

The Impact of Furniture Layout/ Arrangement on Students Behavior in a Study Library Environment	العنوان:
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THE IMPACT OF FURNITURE LAYOUT/ARRANGEMENT ON STUDENTS' BEHAVIOR IN A STUDY LIBRARY ENVIRONMENT

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Abstract

Problem: Few studies were considered the role of furniture layout/arrangement design within study library environments through experiments conducted on students' behavioral responses. Purpose: The purpose of this research is to explore the behavioral responses in a study library environment and determine how designing the interior furniture impacting on users' activities.

Hypotheses: Furniture layout/arrangement within the study library environment can indirectly impact students' behavior positively or negatively.

Question: What are the behavioral responses to furniture layout/arrangements in a study library environment? And how these responses will affect students' behavior during study?

Methodology: Research methods for observation included observation without interaction, timed observations, partner comparisons and studies, drawing and sketches, photographs, and field note taking. Data was analyzed from the observation sketches and photographs for consistency and validity with two observers' note taking. A descriptive statistics method was made to analyzing data in this study.

Findings: Study environments need to provide a variety of stimulation, be

flexible to the activity being performed, and provide appropriate furniture design (i.e., layout/arrangement) in such environments. Topics studied were including proximity, clustering, interactions, territoriality, patterns (movement, behavior, etc.), and time all together affecting duration of stay, movement, and circulation. While, students performing the study task in the appropriate furniture layout/arrangement in a study library environment performed better than those performing the study task in the random furniture design in same environments.

Keywords: Ergonomics, Behavior, Response, Library, Study, Environment, Furniture, and Layout/Arrangement

Introduction / Background of Study

According to Sanders and McCormick (1993) in Human Factors in Engineering and Design, ergonomics is intended to “enhance the effectiveness and efficiency with which work and other activities are carried out” and “enhance certain desirable human values, including improved safety, reduced fatigue and stress, increased comfort, greater user acceptance, increased job satisfaction, and improved quality of life” (p. 4)⁽¹⁾. Castellucci et al. (2010) mentioned that designers should know the anthropometric measurements of students to classroom furniture sizes in schools⁽²⁾. Children spend a large amount of time sitting in desks at schools. Therefore, it is important that desk size is suitable for students’ anthropometric measurements and change in posture throughout the day. Anthropometry studies have reported mismatches between furniture dimensions and children’s measurements in several countries. Designers must consider specifying multiple seating types for classrooms with students as body dimensions may vary significantly. Also, they should consider ergonomic measurements when specifying classroom furniture to assure it effectively meets students’ anthropometric needs⁽³⁾.

1- Sanders, M.M & McCormick, E.J. (1993). Human factors in engineering and design. (7th Ed.). New York: McGraw-Hill.

2- Castellucci, H., et al (2010). Mismatch between Classroom Furniture and Anthropometric Measures in Chilean Schools Elsevier: *Applied Ergonomics*, 41(4): 563-568.

3- Sanders & McCormick (1993).

As cited by Savanur et al, 2007, designing classroom workstations with fixed table heights and adjustable seat heights with footrests that account for the differing anthropometric needs of male and female, and younger and older adolescent students⁽⁴⁾. Students reported sitting discomfort, writing or work discomfort, and inadequate storage space as discomfort experienced as a result of furniture. This discomfort was experienced most in the head, lower right leg, right shoulder, right hand, neck, and lower leg. Lower leg, neck and shoulder discomfort may have been indicative of a disparity between the students' dimensions and furniture dimensions. Some classroom furniture dimensions (i.e., seat and table height, seat plane to top of backrest, backrest width, and seat plane to mid backrest dimensions) were higher than International (Time-Save Standards) standards. Other dimensions (i.e., seat depth, backrest height, and table depth) were lower than others recommended standards. Seat height, seat depth, table height and workstations should be design to accommodate students' anthropometric needs⁽⁵⁾.

As created by Panagiotopoulou et al, (2004), designers should provide students in schools with adjustable furniture (especially in seat height) ⁽⁶⁾. They should not provide desks with a small bookshelf (bookshelves; areas for books and supplies directly beneath the desktop) as it decreases the amount of leg/knee clearance. They must know that as children get older; the variation in their size increases, making adjustable furniture a good option. Designers also should use guidelines developed through anthropometrical testing when choosing furniture for children in schools⁽⁷⁾.

An experimental study performed by Milanese and Grimmer, 2004 indicated that designers should consider specific anthropometric factors

4- Savanur, C., et al (2007). Lack of Conformity between Indian Classroom Furniture and Student Dimensions: Proposed Future Seat/Table Dimensions, Taylor and Francis Ltd: *Applied Ergonomics* 50(10): 1612-1625.

5- Savanur, et al. (2007).

6- Panagiotopoulou, G., et al (2004). Classroom Furniture Dimensions and Anthropometric Measures in Primary School. Elsevier Science: *Applied Ergonomics*, 35(2): 121-128.

7- Panagiotopoulou, G., et al (2004).

such as length of arms and legs in addition to overall stature (i.e., height, weight) when evaluating the proper fit of furnishings⁽⁸⁾. Also, they must consider that a variety of factors may contribute to the incidence of musculoskeletal symptoms in adolescents (e.g., carrying heavy backpacks, lifting books in and out of lockers, posture, and activity both in and out of school). Designers should consider how the increasing use of information technology in the classroom affects sitting duration and overall health. Designers also have consulted with an ergonomist when specifying furnishings for educational settings⁽⁹⁾.

According to Chung and Wong, 2007, designers should evaluate the relationship between anthropometric measurements of school children and their school furniture⁽¹⁰⁾. Musculoskeletal disorders are becoming more prevalent among school-aged children. Poorly designed school furniture may be contributing to musculoskeletal problems⁽¹¹⁾.

Ergonomically designed furniture has been incorporated in the workplace to decrease the occurrence of musculoskeletal disorders. A good fit between school furniture and the anthropometric measurements of students may result in an improved learning environment and increased comfort for students⁽¹²⁾. According to Knight and Noyes, 1999, School furniture design affects children's on-task behaviors and sitting positions⁽¹³⁾. Children spend a considerable amount of time seated in the classroom. The type of furniture provided in the classroom has important implications for children's health, behavior and education.

Knight and Noyes (1999) found that designers must provide furniture

8- Milanese, S., and Grimmer, K. (2004). School Furniture and the User Population: An Anthropometric Perspective. Taylor and Francis Ltd: *Applied Ergonomics*, 47(4): 416-426.

9- Milanese & Grimmer. (2004).

10- Chung, J., and Wong, T. (2007). Anthropometric evaluation for primary school furniture design. Taylor and Francis Ltd. *Applied Ergonomics*, 50(3): 323-324.

11- Chung & Wong (2007).

12- Chung & Wong (2007).

13- Knight, G., and Noyes, J. (1999). Children's Behavior and the Design of School Furniture. Taylor and Francis Ltd: *Applied Ergonomics*, 42(5): 747-760.

with features that support the student when leaning forward and back, such as a divided seat that slopes both forward and back, higher tables, backrests and footrests on tables to encourage on-task behavior and proper sitting position⁽¹⁴⁾. They must select chairs where seat height does not exceed popliteal height of children (measurement from the back of knee to the floor) to decrease discomfort and subsequent non-standard sitting. Designers should create a good match between seat depth and upper leg length to encourage the use of backrests. They should use separate body part measurements instead of height to determine furniture fit. They have to make a variety of seating choices available to children in order to ensure a comfortable fit for each student. Also, designers can assist teachers and administrators in promoting children's understanding of good sitting posture and in making informed decisions about classroom furniture. Designers should specify classroom seating that has adjustable seat and back heights and adjustable seat depths. Also, they should provide educational sessions for teachers and purchasers on correct adjustments to furnishings and about the proper way to sit. A majority of the children experienced back pain in the experimental chair. The major functions of school furniture are to support the student when leaning forward to write or draw and, also, when sitting back and listening. Back support is necessary when sitting back. A child's height is commonly used by furniture manufacturers to define child-chair fit as it is simple to calculate⁽¹⁵⁾.

Most of articles used in literature review talked about the relation between anthropometric furniture and students' behavior in classroom environment, but none of these studies focus on designing study area in libraries.

Observation Site Boundaries

Study area for observation was confined to the third floor of the main university library at Yarmouk University. This area included 12 tables (Rectangular table with 4 chairs each), one computer table, and one supervisor desk. There were 4 columns in entrances, two of them in each side. Windows lined the two side walls which consist of eight floor-to-ceiling windows. The ceiling height is approximately 4m tall with 60x60cm

14- Knight & Noyes (1999).

15- Knight& Noyes (1999).

white gypsum ceiling tiles. The lighting consists of five rows of fluorescent light fixtures approximately 60x60cm. Daylighting intersects the study tables running parallel from skylight window wall. The walls colors are a neutral cream and light green with brown border below. The flooring is a light brown tile which is considerably mild. As far as interior decoration was considered, there was limited decoration with the exception of one piece of artwork found on the west back wall of desk.

Furniture construction and material were specified to provide durable and uniform pieces. Study tables constructed of white solid wooden table tops and brown wooden legs. Plastic chairs match the wooden table; with no arms. One computer table is square in form. Trash cans were sporadically located at the end of the study tables. Air diffusers were located on the ceiling. Electrical outlets were located on the green wall. Adjacent to the study area are public corridors, elevators and stairs leading to the stacks and bookshelves units (see Figure: 1-3).



Figure 1 Observation site boundaries left side.



Figure 2. Observation site boundaries right side.

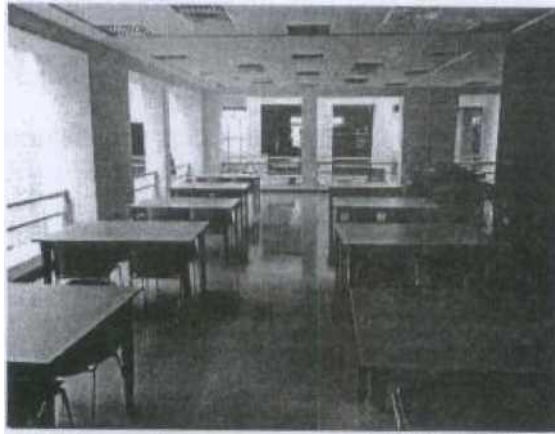


Figure 3. Observation site boundaries tables with windows,

The Question of Study

What are the behavioral responses to furniture layout/arrangements in a study library environment? And how these responses will affect students¹ behavior during study? This question will focus on how the typical student uses the library study area, focusing on behavioral responses during study activities.

The Problem Statement of Study

Study environments need to provide a variety of stimulation, be flexible to the activity being performed, and provide appropriate furniture design (i.e., layout/arrangement) in such environments. Few studies were considered (the role of furniture layout/arrangement design within study library environments through experiments conducted on students' behavioral responses. Students often use library- settings to study and have little control over the furniture layout/arrangement design of such a setting. While students are studying, these furniture designs can impact students' mood, satisfaction, motivation, and performance levels.

The importance of Study

This study will explore the importance of providing appropriate furniture layout/arrangement to study library environment and how it can impact students' behavioral responses in this setting, The aim of this study is to Provide ideas of appropriate furniture layout/arrangement in study library environments, accommodate students with less challenging tasks and provide private study environments with less complex tasks. Also, the study will give designers guidelines during furniture layout/arrangement

design that are more stimulating for study environments where an student must focus on tasks such as reading and studying.

The hypotheses of Study

Furniture layout/arrangement within the study library environment can indirectly impact students' behavior positively or negatively. In the other hand, furniture layout/arrangement may not impact behavior when a student is focused on reading.

While, students performing the study task in the appropriate furniture layout/arrangement in a study library environment performed better than those performing the study task in the random furniture design in same environments.

The Purpose of Study

The purpose of this research is to explore the behavioral responses in a study library environment and determine how designing the interior's furniture impacting on users' activities. Topics studied were including: proximity, clustering, interactions, territoriality, patterns (movement, behavior, etc.), and time all together affecting duration of stay, movement, and circulation.

The Methodology of Study

Research methods for observation included observation without interaction, timed observations, partner comparisons and studies, drawing and sketches, photographs, and field note taking. Observation times yielded twenty hours total from both partners during the week consisting of Sunday through Thursday. Time logs were kept to record hours observed and times for people's movement and patterns. Times were noted when the observer arrived and stopped when observer left. If occupants still remained as the observer was leaving, their time stopped with the conclusion of the observation. Two observers varied the location to sit and study for a complete perspective and more precise study of the conditions. The primary method for data collection consisted of note taking which gathered details of circulation routes, female and male population, duration of stay, and user behaviors including posture, territory or personal space, interaction with other students, use of headphones or cell phones, clothing attire, and bags or articles of belonging Sketches and drawings documented

the study layout, and area, male and female users, time of stay, circulation routes, articles and objects, the users and how the users located the areas (see figure: 4).

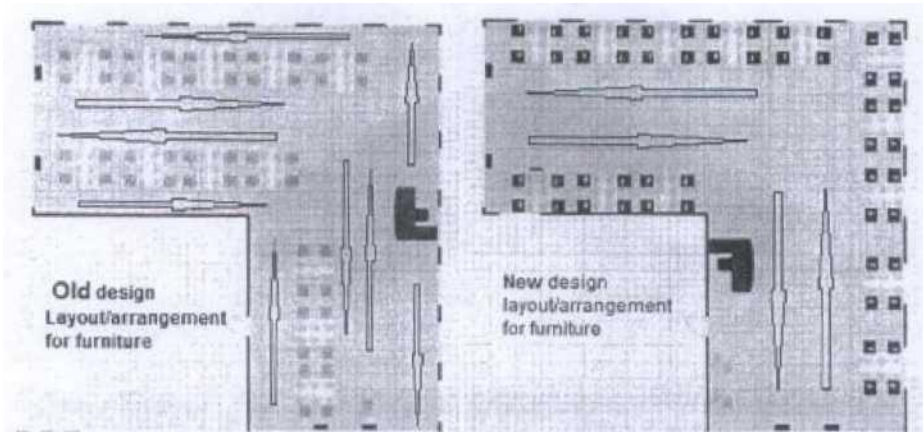


Figure 4 Circulation population paths within the area of study with old and new furniture layout/arrangement.

Unless otherwise noted on the map. bags were placed on the table surface. Photographs were taken of the space from multiple perspectives to cover the area of observation. Included in the photographs were furniture layouts, furniture construction, and equipment placement and frequency, and design elements within the space. Data was analyzed from the observation sketches and photographs for consistency and validity with two observers' note taking. Patterns of behavior for the area of analysis could be further investigated with the added documentation of drawings and photographs to review upon leaving the site. A descriptive statistics method was made to analyzing data in this study (see diagram: 1).

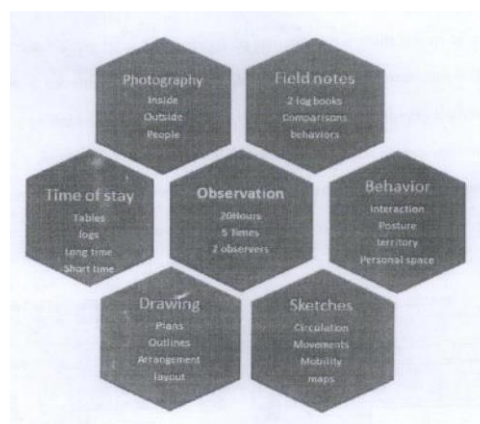


Diagram 1. The methodology in the study

In this observation study, the two observers worked as team work in observe students all the research periods. Also, they worked together in drawing maps, plans, sketches, taking photography, and analyzing data in tables, charts, and figures.

Observation Finding

There were two observation periods before and after furniture layout/arrangement. In each period, there were live days of observation from Sunday to Thursday. Observations were done by partners, most of the time collaboratively and from different perspectives.

Results of First Observation (Before Furniture Layout/Arrangement)

The first period of observation was conducted on May 31st through June 4th, 2015 from 9:00am to 3:00pm with old furniture layout/arrangement (see Figure: 5-7):

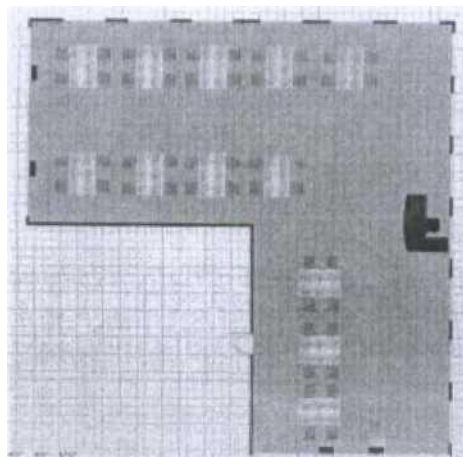


Figure 5. Old furniture design layout/arrangement in study area.

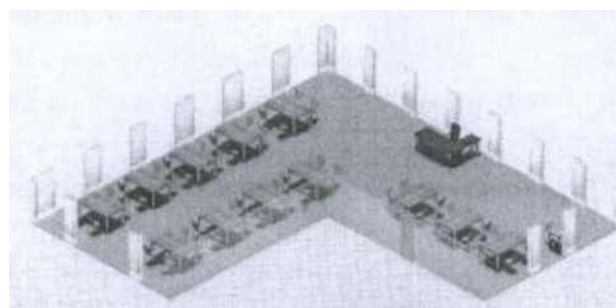


Figure 6. Perspective view for old furniture layout/arrangement in study area

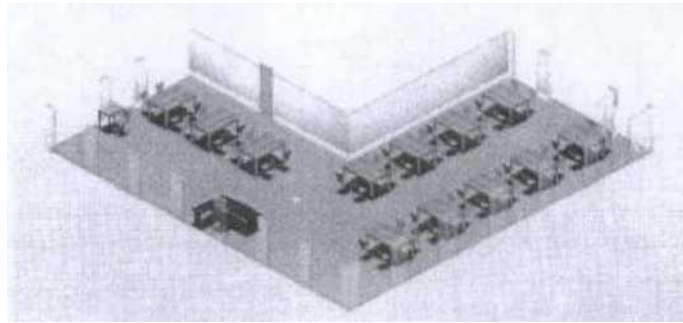


Figure 7. Another perspective view for old furniture layout/arrangement in study area

Observations recorded the duration of stay for users and found most students stayed longer in the open study area with an average time of 35 minutes, whereas computer users spent an average of 28 minutes (see Figure:8; Table: 1).

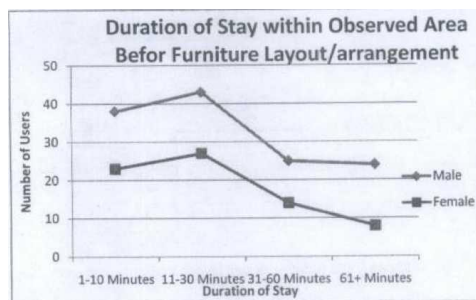


Figure 8. Number of users and their duration of stay within the observed area.

Table 1 ; Duration of study time in the study area within old furniture design:

Observation Old furniture design	1-10 minutes	11-30 minutes	31-60 minutes	61+ minutes
One	M: 1	M:2	M: 2	M: 0
	F: 1	F: 1	F: 1	F: 0
Two	M: 4	M: 9	M: 3	M: 4

Observation Old furniture design	1-10 minutes	11-30 minutes	31-60 minutes	61+ minutes
	F: 4	F: 5	F: 4	F; 1
Three	M: 2 F: 1	M: 2 F: 2	M: 4 F: 0	M: 4 F: 1
Four	M: 8 F: 1	M; 6 F: 3	M: 2 F: 3	M: 4 F: 1
Five	M: 0 F: 0	M: 0 F: 0	M: 4 F: 1	M: 6 F: 4
Totals	M: 15 F: 7	M: 19 F: 11	M: 15 F: 9	M: 18 F: 7

Note: M = Male, F = Female

Circulation patterns and behaviors included occupants walking through the space. Within the circulation path the male population averaged 145 people, whereas the female population averaged 68 people (see Figure: 9), This result is consistent with the male and female population ratio, where males outnumbered females by at least double the amount.

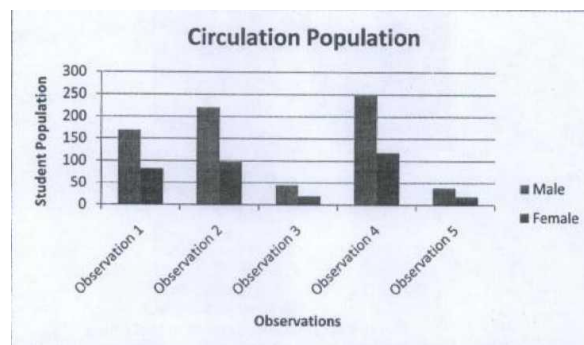


Figure 9. Circulation population within the area of study with old furniture design.

Calculations were recorded for the total amount of males and females during all combined observations. Numbers include circulation, table study areas, computer areas, and library workers. The male population was double the female population, with 722 males in comparison to 339 female (see Figure: 10).

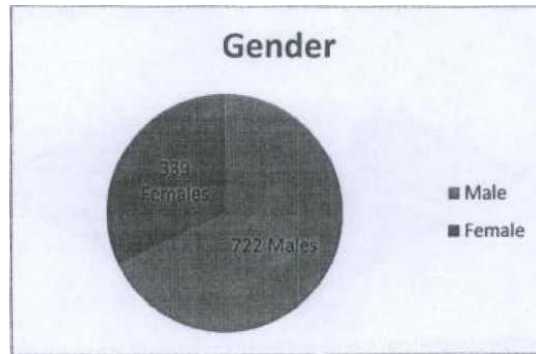


Figure 10. Gender frequency through observation area with old furniture design.

Results of Second Observation (After Furniture Layout/Arrangement)

The second period was conducted on June 7th through June 11th, 2015 from 9:00am to 3:00pm with new furniture layout/arrangement (see figure: 12-14):

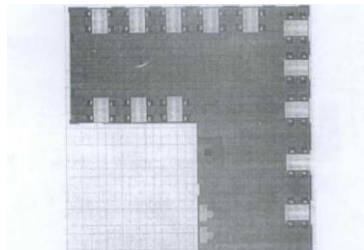


Figure 12. New furniture layout/arrangement in study area.

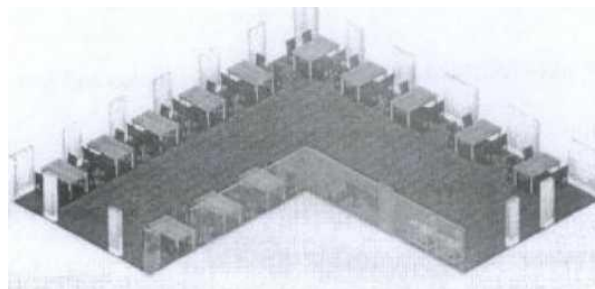


Figure 13. Perspective view for new furniture layout/arrangement in study area.

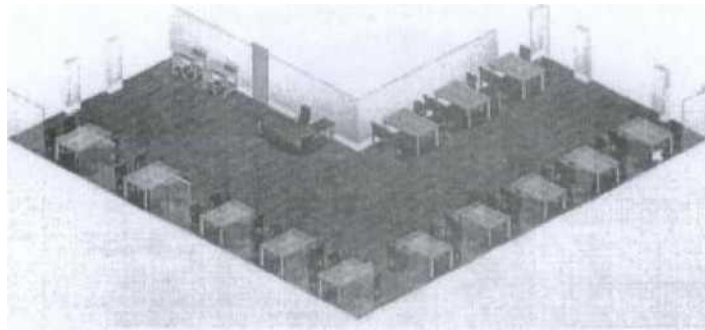


Figure 14. Another perspective view for new furniture layout/arrangement in study area.

Several methods were used during the course of the observation times. Methods included field note taking, mapping or sketching, photography, and non-obtrusive observation. Interactions and behaviors were based off of how the environment was built. Results determined from weather conditions indicated non-favorable outside conditions, cloudy or raining, resulted in students not choosing a seating location near the window. Favorable, sunny conditions resulted in students having a preference to sit near the window. Interior temperatures affected students' behaviors in the study area through multiple factors. Clothing was determined through how cool the interior temperature was; sweaters or pants were worn even with a warm outside temperature. Movement occurred more frequently as the space became colder, users also used the library as a means of protection from the outside elements as a walkthrough or shortcut. The primary age group consisted of college students with ages between 20 and 30 years old. A couple of older occupants were observed from parents in their late 40's and upper 50's. Older users were found to have a preference of selecting a seat near the windows. Two observers chose to sit in multiple locations to vary perspectives and perceptions of users in the space. Initially, Two observers were located in the open study area. Observations recorded the duration of stay for users and found most students stayed longer in the open study area with an average time of 65 minutes, whereas computer users spent an average of 50 minutes (see Figure: 15; Table: 2):

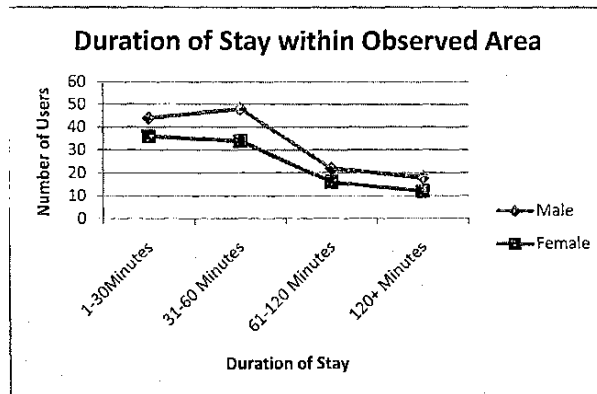


Figure 15. Duration of study time in the study area within new furniture design

Table 2: Duration of study time in the study area with new furniture design:

Observation New furniture design	1-30 minutes	30-60 minutes	60-120minutes	120+ minutes
One	M: 4 F: 8	M: 4 F: 8	M: 2 F: 2	M: 2 F: 2
Two	M: 12 F: 8	M: 8 F: 4	M: 8 F: 2	M: 8 F: 2
Three	M: 2 F: 2	M: 8 F: 2	M: 4 F: 2	M: 4 F: 2
Four	M: 24 F: 16	M: 22 F: 12	M: 6 F: 6	M: 2 F: 4
Five	M: 4	M: 6	M: 2	M: 2

Observation New furniture design	1-30 minutes	30-60 minutes	60-120minutes	120+ minutes
	F: 2	F: 8	F: 4	F: 2
Totals	M: 44 F: 36	M: 48 F: 34	M: 22 F: 16	M: 18 F: 12

Note: M = Male, F = Female

In this observation, two observers recorded Noise existed in varying levels of people and equipment. Major noise distractions included printers, talking of students, large tour groups passing through, cell phone use, and on a couple of observations the advising table located outside the space. The advising table acted as a barrier to our space and noise levels carried due to the open area and hard surfaces.

Circulation patterns and behaviors included occupants walking through the space, and to computers and work areas. Within the circulation path the male population averaged 908 people, whereas the female population averaged 499 people (see Figure: 16). This result is consistent with the male and female population ratio, where males outnumbered females by at least double the amount.

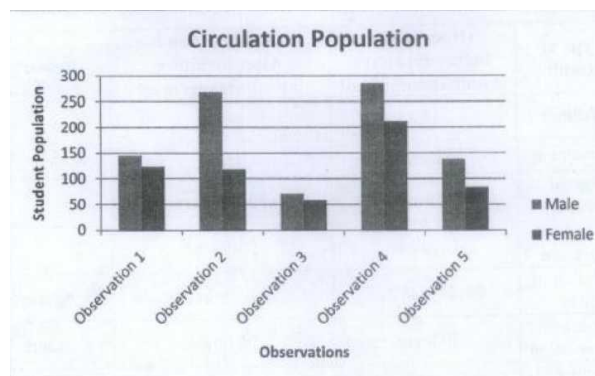


Figure16 Circulation population within the area of study with new furniture design.

Calculations were recorded for the total amount of males and females during all combined observations. Numbers include circulation, table study areas, computer areas, and library workers. The male population (162 males) was the almost same to female population (178 female) (see Figure: 17):

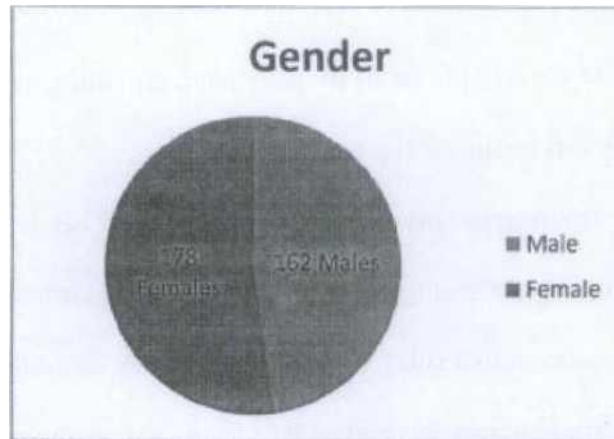


Figure 17. Gender frequency through observation area with new design of furniture.

Finally, Comparing between observation before and after furniture layout/arrangement, see the following table# 3:

Table 3: Result Differences between first observation and second observation:

Type of Result	Observation Before furniture layout/arrangement	Observation After furniture layout/arrangement	Remarks
Weather	Hot	Warm	
Movement	Low	High	
Age of occupant	20-40 years	20-50 years	
Observers Location	Together	Different	
Duration of	28-35 minutes	50-65 minutes	Average

Type of Result	Observation Before furniture layout/arrangement	Observation After furniture layout/arrangement	Remarks
Stay			
Hours of Observation	20 hours	20 hours	same
Number of Observation	5	5	same
Circulation / Females	68	178	Average
Circulation / Males	145	162	Average
Circulation / Males	722	908	Total
Circulation / Females	339	499	Total

Behaviors were observed in terms of movement, proximity, territorial and privacy issues.

Findings of this study can be summaries as following:

1. This exploratory study investigated that student behavior is impacted by the furniture layout/arrangement of study library environment.
2. This observational study does more to link the furniture layout/arrangement factor of the study library environment to its impact on student behavioral experiences.
3. Interior designers and library decision-makers in any study library areas should pay attention to the importance of furniture design which it may be important to optimize any study environment use and students' behavioral responses.
4. Designers should be aware that student learning may be impacted by

furniture design layout/arrangement and the quality of personal space of students.

5. The mobility and visibility of furniture displays may be very important to students' educational experience in study library environments,
6. The majority of students indicate that the appropriate furniture layout/arrangement did impact students' behavioral experience.
7. A common proximity issue was indicated when students chose to sit at tables which were unoccupied or on exterior walls for privacy. People who sat near the windows were found to study longer than those who did not.
8. Territory was addressed through placement of bags, textbooks and notebooks, or belongings, as students spread their objects out or placed them in a chair to indicate personal space. A reoccurring theme of territory was observed when students indicated their personal space through demonstrating their use of a laptop.
9. Privacy was observed when students selected locations near columns, walls and windows to act a shield to other students.
10. Most users primarily used the tables to write documents, work on documents, read books, preparing for exams or group discussions.
11. Users positioned near the windows would occasionally skylight, and older adults typically sat closest to the window space. Older people were found to sit near the windows for more natural light coming from the windows, possibly to help them read better.
12. Discomfort of furniture was observed in study area when student stood up a couple of times to stretch and walk around, possibly indicating chairs were non- conforming to longer periods of sitting. Most of new ergonomics furniture was comfortable in study tables.

Finally, According to Cha, and Tae, (2015) ⁽¹⁶⁾, Cunningham, et al.

16- Cha, Seung Hyun, and Tae, Wan Kim. (2015). "What Matters for Students' Use of Physical Library Space?" *The Journal of Academic Librarianship*, 41(3): 274-279.

(2012)⁽¹⁷⁾, Delaney, et al., (2015)⁽¹⁸⁾, Merrell, et al., (2011)⁽¹⁹⁾ and Strange, et al., (2015)⁽²⁰⁾, designers should aware of several roles during designing study library areas such as:

- Supply adequate accessibility at the most commonly used study tables and chairs.
- Be aware of users' concerns about small and difficult paths.
- Provide enough time for users to safely move through doors and corridors and be sure to provide easy openers at library exit and entry points.
- Remove protruding items from accessible routes to prevent injuries.
- Allow enough space (approximately 120cm) between pieces of furniture so that any person may walk next to another person and wheelchair users have a clear turning space.
- Provide continuous signs on site and parallel to hallways to provide support and increase safety.
- Be aware that ramps and levels can be difficult to use for wheelchair and blind users.
- Provide integrated seating in the sides of study area and in visible locations.
- Be sure that the furniture layout/arrangement seating is on a flat surface and out of the traffic path.

17- Cunningham, Heather V., and Susanne Tabur. "Learning space attributes: reflections on academic library design and its use." *Journal of Learning Spaces*, 7(2):.

18- Delaney, Geraldine, and Jessica Bates. (2015). "Envisioning the academic library: a reflection on roles, relevancy and relationships." *New Review of Academic Librarianship*, 2/(1): 30-51.

19- Merrell, P., Schkufza, E., Li, Z., Agrawala, M., and Koltun, V. (2011). Interactive furnitur layout using interior design guidelines. *Journal of ACM transaction on Graphics*, 30(4): 30-49.

20- Strange, C. Carney, and James H. Banning. (2015). *Designing for Learning: Creating Campus Environments for Student Success*. New York: John Wiley & Sons, Inc.

- Provide a search service in the study library area to aid in obtaining books.
- Provide enough area for library's supervisor desk for easy service to students.
- Provide a safety rail and windows, especially in open skylight and open areas.
- Clear objects from in front of doors and exits to facilitate use.

Conclusion

The recorded observations determined behavioral responses to furniture/layout arrangements in the study library environment. Students in the observed study area spent less time than users in the adjacent private study area. Reasoning for this may be the idea of wanting more privacy and seclusion from other's view.

Proximity and territory issues were observed by the repetitive use of people marking their personal space with belongings, backpacks, or textbooks. In addition, the majority of students selected tables where no other person was sitting. The study table area of preference was sitting along the exterior wall, not in the central location.

Methods for conducting the observation consisted of defining the site boundaries, observing for a period of five days in the morning, afternoon and evening, field note taking, mapping behavior diagrams, and taking photographs of the site. Two observers obtained validity through performing observations at similar and different times. In doing so, any similarities or variances were compared and discussed, resulting in a feasible report. Data analysis was documented and recorded through mapping, tables, charts, and photographs. Mapping diagrams were sketched and color coded, showing male and female users, circulation routes, laptop users, book or book bag placement, and duration of stay in each space. The tables on duration of stay were formed to demonstrate the differences in gender in the open study area when compared to the closed area. A population study was also shown in the bar graph comparing the study area and computer area. Circulation populations were recorded in a bar graph to demonstrate the differences in males and females walking through or utilizing the space. The observed study area and adjacent private study area

was shown in a bar graph to signify public and private users. Gender was visually represented in a pie chart to show the significant difference in population between males and females. Photographs were included to form a visual connection to the observation site and the conditions which users encountered (e.g. furniture, lighting, spatial layout, natural lighting, etc.).

Unexpected Outcomes/Limitations

Unexpected Outcomes

A couple of unexpected outcomes were made evident after several observation times. The first surprise occurred when laptop users frequently chose exterior wall locations to sit. We determined electrical outlets were only located on the exterior walls, forcing students to sit accordingly. A partial barrier was formed as students circulated around the table into the study area. On one observation, the outside weather was sunny and then changed into a windy, causing students to relocate to the center of the space.

Another surprise came with the population of males versus females. As indicated earlier, the male population doubled the female population. The stereotype of females studying more does not necessarily hold true. Possibly males work well in public places or are finding things to do in their spare time. Another surprising occurrence was most students brought food or beverages and consumed them within the space. Not only was the food a distraction in terms of smelling the food, but commonly trash cans were full of the food remains. In addition, the perceived notion of not being allowed to bring food in the library was not observed; the library appeared more as a small dining area.

The two observers found it surprising when friends came and talked, not realizing they were now a part of the observation. Noise distractions were also a surprise as many students showed no concern for others by talking with a normal tone on cell phones or to others. The library is no longer a quiet place to study. It was interesting when families came with their children for new student orientation and interacted with them in the various areas. A final surprise was observed in the form of security when students left their belongings unattended for several minutes as they stepped out. Students may have felt the library was a safer place than

another public area, as fellow peers were around.

Limitations

Results will vary if further studies are implemented in due to the increased population of students attending the university. It would be interesting to determine if males continued to outnumber females. Behaviors have a potential of alteration due to possible furniture rearrangement, increased population, different class times, and weather changes.

Recommendations for future studies include observing ergonomics, and redesigning the area to better fit student's required comfort levels, as most found the seating uncomfortable or non- conducive to their needs. The furniture layout and overall space design should be addressed in how to make the area more attractive. Perhaps more areas of privacy should be designed to encourage student's behaviors as defined in the adjacent space.

Recommendations

This study provides information on furniture layout/arrangement within study library environments that can directly and indirectly impact a student's mood, performance, and satisfaction. Also, this study was representational of a study library furniture layout/arrangement environment, while students were in a real study situation, which could furniture design have impacted students behavioral levels.

In future, a similar study can be repeated in different study library areas, big sample of students and bigger amount of time spent studying in these environments. Similarly, another study can be conducted in future with thought given to furniture layout/arrangement to see if any relationships exist between student' performance and furniture' preference in color, design and style.

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تأثير تخطيط/ ترتيب الأثاث على سلوك الطلبة في بيئة الدراسة

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ملخص

المشكلة: دراسات قليلة تبحث دور تصميم الأثاث تخطيط/ ترتيب ضمن بيئات مكتبة الدراسة من خلال التجارب التي أجريت على الاستجابات السلوكية لدى الطلاب.

الغرض: إن الغرض من هذا البحث هو استكشاف الاستجابات السلوكية في بيئة المكتبة الدراسية وتحديد كيفية تصميم الأثاث الداخلي وتأثير على أنشطة المستخدمين.

الفرضيات: يمكن أن يؤثر تخطيط/ ترتيب الأثاث ضمن بيئة المكتبة الدراسية بشكل غير مباشر على سلوك الطلاب سلبا أو إيجابا.

السؤال: ما هي الاستجابات السلوكية لتأثيرات تخطيط/ ترتيب الأثاث في بيئة الدراسة للمكتبة؟ وكيف يمكن لهذه الردود أن تؤثر على سلوك الطلاب أثناء الدراسة؟

المنهجية: شملت طرق البحث المراقبة دون تدخل، الملاحظات وتوقيتاتها، مقارنات كل شريك أثناء الدراسات، المخططات والرسومات، الصور، وتدوين الملاحظات أثناء البحث. تم تحليل البيانات من خلال الرسومات والصور الفوتوغرافية، ومراعاة الاتساق وصحة الملاحظة من المراقبين. استخدام أسلوب الإحصاء الوصفي لتحليل البيانات في هذه الدراسة.

النتائج: دراسة البيئات تحتاج إلى توفير مجموعة متنوعة من التحفيز، أن تكون مرنة إلى النشاط الذي يتم فيها، وتوفير التصميم المناسب للأثاث (تخطيط/ ترتيب) في مثل هذه البيئات. كانت الموضوعات

المدرسة بما في ذلك: القرب، والمجموعات، والتفاعلات، والإقليمية، والأنماط (الحركة والسلوك، وما إلى ذلك)، واحتساب الوقت معا والتي تعتمد على مدى الإقامة والحركة. كذلك الطلاب يؤدون مهمة الدراسة بما يتناسب مع تخطيط/ ترتيب الأثاث في بيئة المكتبة الدراسية بأداء أفضل من أولئك الذين يؤدون مهمة الدراسة في حالة تصميم الأثاث بشكل عشوائي في البيئات نفسها.

الكلمات الافتتاحية: هندسة العوامل البشرية، السلوك، الاستجابة، مكتبة، قراءة، بيئة، أثاث، تخطيط/ توزيع.