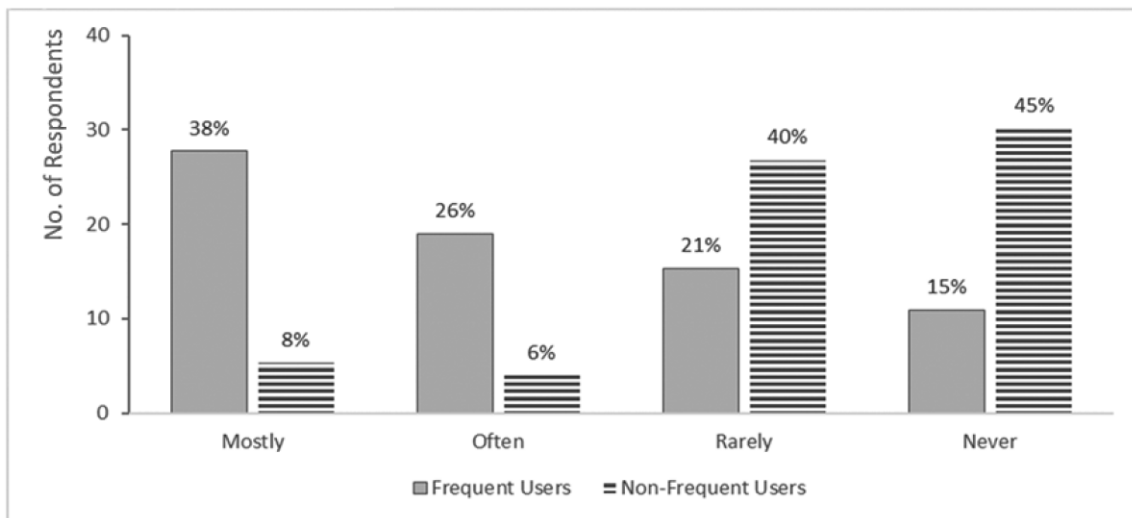


Figure 16 - Frequency Distribution of Individual study in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

#### 4.2.2. Frequency Distribution of Conducting Research in the Lounge

For research activity in the lounge, frequent and non-frequent users indicate similar patterns (Figure 18). While the ratio of individuals in the frequent users' group stands 16% more than the non-frequent ones, yet both ratios are relatively low.

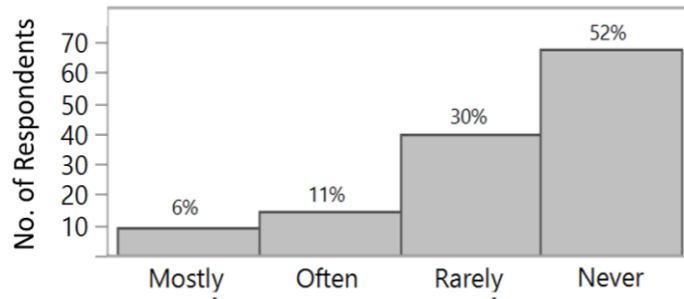


Figure 17 - Frequency Distribution of Research activity in the lounge, for all the participants combined

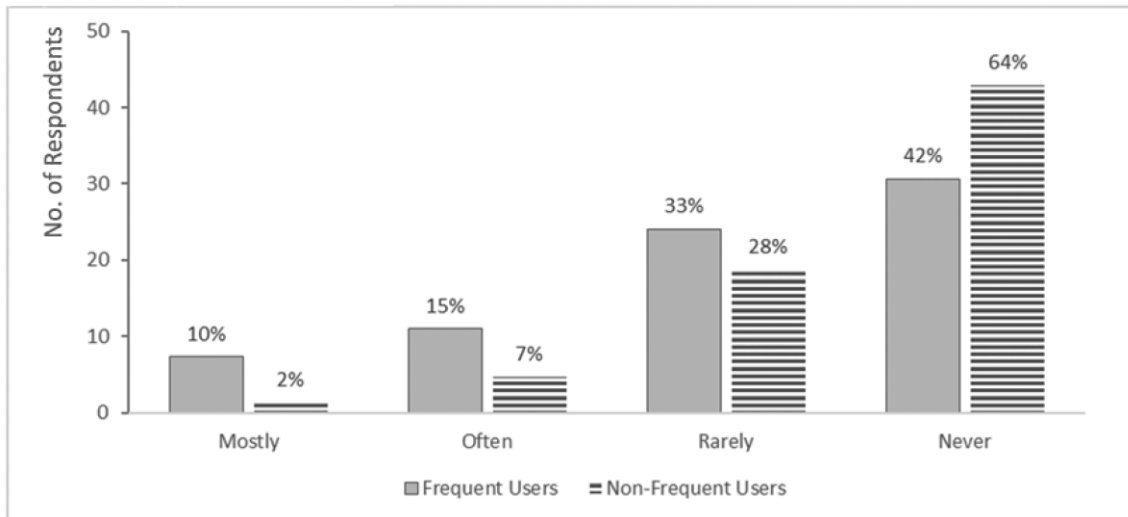


Figure 18 - Frequency Distribution of Research activity in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

#### 4.2.3. Frequency Distribution of Teamwork Activities in the Lounge

Teamwork gets the highest number of votes among both frequent and non-frequent users, with ratios as high as 69% and 49%, respectively (Figure 20).

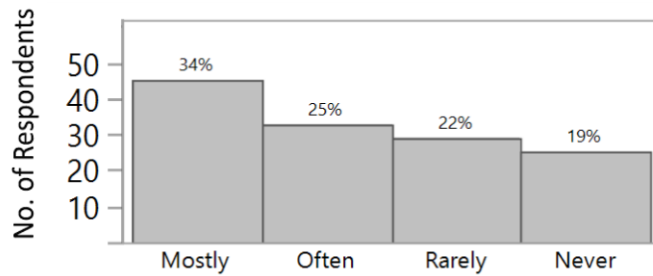


Figure 19 - Frequency Distribution of Teamwork activity in the lounge, for all the participants combined

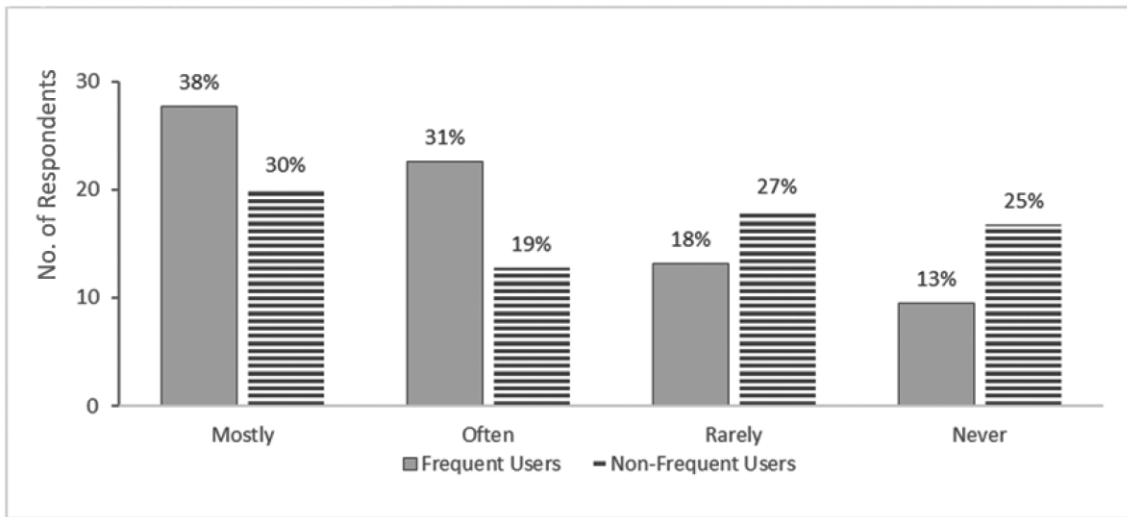


Figure 20 - Frequency Distribution of Teamwork activity in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

#### 4.2.4. Frequency Distribution of Meeting and Socializing with Friends in the Lounge

For both frequent and non-frequent users, around 35% of participants vote for meeting and socializing with friends in the lounge (Figure 21). This activity may not be considered as a major one for none of the frequent and non-frequent users, compared to other activities (Figure 22).

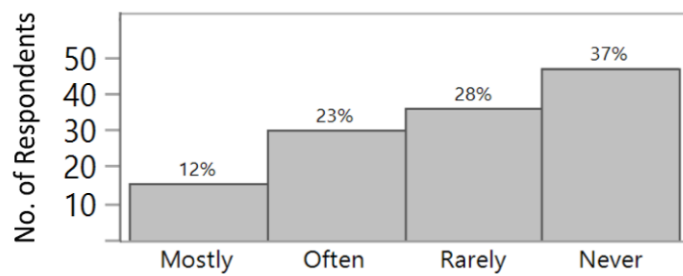


Figure 21 - Frequency Distribution of meeting and socializing with friends in the lounge, for all the participants combined

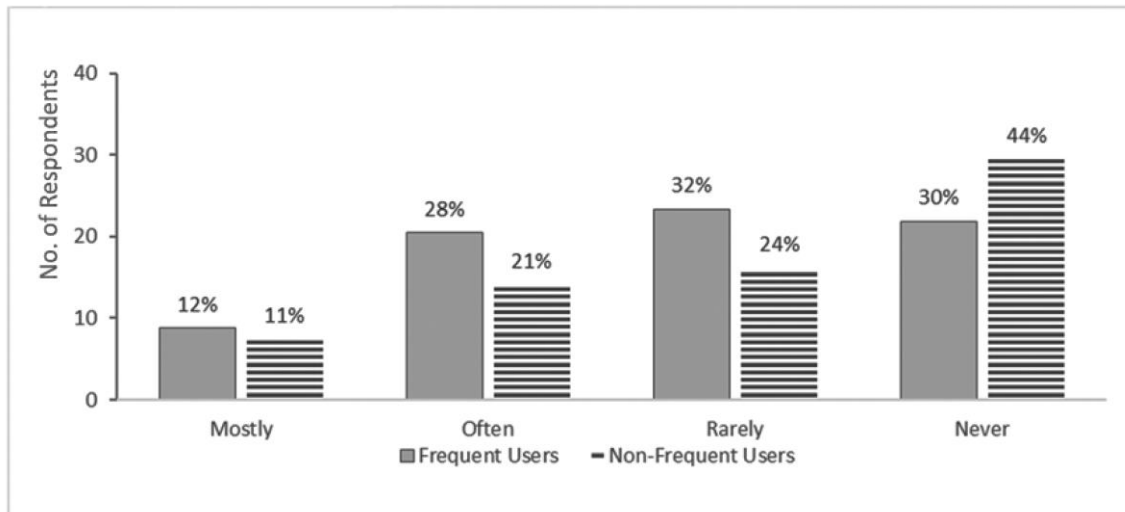


Figure 22 - Frequency Distribution of meeting and socializing with friends in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

#### 4.2.5. *Frequency Distribution of Waiting in the Lounge for other Classes to Start*

As shown in Figure 24, 81% of non-frequent users opposed the author's hypothesis that they may at least use their lounge when they need to wait for the upcoming classes.

However, with almost 64% of votes, waiting in the lounge for classes to start is usual among frequent users.

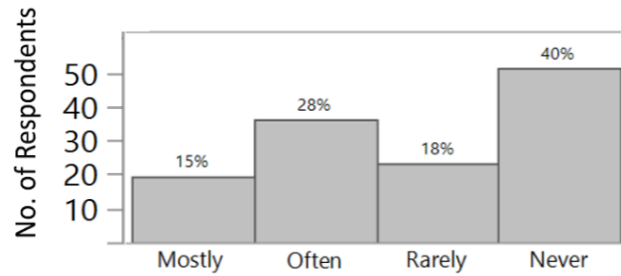


Figure 23 - Frequency Distribution of waiting in the lounge for upcoming classes, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

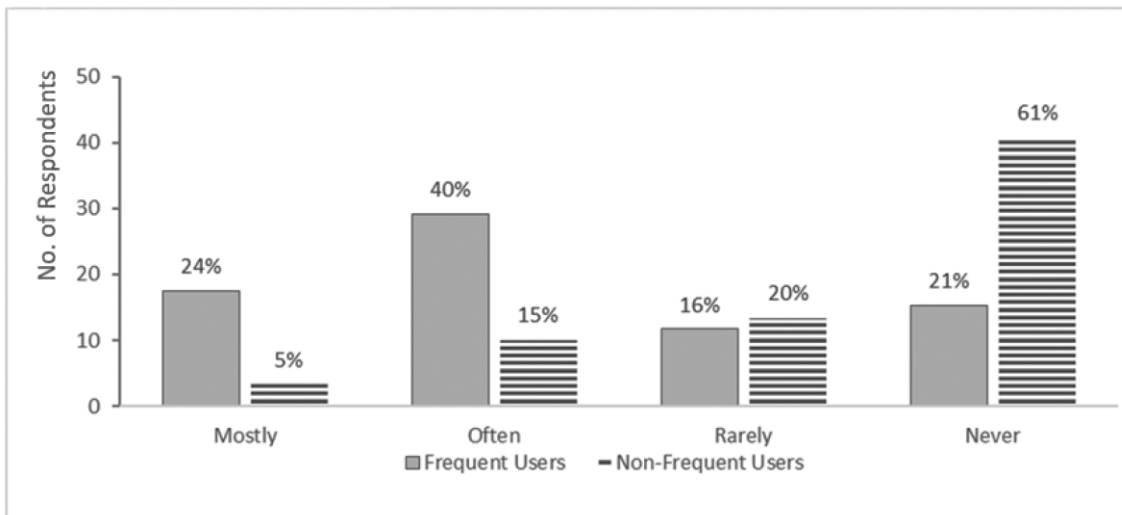


Figure 24 - Frequency Distribution of waiting in the lounge for upcoming classes, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

#### 4.2.6. Frequency Distribution of Eating/Relaxing in the Lounge

While almost third of frequent users spend a considerable time in lounge spaces for eating or relaxing, only tenth of non-frequent users vote for this activity (Figure 26). For both of groups, this may not be considered as a significant activity.

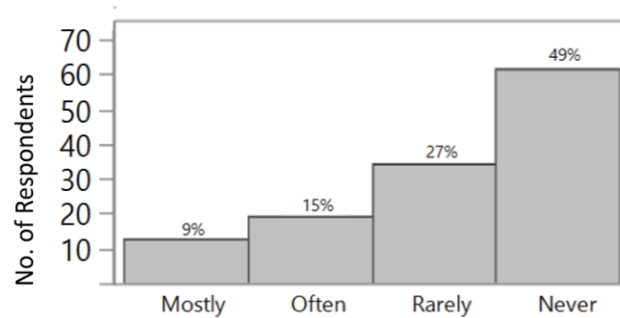


Figure 25 - Frequency Distribution of eating/relaxing in the lounge, for all the participants combined

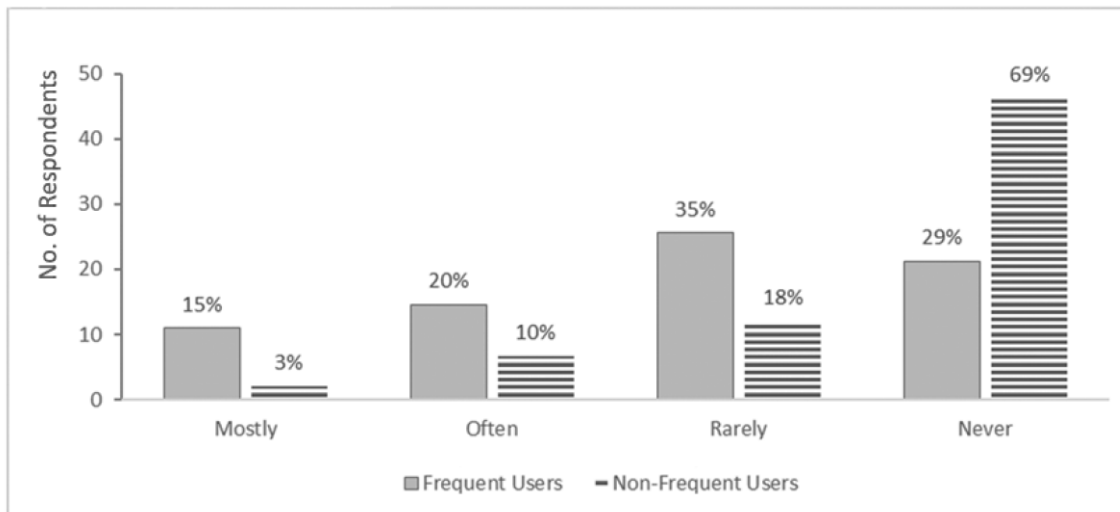


Figure 26 - Frequency Distribution of eating/relaxing in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)



4.2.7. Frequency Distribution of Web Surfing in the Lounge

With almost the same pattern as the ones eating and relaxing in the lounge, the portion of participants with frequent web surfing in the lounge stands around 36% and 10% for frequent and non-frequent users (Figure 28). Like eating and relaxing, this activity is not a major one among users, regardless of frequency of use.

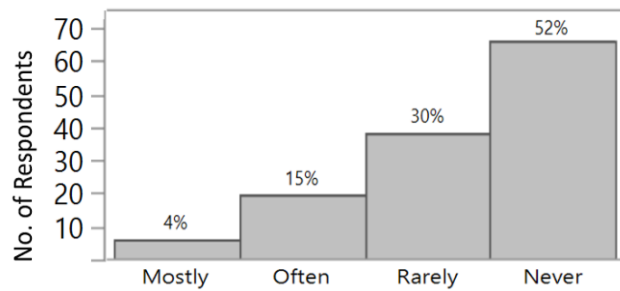


Figure 27- Frequency Distribution of web-surfing in the lounge, for all the participants combined

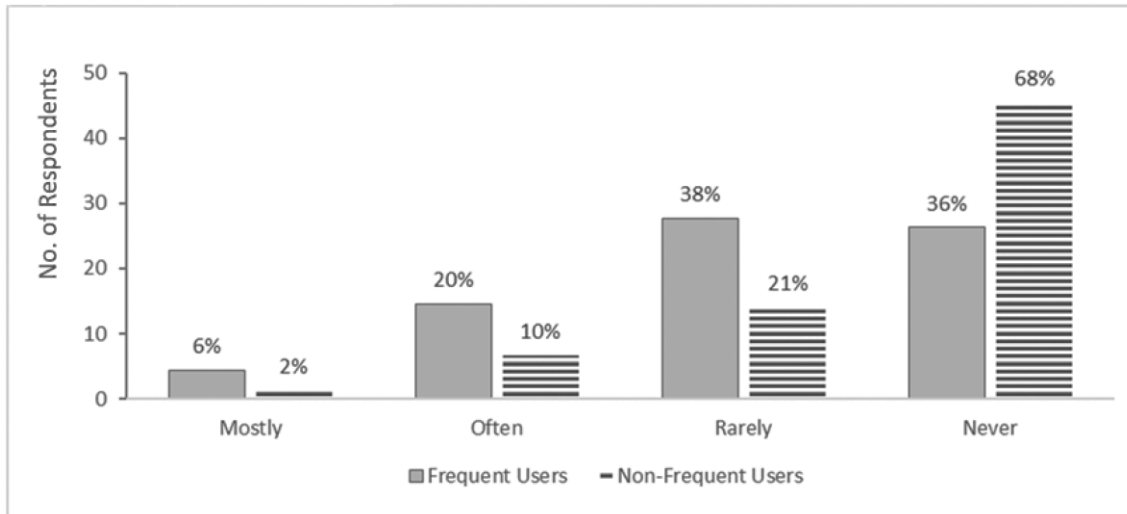


Figure 28 - Frequency Distribution of web-surfing in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

4.2.8. Frequency Distribution of Making Phone Calls in the Lounge

The least frequent activity among both groups of lounge users is making phone calls. This ratio is just below 10% among frequent users, and only 5% for non-frequent users (Figure 30).

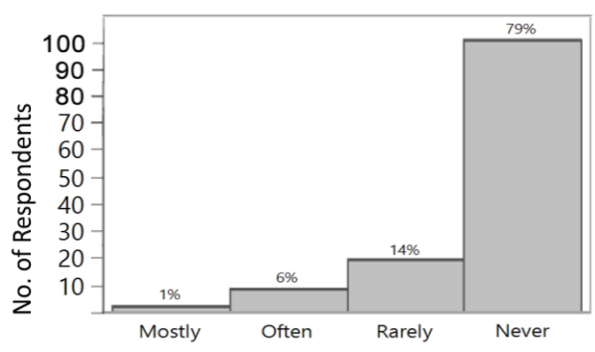


Figure 29 - Frequency Distribution of making phone calls in the lounge, for all the participants combined

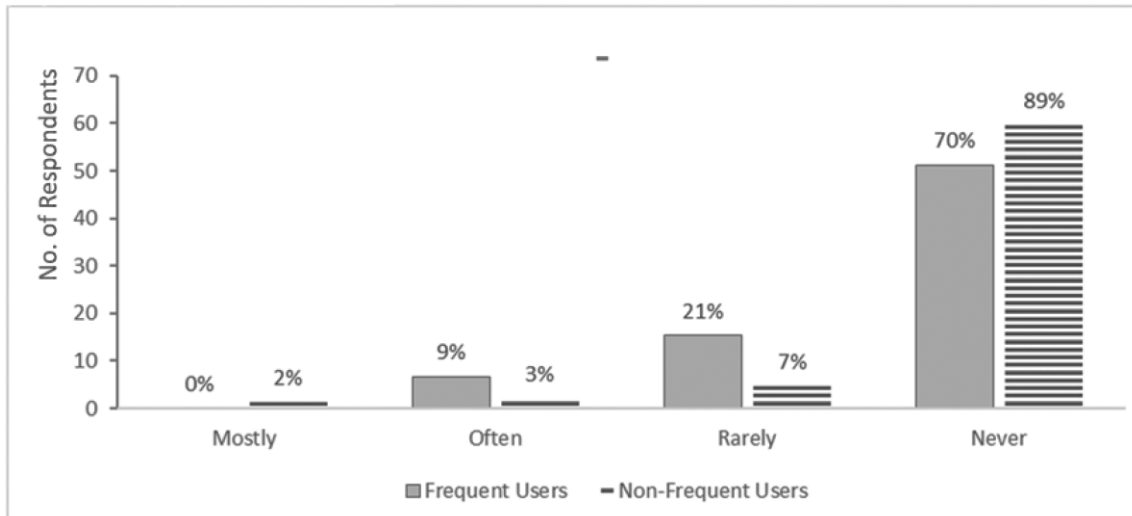


Figure 30 - Frequency Distribution of making phone calls in the lounge, for frequent users versus non-frequent users (The percentages indicate the portion from each sub-category, and not the whole population.)

Combining the votes for “Mostly” and “Often”, Figure 31 summarizes the items discussed above, on the distribution of activities among two different groups of frequent

users and non-frequent users in the lounge. Both frequent and non-frequent users are most commonly using their lounge for teamwork. Individual studies, which seems to be correlated with waiting for classes, and/or relaxing are also common among frequent users. One may argue that the main activities in lounge are teamwork (a noisy activity), and individual study or relaxing (a silent activity). These two common activities are conflicting in terms of their acoustical needs. The non-frequent users mostly use the space for teamwork and socializing, which are not conflicting with high level of noise in the space. However, their usage of space for individual studies, where noise level could be of a concern, is significantly low. The question would be whether noise level or any other inherent factor within the lounge hinders non-frequent users from using such spaces, or an external factor such as office ownership determines the usage pattern of graduate lounge.

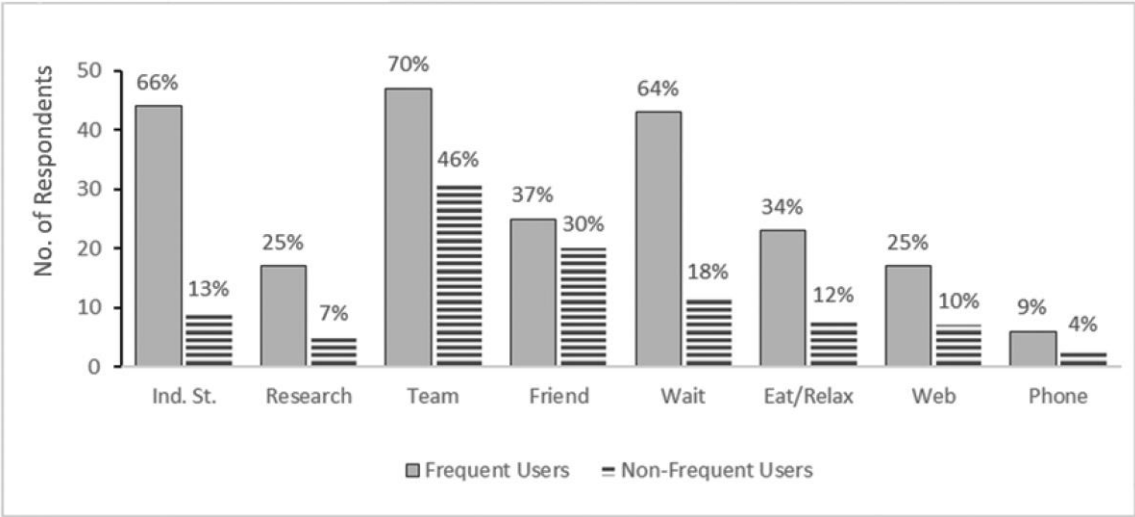


Figure 31 - Distribution of activities among two different groups of frequent users and non-frequent users in the lounge (The percentages indicate the portion from each sub-category, and not the whole population.)

### **4.3. Further Discussions**

As already mentioned, frequent user in this study refers to anyone who uses the lounge at least once per week. With limited number of 140 participants, merging the 6 frequency users into two groups of frequent users and non-frequent users provides enough data sets to each group for statistical analysis. Also, it minimizes inaccurate results due to possible uncertain answers, as one may confuse 1-2 days per week with 3-4 days per week, but not with rare or almost never options.

In the previous section the results were grouped between frequent and non-frequent users, as main estimator for type of major activities in the lounge. One may argue whether this factor is the most appropriate one, or other contributing factors need to be considered. This section tries to justify that “frequency of use” is the most appropriate estimating factor for analysis of activities in the lounge.

For this, series of nominal logistic regression analysis are done to understand the relationship between each type of activity and any possible estimator factor. Then for each activity, the effect of all the main estimators are put in order in the effect summary of each set of analysis to find the most effective factor for each activity.

The following shows logistic regression analysis (by JMP software) for all the most frequent activities in the lounge. Note where P-values and Chi square test values are highlighted and less than 0.01, is where the effect of the factor is significantly high.

#### 4.3.1. Nominal Logistic Fit for Individual Study

As the effect summary in Table 5 shows, frequency of use, with the least P-Value, is the strongest estimator of participants behavior in terms of their tendency for individual study in the lounge. While office type ownership is also of significant influence, with a P-Value of 0.01, its significance (logarithmic worth) is almost third of significance of use frequency (Table 5). Table 6 and Table 7 include the details of the nominal logistic regression test and likelihood ratio test by JMP software, based on which the effect summary is provided.

Table 5 - Nominal Logistic Fit for Individual Study – Effect summary




Source	Log Worth	P-Value
Use Frequency*	5.939 	<b>0.000001*</b>
Office Type	1.969 	0.010751
Semester (<1, +1)	0.411 	0.387954

Table 6 - Nominal Logistic Fit for Individual Study – Parameter Estimates

Term	Estimate	Std. Error	Chi Square	Prob. > Chi Sq.
Intercept	6.09	631	0.00	0.992301
Semester (<1, +1)	-0.2	0.22	0.75	0.386394
Office Type [No Office]	-5.9	631	0.00	0.992489
Office Type [Shared]	-5.2	631	0.00	0.993403
Use Frequency [Frequent]*	-1.0	0.23	20.59	<b>0.000006*</b>

Table 7 - Nominal Logistic Fit for Individual Study – Likelihood Ratio Test

Source	L-R Chi Square	Prob. > Chi Sq.
Semester (<1, +1)	0.75	0.387954
Office Type	9.07	0.010751
<b>Use Frequency*</b>	23.7	<b>0.000001*</b>

#### 4.3.2. Nominal Logistic Fit for Research

As the effect summary in Table 8 shows, frequency of use, with the least P-Value, is the strongest estimator of participants behavior in terms of their tendency for doing research in the lounge. Office type ownership influence is not significant in this case, with a P-Value of 0.2 (Table 8). Table 9 and Table 10 include the details of the nominal logistic regression test and likelihood ratio test by JMP software, based on which the effect summary is provided.

Table 8 - Nominal Logistic Fit for Research – Effect Summary




Source	Log Worth	P-Value
<b>Use Frequency*</b>	2.049 	<b>0.00894*</b>
Office Type	0.596 	0.25357
Semester (<1, +1)	0.044 	0.90458

Table 9 - Nominal Logistic Fit for Research – Parameter Estimate

Term	Estimate	Std. Error	Chi Square	Prob. > Chi Sq.
Intercept	6.88	663	0.00	0.992
Semester (<1, +1)	-0.0	0.26	0.01	0.904
Office Type [No Office]	-4.9	663	0.00	0.994
Office Type[Shared]	-5.3	663	0.00	0.994
<b>Use Frequency*</b>	-0.7	0.29	5.99	<b>0.014*</b>

Table 10 - Nominal Logistic Fit for Research – Effect Likelihood Ratio Tests

Source	L-R Chi Square	Prob. > Chi Sq.
Semester (<1, +1)	0.01	0.905
Office Type	2.74	0.254
<b>Use Frequency*</b>	6.84	<b>0.009*</b>

#### 4.3.3. Nominal Logistic Fit for Teamwork

As the effect summary in Table 11 shows, office type with the least P-Value of 0.01, is the strongest estimator of participants behavior in terms of their tendency for teamwork activity in the lounge. In this case use frequency is not of significant influence, with a P-Value of 0.4 (Table 11). Table 12 and Table 13 include the details of the nominal logistic regression test and likelihood ratio test by JMP software, based on which the effect summary is provided.

Table 11 - Nominal Logistic Fit for Teamwork – Effect Summary




Source	Log Worth	P-Value
Office Type	2.005 	0.01
Semester (<1, +1)	0.357 	0.44
<b>Use Frequency*</b>	0.352 	<b>0.44*</b>

Table 12 - Nominal Logistic Fit for Teamwork – Parameter Estimates

Term	Estimate	Std. Error	Chi Square	Prob. > Chi Sq.
Intercept	0.00	0.31	0.00	0.988
Semester (<1, +1) [<1]	-0.2	0.21	0.60	0.440
<b>Office Type* [No Office]</b>	-1.0	0.36	7.15	<b>0.007*</b>
Office Type[Shared]	0.08	0.35	0.05	0.823
Use Frequency [Frequent]	-0.1	0.19	0.59	0.443

Table 13 - Nominal Logistic Fit for Teamwork - Effect Likelihood Ratio Tests

Source	L-R Chi Square	Prob. > Chi Sq.
Semester (<1, +1)	0.59	0.440
<b>Office Type*</b>	9.23	<b>0.010*</b>
Use Frequency	0.58	0.444

#### 4.3.4. Nominal Logistic Fit for Meeting Friends and Socializing

As the effect summary in Table 14 shows, even though frequency of use, with the least P-Value, is the highest estimator of participants behavior in terms of their tendency for socializing in the lounge, P-Value of 0.57 is far higher than 0.01 to be considered as significant. Therefore, none of the factors are of significant influence, with a P-Value close to 0.01 (Table 14). Table 15 and Table 16 include the details of the nominal logistic regression test and likelihood ratio test by JMP software, based on which the effect summary is provided.

Table 14 - Nominal Logistic Fit for meeting friends and socializing – Effect Summary




Source	Log Worth	P-Value
Use Frequency	0.248 	0.57
Semester (<1, +1)	0.226 	0.59
Office Type	0.022 	0.95



Table 15 - Nominal Logistic Fit for meeting friends and socializing – Parameter Estimates

<b>Term</b>	<b>Estimate</b>	<b>Std. Error</b>	<b>Chi Square</b>	<b>Prob. &gt; Chi. Sq.</b>
Intercept	0.82	0.31	7.08	0.008
Semester (<1, +1) [<1]	0.11	0.21	0.28	0.596
Office Type [No Office]	-0.1	0.36	0.05	0.821
Office Type[Shared]	0.05	0.35	0.02	0.893
Use Frequency	-0.1	0.20	0.33	0.566

Table 16 - Nominal Logistic Fit for meeting friends and socializing – Effect Likelihood Ratio Tests

<b>Source</b>	<b>L-R Chi Square</b>	<b>Prob. &gt; Chi Sq.</b>
Semester (<1, +1)	0.28	0.594
Office Type	0.10	0.951
Use Frequency	0.33	0.565

#### 4.3.5. Nominal Logistic Fit for Waiting for Upcoming Classes

As the effect summary in Table 17 shows, frequency of use, with the least P-Value, is the strongest estimator of participants behavior in terms of their tendency for elapsed time and waiting in the lounge. While office type ownership is also of significant influence, with a P-Value of 0.05, its significance (logarithmic worth) is almost third of significance of use frequency (Table 17). Table 18 and Table 19 include the details of the nominal logistic regression test and likelihood ratio test by JMP software, based on which the effect summary is provided.

Table 17 - Nominal Logistic Fit for Waiting for upcoming classes – Effect Summary

Source	Log Worth	P-Value
Use Frequency*	3.710	<b>0.0002</b>
Office Type	1.286	0.0517
Semester (<1, +1)	0.687	0.2057

Table 18 - Nominal Logistic Fit for Waiting for upcoming classes – Parameter Estimates

Term	Estimate	Std. Error	Chi Square	Prob. > Chi Sq.
Intercept	0.56	0.33	2.82	0.0932
Semester (<1, +1) [<1]	-0.3	0.21	1.61	0.2040
Office Type [No Office]	-0.6	0.38	2.62	0.1056
Office Type[Shared]	0.4	0.39	1.09	0.2962
Use Frequency*	-0.8	0.21	13.04	<b>0.0003*</b>

Table 19 - Nominal Logistic Fit for Waiting for upcoming classes – Effect Likelihood Ratio Tests

Source	L-R Chi Square	Prob. > Chi Sq.
Semester (<1, +1)	1.6	0.2057
Office Type	5.92	0.0517
Use Frequency*	13.9	<b>0.0002*</b>

#### 4.3.6. Nominal Logistic Fit for Eating and Relaxing

As the effect summary in Table 20 shows, frequency of use, with the least P-Value, is the strongest estimator of participants behavior in terms of their tendency for eating and relaxing in the lounge. In this care, office type ownership is not of a significant influence, with a P-Value of 0.18 (Table 20). Table 21 and Table 22 include the details of the nominal logistic regression test and likelihood ratio test by JMP software, based on which the effect summary is provided.

Table 20 - Nominal Logistic Fit for Waiting for eating and relaxing  
– Effect summary




Source	Log Worth	P-Value
<b>Use Frequency*</b>	2.109 	<b>0.01*</b>
Office Type	0.743 	0.18
Semester (<1, +1)	0.108 	0.78

Table 21 - Nominal Logistic Fit for Waiting for eating and relaxing – Parameter Estimate

Term	Estimate	Std. Error	Chi Square	Prob. > Chi Sq.
Intercept	6.55	665	0.00	0.99
Semester (<1, +1) [<1]	-0.1	0.23	0.08	0.78
Office Type [No Office]	-5.1	665	0.00	0.99
Office Type[Shared]	-5.4	665	0.00	0.99
<b>Use Frequency*</b>	-0.6	0.24	6.48	<b>0.01*</b>

Table 22 - Nominal Logistic Fit for Waiting for eating and relaxing – Effect Likelihood Ratio Tests

Source	L-R Chi Square	Prob. > Chi Sq.
Semester (<1, +1)	0.1	0.78
Office Type	3.4	0.18
<b>Use Frequency*</b>	7.1	<b>0.01*</b>

As already shown through Tables 5 to 22, P-values and Chi Squares are the least for frequency of use in most of the cases, and mostly far less than 0.01, which makes this factor as the best estimator for type of major activities in lounge spaces.

Table 23 summarizes the best estimator for each significant activity in the lounge. The only significant activity with best estimator other than frequency of use is teamwork, where office ownership stands far stronger than frequency of use. However,

for uniformity of comparison, one factor with most influence in majority of cases is to be selected. Therefore, using the frequency of use, and dividing participants in two groups of frequent users and non-frequent users is statistically the most reasonable solution.

Table 23 - Best estimator factor based on activity type

<b>Table</b>	<b>Activity</b>	<b>Best Estimator</b>	<b>P-Value</b>
5, 6, 7	Individual Studies	Frequency of Use	0.000001
8, 9, 10	Research	Frequency of Use	0.0089
11, 12, 13	Teamwork	Personal Office	0.01
14, 15, 16	Socializing	Frequency of Use	0.57*
17, 18, 19	Waiting for Classes	Frequency of Use	0.0002
20, 21, 22	Eating & Relaxing	Frequency of Use	0.01

**4.4. Ideas and Critics About Lounge Spaces**

The variety of questions within this part of the survey provides an insight on different aspect of individuals’ perception about lounge spaces. Comments are provided to each question, accordingly.

4.4.1. *Q1: Using Graduate Lounge More Often When It Is Close to Midterm Or Final Exams*

Figure 32's distribution does not reveal any significant difference in terms of their tendency to use the lounge, depending of time during the semester.

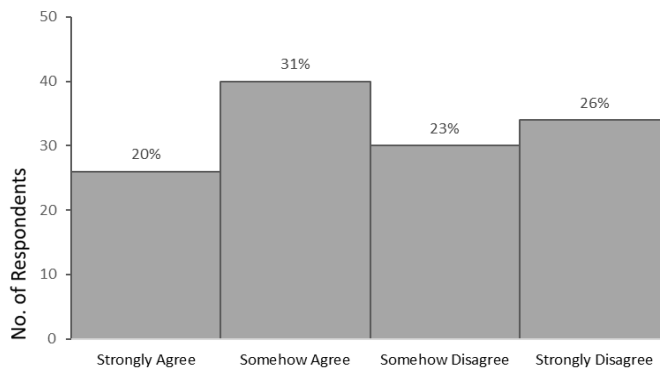


Figure 32 - Distribution of answers to Q1

4.4.2. *Q2: Lounge Is A Useful Space Within Departments.*

Figure 33 shows a high level of agreement on utility of lounge spaces among participants. The distribution shows that 87% have voted for lounge overall value, which means the reason for low occupancy of such spaces is dependent on quality offered by these spaces, not disagreement of non-frequent users on lounge value.

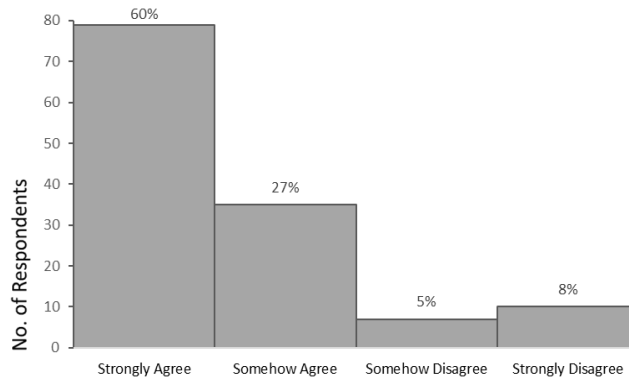


Figure 33 - Distribution of answers to Q2

4.4.3. *Q3: Lounge Spaces Are Useful Only If Students Don't Have Any Dedicated Desk/Office Space.*

*Q9: There Is No Specific Value to Lounges and Spaces Such As Library, Cafes, Or Others Already Provide A Wide Range Of Spaces For Different Activities Out Of Classrooms, Which Obviates The Need For Having a Specific Graduate Lounge.*

Following the previous question, Figure 34 underlines the significance of office ownership on using the lounge.

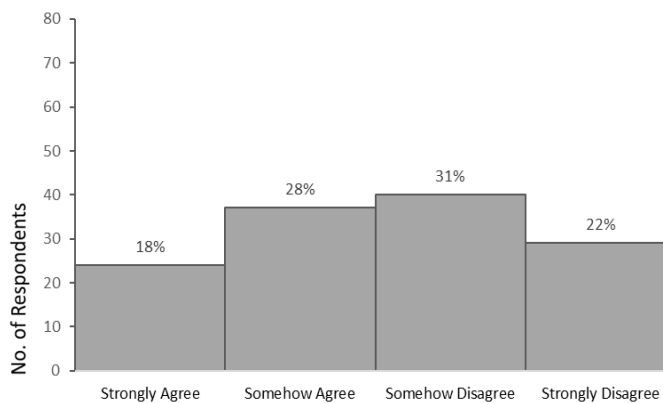


Figure 34 - Distribution of answers to Q3

Figure 35 again shows the significance of lounge to both frequent and non-frequent group. 89% believe lounge spaces have unique values above library and other spaces within the campus.

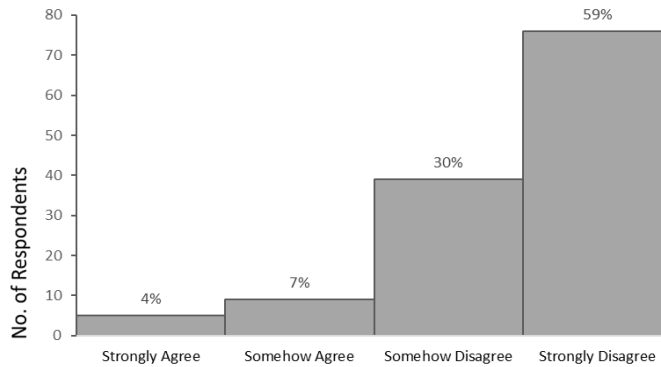


Figure 35 - Distribution of answers to Q9

4.4.4. *Q4: Any Preference for Using Other Spaces on Campus Such as Library Rather Than the Lounge.*

Figure 36, confirms the results from Figure 35. No other space is preferred over lounge spaces, by far. Lounges have the potential to attract users, if well designed and tailored to the individuals' needs.

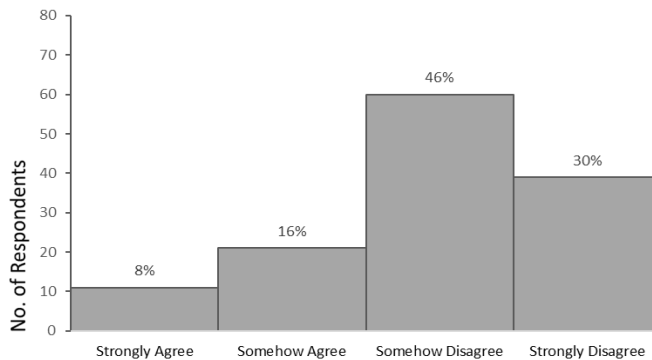


Figure 36 - Distribution of answers to Q4

4.4.5. Q5: Satisfaction Level of Users with Facilities and Design of Lounges.

In Figure 37, the group of frequent users are also quite satisfied with their lounge. However, 50% voting for “somehow agree” rather than the “strongly agree” (16%), illustrates the huge opportunity for design improvement. Also, the non-frequent users, who have voted for dissatisfaction from the space, imply the fact that their low frequency of use is not due to external factors or their personal reasons, but due to inherent low quality of such spaces.

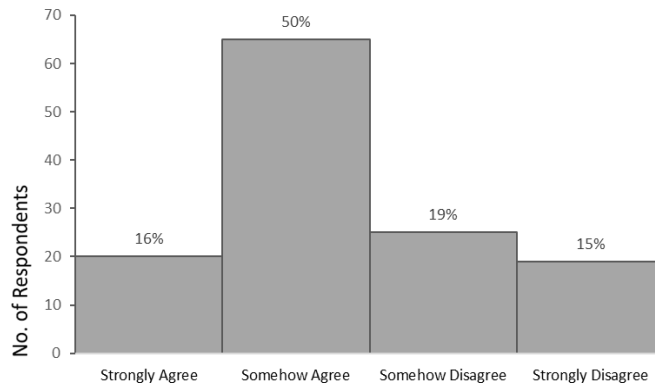


Figure 37 - Distribution of answers to Q5

4.4.6. Q6: Being A Non-Frequent User, Improving the Lounge Quality, The User Would Become A Frequent One.

25 of non-frequent users, which make almost third of the non-frequent participants in this study, would consider themselves to become a frequent user, if lounge space qualities are improved. Figure 38 shows almost half of the participants, regardless of their frequency of use, would increase their use frequency if lounge space quality is improved. This underlines the significance and change which such studies could make on users' behavior within spaces.



Note that the 46% of participants who would more frequently use their lounge in case of space improvements, are referred as “potential users” in this study. This group would be the target of analysis in the next section.

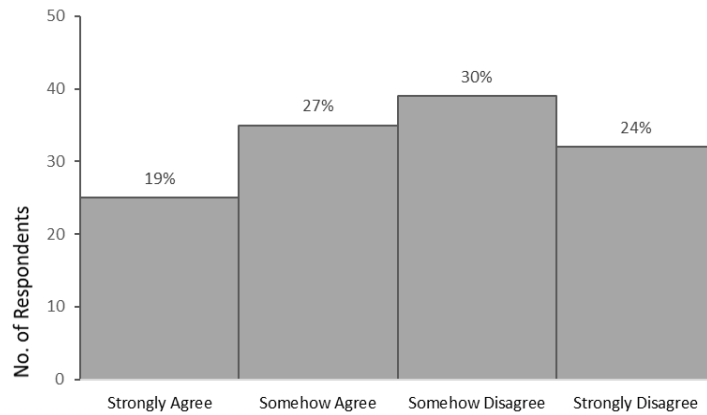


Figure 38 - Distribution of answers to Q6

*4.4.7. Q7: Being A Non-Frequent User, Improving the Lounge Quality, The User Would Not Become A Frequent One.*

*Q8: No Matter Any Interior Improvements Happen to The Same Graduate Lounge, Other Spaces Within the Campus Are Always Preferred.*

Confirming the same results as the previous question, Figures 39 and 40 show the high density of answers on the “disagree” side with questions 7 and 8. The clear leaning of answers towards disagreement shows the opportunity to increase occupancy and lounge utilization rate through space quality improvements.

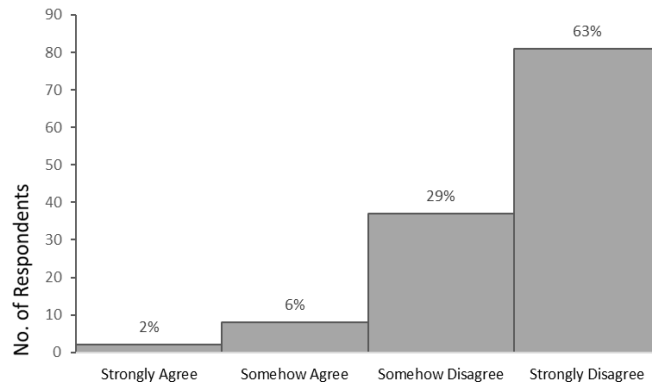


Figure 39 - Distribution of answers to Q7

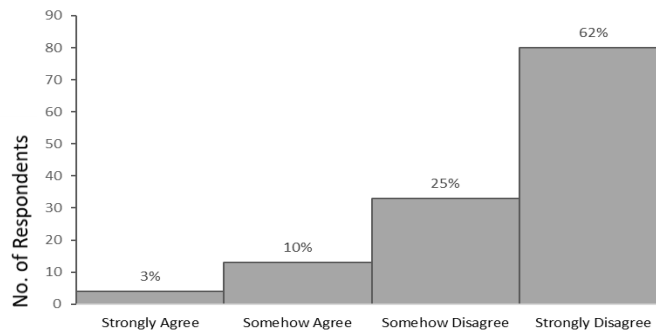


Figure 40 - Distribution of answers to Q8

4.4.8. *Q10: The Library Is Better Than the Graduate Lounge for Studying and Hard Work, As It Is Less Distracting with Friends and Classmates.*

Figure 41 shows a lower level of disagreement with this Q10 compared to Figure 36 and Q4. This shows the significance of distraction to participants for picking their preferred space.

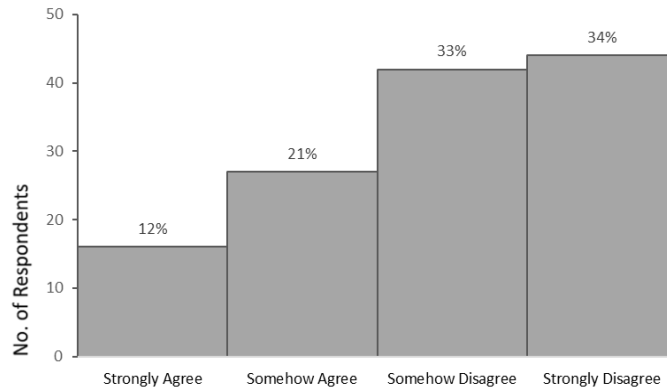


Figure 41 - Distribution of answers to Q10

*4.4.9. Q11: The Department Lounge Is Always Preferred to Out of Department Spaces, Because Of Its Short Distance Travel.*

Figure 42 shows a high skewness of results towards the “agree” side of the spectrum.

This shows the significance of short travel distance for making lounges a hotspot to students.

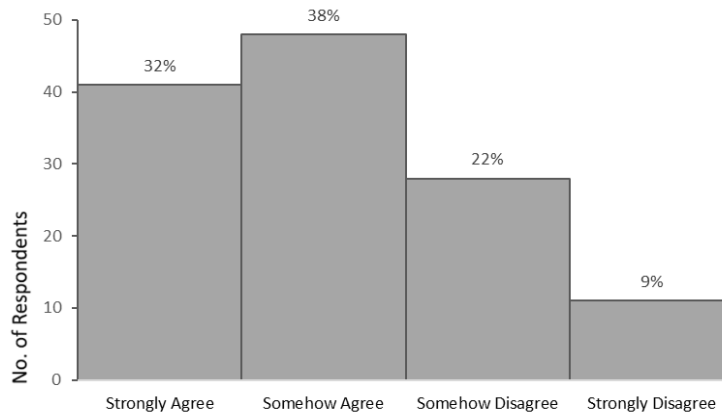


Figure 42 - Distribution of answers to Q11

4.4.10. Q12: *Restricted Access for Undergraduate Students in The Graduate Lounge Is Appropriate and Each Academic Level Should Have Exclusive Lounge Spaces.*

Q13: *Lounge Space Are for Socializing and It's Better to Combine Undergraduate and Graduate Students in One Lounge Room, Rather Than Separate Spaces.*

The results from Figures 43 and 44 underlines the fact that graduate students mostly seek their own space, not accessible by undergraduate or out of department students.

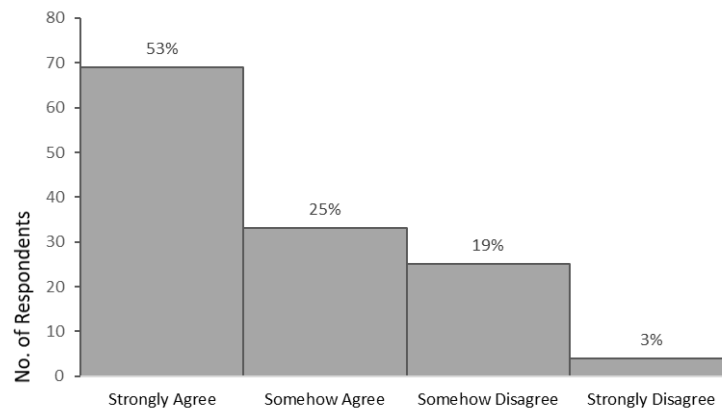


Figure 43 - Distribution of answers to Q12

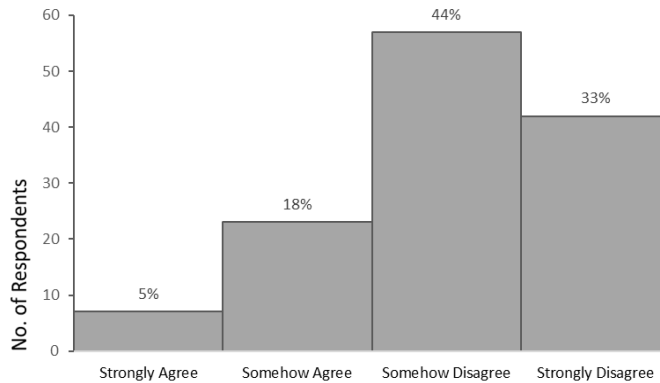


Figure 44 - Distribution of answers to Q13

*Q14: Participants Have Never Been Involved in Decision Making About Spaces at University for Their Use.*

As anticipated by the author, Figure 45 shows that value of surveys and users' opinion of spaces is not highly valued within the campus (The case is only applicable to Texas A&M University). As already discussed in the literature review, the value of decision making through user experience is highly appreciated in business and other industries. However, such a valuable resource is not well used in Texas A&M University. The author's hypothesis is students' involvement in decision making for spaces of universities is not generally well supported. Though this hypothesis requires further studies, as a future research project.

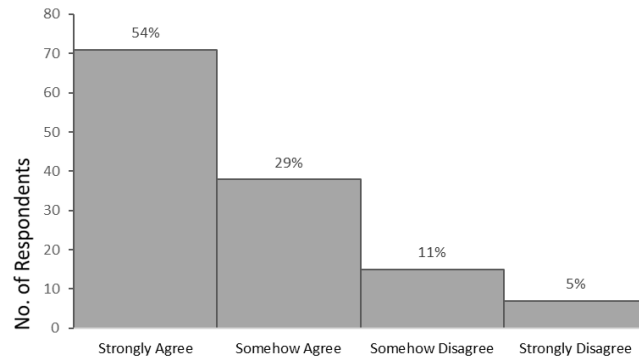


Figure 45 - Distribution of answers to Q14

**Q15: Perception Regarding Questionnaires for Making A Big Difference and Value in Decision Making of Spaces Within the Campus.**

Figure 46 shows a normal distribution of perception regarding the effect and significance of surveys in application. No specific conclusion is possible.

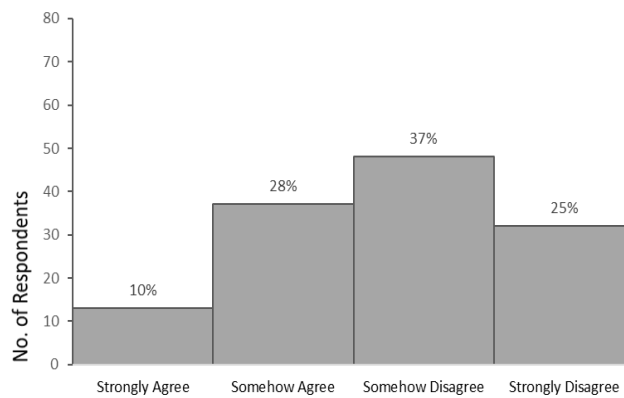


Figure 46 - Distribution of answers to Q15

#### 4.5. *Potential User Analysis*

Potential users, as already defined in previous section in question Q6, are defined as participants who indicated using their lounge if their department made improvements to the quality of the lounge. This section tries to identify the factors, improving which could make potential users to more frequently use lounge spaces. To achieve this, the main focus is on most prevalent complaints among users.

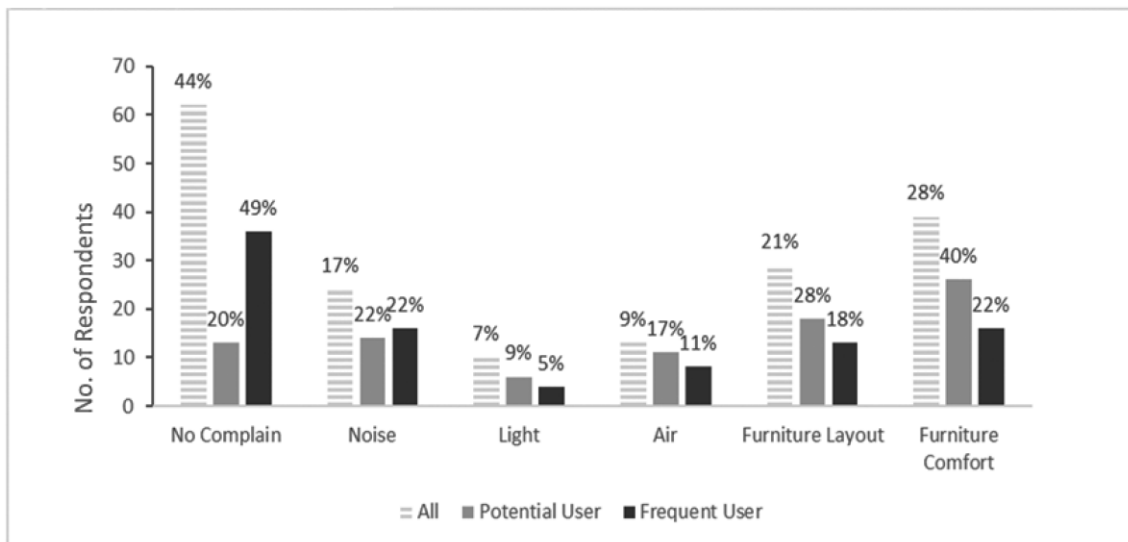


Figure 47 -Distribution of perceived issued among two different groups of frequent users and potential users in the lounge (The percentages indicate the portion from each sub-category, and not the whole population)

Base on Figure 47, most people who use the lounge indicate that they have no complaints. In terms of noise level, a lot of people complain but no apparent difference between frequent users and potential users exists. Furniture layout seems to be more of a problem for potential users than the frequent ones. The following is the Fisher’s exact

test results, which confirms the complaints' types are significantly different among frequent and potential users.

- H0 the type of complaints does not depend on the type of user (frequent or potential)
- H1 the type of complaints is different for users and potential users

```
## Fisher's Exact Test for Count Data
## data: complaints
## p-value = 0.009279
## alternative hypothesis: two.sided
```

We can test for a difference in furniture complaints. Does the proportion of people who are unhappy with the furniture differ between users and potential users?

With proportion test (hypothesis proportion testing), where test statistic

is  $Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{p^*(1-p^*)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$  and  $p^* = \frac{x_1 + x_2}{n_1 + n_2}$ , the significance of difference in furniture

complaints among frequent and potential users can be tested. With a test statistic of -14.22, it could be concluded that potential users have a significantly higher dissatisfaction with the furniture than those who frequently use the lounge.

#### 4.5.1. Complaints by Department

Figure 48 summarizes the distribution of complains within the different departments.



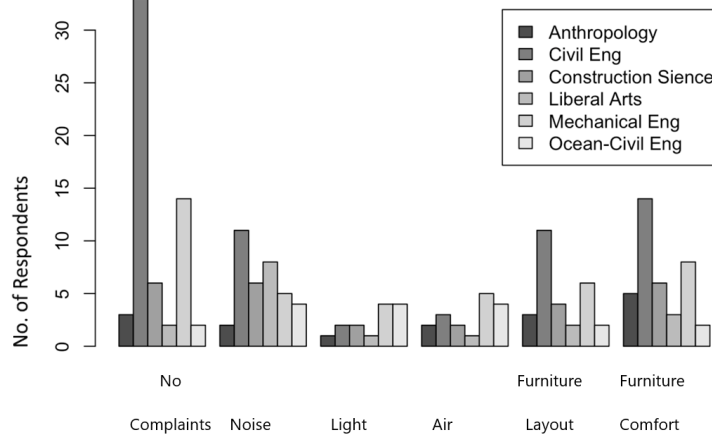


Figure 48 - Complain distribution within different departments

With Fisher's exact test, and a p-value of 0.16, it can be concluded that the types of complaints seem not to depend on the department. The breakdown in the figure above can give a preliminary indication about what students from the departments above are interested in. For instance, the furniture and layout highly stand out in Construction Science Department, compared to the two other departments.

```
## Fisher's Exact Test for Count Data with simulated p-value (based
## on 1e+05 replicates)
## data: tab[-c(1, 6), ]
## p-value = 0.1581
## alternative hypothesis: two.sided
```

#### 4.5.2. Frequency of Use by Department

The Chi-Square test with a P-Value of 0.2153 shows that Lounge usage frequency does not dependent on the department.

Table 24 - Distribution of frequent and non-frequent users among the departments

Department	Non-Frequent	Frequent
Anthropology	1	2
Anthropology-Liberal Arts	5	6
Civil Eng.	28	34
Construction Science	6	12
English-Liberal Arts	7	1
Mechanical Eng.	14	18
Ocean-Civil Eng.	3	1

```
## Pearson's Chi-squared test
## data:  tab
## X-squared = 8.324, df = 6, p-value = 0.2153
```

#### 4.5.3. Seating Arrangement Analysis

Participants were given seven furniture layout alternatives (Figure 50) to pick their first two favorite alternatives. Figure 49 summarizes their answers to this question. Overall it does not seem to be much of a difference in furniture layout preference between frequent users and potential users. For both groups layout G is the most popular, followed by E, B, and A, respectively. Author's suggestion for space designer and planners is to include combination of these preferred alternatives within the same space.

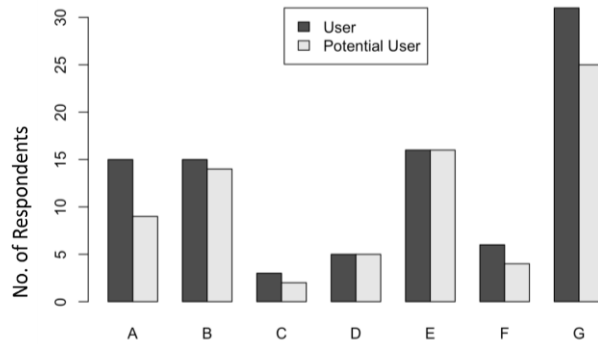


Figure 49 - Furniture layout preferences among frequent and potential users

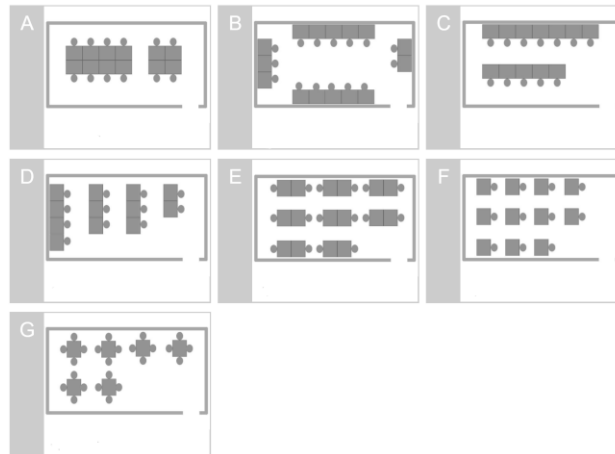


Figure 50 - Possible furniture layouts suggested by the survey

Table 25 summarizes the effect of different layouts on inviting potential users.

This is achieved through logistic regression analysis:

Table 25 –Logistic Regression on influence of furniture layout on usage frequency

	Estimat	Std. Error	z	Pr(> z )	97.5 %	Exp. (2.5%)	Exp. (97.5%)
(Intercept)	-0.86	0.45	-	0.05	0.00	0.17	1.00
Image A	-0.27	0.51	-	0.59	0.71	0.28	2.04
Image B	0.37	0.50	0.75	0.46	1.36	0.54	3.89
Image C	0.14	1.13	0.13	0.90	2.45	0.11	11.63

	Estimat	Std. Error	z	Pr(> z )	97.5 %	Exp. (2.5%)	Exp. (97.5%)
Image D	0.51	0.74	0.68	0.50	2.03	0.38	7.61
Image E	0.48	0.49	0.99	0.32	1.45	0.62	4.27
Image F	0.57	0.87	0.65	0.51	2.36	0.31	10.64
Image G	-0.19	0.44	-	0.66	0.67	0.35	1.95
Furniture	1.13	0.44	-	0.03	2.16	1.3	7.58
Too Noisy	1.12	0.51	2.17	0.03	2.15	1.12	8.62

At the standard 95% confidence level there are two factors which predict that someone will indicate they will consider using the graduate lounge: decreasing noise level and altering the furniture. At 95% confidence level, as the logistic regression shows, noise level affects people's willingness to use their lounge. People are about  $3.06 = e^{1.12}$  times more likely to indicate they will use their lounge if the noise level is reduced. The 95% confidence interval for this effect is  $(1.12, 8.61) = (e^{0.12}, e^{2.153})$ . Similarly, people who indicated that the furniture in their lounge is not adequate (not comfortable or stylish) or that the arrangement of the furniture is not optimal are more likely to answer that they will use their lounge if those changes are made. People are  $3.09 (= e^{1.13})$  times more likely to say they will use their lounge if they indicate their problem with the lounge is the furniture. The 95% confidence interval for this effect is  $(1.13, 7.58)$ .

## CHAPTER V

### CONCLUSION

#### *5.1. Discussion*

Not only for lounge and serendipity areas, but overall in higher education and academic space planning, to the knowledge of the author, no clear hierarchy for significance level of different attributes (functionality, aesthetics, noise, privacy, distraction, group interaction, layout, furniture, and sense of belonging) is available in the literature. While some studies may compare only two properties (ex: functionality versus aesthetics (Chism 2006; Jessop et al. 2012; Mitchell 2003) or noise versus privacy (Gurung 2005; Matthews et al. 2011; Woolner et al. 2007; Yau and Joy 2010)), no comprehensive study compares attributes from different natures. This study claims to be the first endeavor of comprehensive study on all the alternatives, in academic environments. With the limited budget in the real world, and complexities of decision making, the author believes further studies as such could significantly help the professionals in the industry with more appropriate solutions, and sound allocation of resources.

The results of this study underline almost same, and even slightly higher, significance of furniture layout and comfort compared to the noise level, for success of study rooms and lounge spaces in universities. Though the limited number of 140

participants may not precisely estimate the significance factor of these two attributes. As already mentioned through the research method, based on the population portion equation (Wonnacott and Wonnacott 1990) with 95% confidence level, and confidence interval of 0.05, 140 to 380 responses are necessary, depending on the population proportion (the number of members in the population with a particular attribute divided by the number of members in the population) ranging from 50% to 90%. Therefore, further studies with minimum 380 participants would put the results within 5% confidence interval, regardless of the population distribution.

Also, after furniture layout and quality improvement in the graduate lounge of the Construction Science Department at Texas A&M University, another interesting study could be comparing the pre and post-change results.

## **5.2. *Results Highlights***

### *5.2.1. Participants Demographics*

The main participants of this study are graduate students from Civil Engineering, Mechanical Engineering, and Construction Science, with 46%, 24%, and 13% of the respondents, respectively. As per observation of the author, based on the mostly high rate of occupancy present with civil and mechanical engineering graduate lounge spaces, these two are successful instances of lounge space design.

Overall, 58% of participants are Masters' level students, and the rest are Ph.D. students. Besides, 36% of participants were in their first semester at Texas A&M University, when they submitted this survey, while others have been to the campus for at least one full semester.

The ratio between students with office space versus the ones without are almost equal (51% to 49%). Similarly, the frequent and non-frequent users (frequent users are those who use their lounge at least once or twice a week, for few hours) are almost equal populations (51% and 49%). This supports true randomness of the sample and is conducive to fair comparisons between these groups.

Other personal attributes do not seem to be of any clear significance to the individual's space usage pattern.

### *5.2.2. Major Activities in The Lounge*

Based on the logistic regression analysis, the frequency of use, which was applied as the dividing factor for the most possible activities in the lounge, is the soundest dividing factor for type of activities in the lounge.

Teamwork is the main activity in lounge to both frequent and non-frequent users. However, for the second highest frequent activity, frequent and non-frequent users are different. Individual studies, followed by waiting for classes, and eating/relaxing are the most common activities among frequent users. Though, socializing and meeting friends is the second major activity among non-frequent users.

It is interesting to note that frequent users top two activities (teamwork and individual studies) are acoustically conflicting. In other words, one requires a quiet space while the other demands communication. However, the top two activities among non-frequent users (teamwork and socializing), are both communicative and do not require any acoustical provisions. In fact, the activities such as individual studies, which require a quiet space, are not common among non-frequent users. This leads to the final question of this study which is if noise level or any other inherent factor within the lounge hinders non-frequent users from using such spaces or is it an external factor such as having personal office space or a personal attribute which stops people from using lounge spaces.

### *5.2.3. Value of Lounge to Graduate Users*

Based on 15 multiple choice questions in the survey, participants perception regarding the value and utility of graduate lounges is evaluated. Below is a summary of the highlights from analysis of responses to these questions:

1. Based on participants' perception of their lounge usage pattern, occupancy rate and frequency of using a graduate lounge is not significantly higher close to midterm or final exams.
2. Lounges are perceived as useful spaces within departments, regardless of users' office ownership and individual usage pattern. This illustrates the significance of design quality in attracting individuals towards using such



spaces. In other words, non-frequent users still believe in the value of lounges, which ties their reason for not using such spaces to design issues.

3. Only 16% of frequent users are highly satisfied with the quality of lounges, and other 50% are just satisfied. This implies the need for improvement in lounge space. Also, the non-frequent users, who have voted for dissatisfaction from the space, imply the fact that their low frequency of use is not due to external factors or their personal reasons, but due to inherent low quality of such spaces.
4. Most of non-frequent users, which make almost 50% of the participants in this study, would consider themselves to become a frequent user, if lounge space qualities are improved. This underlines the significance and change which such studies could make on users' behavior within spaces.
5. The short distance travel of graduate lounges within the departments, makes them mostly preferable to out of departments. Therefore, the main reason which makes such spaces with low occupancy is lack of proper design.
6. Mostly graduate students prefer limited access to their department lounge. They are not overall willing to share it with undergraduate students or students from other departments. This may underline the item discussed by Lansdale et al. (2011) as the "sense of belonging".
7. For successful FM, literature urge involving students' voice in physical environment decision-making (Fisher and Newton 2014; Harrop and Turpin

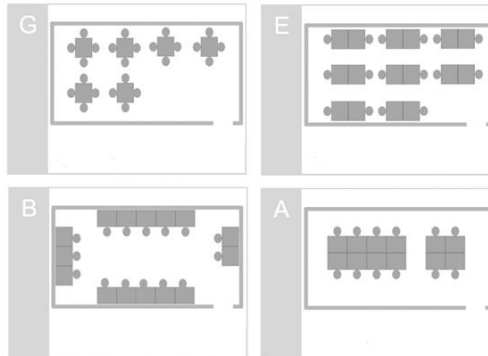
2013; Jessop et al. 2012). However, at Texas A&M University campus, student surveys are not highly applied and valued.

#### 5.2.4. *Quality Improvement of Lounge Spaces*

Set of questions within the last part of the survey targets the factors which contribute to improvement of users experience at graduate lounge spaces. Below is a summary of highlights from analysis of the responses to these questions:

1. Furniture (layout and comfort) and Noise level are the most critical issues referred by students in lounges.
2. No apparent difference between frequent users and potential users exists regarding complains about noise.
3. Potential users have a significantly higher dissatisfaction with the furniture (layout and comfort) compared to the frequent users.
4. The types of complains is not significantly different within departments. However, complains regarding furniture comfort and layout is by far the main issue addressed by the students of Construction Science. This is the only department whose lounge significantly lacks comfort furniture.
5. The lounge layout preferences are similar among different departments, as well as between frequent users versus potential users.
6. For both frequent and potential users, G is the most popular furniture layout, followed by E, B, and A, respectively. Author's suggestion for space design and planners is to include combination of these preferred alternatives.

Figure 51 - Most preferred layouts in all groups and categories



7. At 95% confidence level, noise level affects people's willingness to use their lounge. People are about 3.06 times more likely to indicate they will use their lounge if the noise level is reduced (refer to discussions on logistic regression summary at Table 25).
8. At 95% confidence level, people who indicate that the furniture in their lounge is not adequate (not comfortable or stylish) or that the arrangement of the furniture is not optimal are more likely are 3.09 times more likely to say they will use their lounge if they indicate their problem with the lounge is the furniture.
9. The influence of noise and furniture improvement on inviting lounge spaces could potentially be up to 8 times. The confidence intervals of 95% shows increasing factor intervals of (1.12, 8.61) and (1.31, 7.58), for noise and furniture improvements, respectively (refer to discussions on logistic regression summary at Table 25). Further studies and participants are required to minimize such intervals with more accurate estimators.

10. It is expected that improving the furniture comfort and layout within the graduate lounge of the Construction Science Department of Texas A&M University, the occupancy rate would considerably increase.

### **5.3. *Limitations of The Study***

#### *5.3.1. Observation of Spaces*

No hidden camera and invisible surveillance was permitted within lounges to monitor students' behavior, which made precise calculation of occupancy and usage patterns facing limitations, due to lack of resources. The author believes further accurate data from actual behavior of students within such spaces would highly contribute to the accuracy of results, as well as revealing other factors that might have not been included and overlooked in this study. These are any possible factors which may have not been clearly visible to be included in this study.

Data collection could have been possible through personal presence of the author within lounge spaces, which due to other academic and work commitments was not possible.

### *5.3.2. Participation Ratio*

The participation of students was not as high as initially expected. If more than 350 participants have been included in such a study, far more accurate results could have been obtained.

## *5.4. Lessons Learnt and Future Studies*

### *5.4.1. Lessons learnt in Survey Design*

Special care was given to design the survey so that no false impression, or biased translation of answers could be possible. However, some questions could have been more specifically addressed within the survey, which the author had not initially foreseen. Also, some of the questions were not helpful excluding which, the author could have exploited them for more valuable data collection.

For instance, the perception of students from their actual usage pattern does not seem to be well addressed in this study. While students have indicated to be using their lounge spaces at least for 1-2 days per semester, it is not clearly how long is their duration of stay each time. For instance, if someone is staying shortly in the lounge for only 10 minutes per week (maybe only to meet someone or have a quick lunch), it may not be categorized as a frequent user. However, lack of such data in this study includes all of such rare users, as frequent.

#### *5.4.2. Future Studies*

A study consisting of larger number of participants could lead the results of this study into solid true estimates for better space design decision making. As already discussed, based on the “hypothesis proportion test” equation, minimum of 380 participants is recommended for a 5% confidence interval.

1. The author is planning for some furniture improvements within the Construction Science Department of Texas A&M University. Studying the same space after the improvements could be valuable for future decision making and the body of knowledge within space management, and space design.

#### *5.4.3. Significance of Study*

The value of this study is twofold. While it helps to identify the issues, which leads to low occupancy of graduate lounge in Francis Hall, the results help other departments within Texas A&M University to improve their space efficiency. Also, combined with future studies in other universities, the results add the body of knowledge within the HEI domain. While case studies are not to be generalizable, they provide valuable information, and highlight data which pave way for future studies.

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## APPENDIX A – SAMPLE QUESTIONNAIRE

I completely understand the significance of my answers for accuracy of this research.

### **Major:**

Construction Management

Mechanical Engineering

Civil Engineering

Other (Please Specify): \_\_\_\_\_

### **Academic Level:**

Master Student

PhD Student

### **Years in this department?**

New Arrival

At least one semester old.

### **Age:**

Under 25

26-30

Above 30



**Gender:**

Male

Female

**Nationality:**

American

International

**Do you have your specific dedicated desk/office in your department?**

No

Yes, "private" office Room

Yes, Desk inside a shared office space

**How often do you use your dedicated graduate Lounge during working days?**

**(Monday – Friday)**

Everyday

3-4 days per week

Every 1-2 days per week

Every once in a while

Very Rarely in the semester

Almost Never

**How often do you use your dedicated graduate Lounge during WEEKENDS?**

- Everyday
- 3-4 days per week
- Every 1-2 days per week
- Every once in a while
- Very Rarely in the semester
- Almost Never

**I use the Graduate Lounge Room mainly for the following activities:**

	<b>Mostly</b>	<b>Often</b>	<b>Rarely</b>	<b>Never</b>
Individual Studying and Doing Assignments	1	2	3	4
Research Development	1	2	3	4
Teamwork Projects	1	2	3	4
Socializing or Meeting Friends	1	2	3	4
Waiting for my Upcoming Classes	1	2	3	4
Eating and Relaxing				

1 2 3 4

Web-surfing or Non-University Related Reading

1 2 3 4

Making Phone Calls

1 2 3 4

**Please pick all that applies**

**Strongly Agree   Somehow Agree   Somehow Disagree   Strongly Disagree**

I mostly use the Graduate Lounge when it is close to midterm or final exams, or whenever I need to study or work hard for deadlines.

1 2 3 4

I find Graduate Lounge Spaces a useful place in the department.

1 2 3 4

Lounge spaces are useful only if students don't have any dedicated desk/office space.

1 2 3 4

I don't use the graduate lounge and I would rather use other spaces on campus such as Library, MSC Building, etc.

1 2 3 4

I use the graduate lounge and I am happy with its facilities and design.

1 2 3 4

I am not satisfied with the graduate lounge and I almost don't use it. However, improving its quality, I would consider using it.

1 2 3 4

I am not satisfied with the graduate lounge and I almost don't use it and improving its quality, I would not use it either.

1 2 3 4

No matter any interior improvements happen to the same graduate lounge, I always prefer other places.

1 2 3 4

I don't see any benefit in lounges and I think spaces such as library, cafes, or others already provide a wide range of spaces for different activities out of classrooms, and obviates the need for having a specific graduate lounge.

1 2 3 4

I like library better than the graduate lounge for studying and hard work, as it is less distracting with friends and classmates.

1 2 3 4

I always prefer the department lounge for study and academic activities to out of department spaces because of its short distance travel.

1 2 3 4



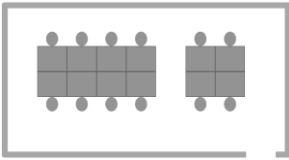
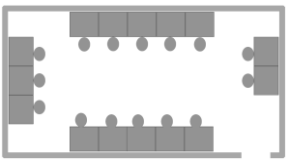
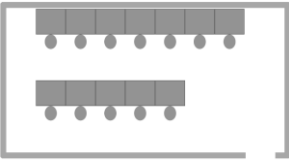
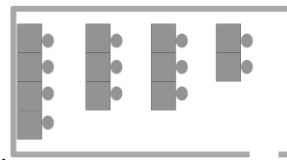
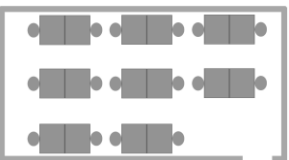
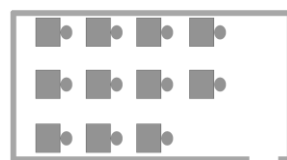
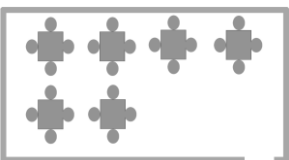
**Regarding the furniture layout and plan in the graduate lounge area:**

- layout is good and changing it would not make a big difference
- layout is not good enough and it needs a change.
- layout is way without thought and it needs a big change.

**I am not satisfied with the graduate lounge and I WILL NOT very often use it  
UNLESS the following improvements will be provided: (Please do not pick more  
than 2 Items)**

- Not Applicable as I am already happy with the graduate lounge, no critical need.
- Noise
- Light
- Air Quality & Temperature
- Furniture Layout
- Furniture's' Style and Comfort

Please select your preferred layout which you think fits best in your graduate lounge area (Assume windows are located only on up and left side of drawings.)

- A. 
- B. 
- C. 
- D. 
- E. 
- F. 
- G. 

I think there are other spaces in the department spending time on studying and improving which is of more value and significance than improving the graduate lounges

Disagree

Agree, Please Specify which space(s) you think need(s) critical improvement in your department: \_\_\_\_\_

**Feel free to provide any comments or suggestions which you believe would improve the space quality of your department graduate lounge. If unhappy with the quality of the space, please underline the factors which turns off your interest in using this space. Please be as specific and clear as possible.**

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## APPENDIX B – IRB APPROVAL

DIVISION OF RESEARCH



### EXEMPTION DETERMINATION

September 27, 2017

Type of Review:	Initial Review Submission Form
Title:	Value Generation In Higher-Education-Space-Management Through User-Centric Data Analytics
Investigator:	Sarel Lavy
IRB ID:	IRB2017-0623
Reference Number:	062941
Funding:	Internal Funds
Documents Reviewed:	Simple Survey Consent Script 1.1 Survey 1.0
Risk Level of Study:	Not Greater than Minimal Risk under 45 CFR 46 / 21 CFR 56

Dear Sarel Lavy:

The HRPP determined on 09/27/2017 that this research meets the criteria for Exemption in accordance with 45 CFR 46.101(b) under Category 2: Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior unless, the information is obtained in an identifiable manner and any disclosure of the subjects responses outside of research could reasonably place the subject at risk..

Your exemption is good for five (5) years from the Approval Start Date. At that time, you must contact the IRB with your intent to close the study or request a new determination.

If you have any questions, please contact the IRB Administrative Office at 1-979-458-4067, toll free at 1-855-795-8636.

Sincerely,  
IRB Administration

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