

# Study of Anthropometry & Ergonomic for Study Room Furniture at Pantai Mutiara Residence

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## ABSTRACT

Home is a place where people live and work in their daily life. One of the activities is learning. Study room is a room that is used for learning activities so it must be considered carefully in designing the facilities needed, especially for furniture. Study of Anthropometry & Ergonomic for Study Room Furniture at Pantai Mutiara aims to compare the literature data with field data regarding the furniture size to find out whether the ergonomics principles have been applied or not so that users can feel comfortable while on the move. This study uses a mixed method, namely qualitative and quantitative by combining numerical data, text, and images to provide a more complete representation through a descriptive approach to three pieces of furniture. In designing a piece of furniture, the designer must understand the anthropometric aspect so that it can produce ergonomic and comfortable furniture for the user. The application of anthropometric data has been seen in study chairs, study tables with cabinets & bookshelves, and storage cabinets. However, the study shows that only study chairs that as a whole have met the principles and rules of ergonomics. While the study table with cupboard & bookshelves and storage cabinet still needs to be considered again on several aspects that are still not following with anthropometric studies and ergonomics rules. This research is expected to be useful for designers to design comfortable furniture and following the user.

**Keywords:** Anthropometry, Ergonomic, Furniture, Study Room.

## 1. INTRODUCTION

Reflecting on the pandemic conditions that have not subsided in Indonesia, most people are still working from home. For this reason, the comfort level for workspace at home need to be adjusted to each work requirement. One of them is through the selection of space-saving and multifunctional ergonomic furniture to maximize space [8]. One of the activities of working from home is learning activities. The study room is a place used for learning activities so that it needs to be considered optimally in designing the necessary facilities. Learning is the main activity and cannot be separated from human life. It is undeniable that in their activities, humans are interrelated with their supporting facilities, such as furniture. In designing furniture, it is necessary to pay attention to anthropometric and ergonomic factors to meet the requirements and according to user needs. Ergonomics is the study of human aspects of the work environment in terms of anatomy, physiology, psychology, design, engineering, and management [5].

The main focus of ergonomics thinking is a deeper review of the human element in designing an object, work procedure, and work environment [9]. In this case, ergonomics has an important role for humans in terms of health, safety, and comfort in activities in the workplace.

Ergonomics can also reduce fatigue at work, as well as visual and human posture discomfort. So that the activities carried out can run effectively and efficiently.

Anthropometry is the study of the measurements of the human body to explain differences in size for each person [6]. Anthropometry is a collection of numerical data related to the characteristics of the human body, dimensions, shape, and strength as well as the data application for solving problems in design [5]. An important thing in the application of ergonomics is anthropometry. The combination and use of anthropometric data with statistics will result in an ergonomic work facility design. In general, the anthropometric data used by the designer is presented in graphs and in the form of percentiles. The size of the human body is influenced by several factors such as age, gender, race/ethnicity, type of work, and others.

In this study, the authors chose the study room because it is the most important room and is used for a long period time in daily life so that anthropometric and ergonomic studies on furniture are needed. If the anthropometric design is not precise and accurate, it will allow users to feel instability (when the seat height is too high, the feet cannot touch the floor), physical fatigue, and discomfort. If it continues, it will lead to various diseases such as circulatory disorders, bones, joints, and so forth.

The limitation of this research is only three types of furniture in the study room. This research is presented in form of a comparison between anthropometric literature data with data from fields survey which aims to analyze whether the furniture has met the principles and rules of ergonomics in its design or not.

**2. METHOD**

Mixed method research is an inquiry approach that implies the collection and combination of quantitative and qualitative data; and using different designs that can involve philosophical thinking and theoretical frameworks [3]. This method provides a more complete picture of the research problem than either the approach alone.

**2.1. Data Collecting Method**

1. Study of Literature  
Collecting literature data such as data on ergonomics and anthropometry of furniture, serve as benchmarks in analyzing a comparison to field data on research subjects. Literature studies can be done from books, journals, news, and the internet.
2. Documentation  
The documentation technique is carried out online because the research location located on the Pantai Mutiara study room is still under construction. Documentation in the form of AutoCAD and 3D SketchUp drawings for study room.

**2.2. Data Processing Method**

The first stage is to collect literature data related to ergonomics and anthropometry. Followed by field data collection such as dimension measurements on study room furniture. Then an analysis will be carried out by comparing literature data and field data to produce conclusions regarding anthropometric and ergonomic studies on study room furniture.

**2.3. Data Analysis Method**

The analytical method used is a descriptive method where the author will describe the furniture and user activities in the study room, then compare it with the literature data. In this study, there is a quantitative method in which field data and some of the literature data collected are in numerical form, namely the dimensions of the study room furniture. Then the qualitative method discusses the application of the theory of ergonomics and anthropometry.

**3. RESULT AND DISCUSSION**

The human factor is an important aspect in furniture design. Furniture design that is following ergonomics rules

alongside a functional design, can produce furniture that is healthy, safe, and comfortable [4]. Meanwhile, ergonomics will play an indirect role in user’s experience, so they will feel more comfortable and relaxed. Furniture that applies ergonomic principles will feel the difference compared to furniture that does not apply ergonomics principles [1]. Figures 1 and 2 are photos of the study room at Pantai Mutiara Residence. Inside the study room, you can see study chairs, study tables with cupboards & bookshelves, and storage cabinets.



**Figure 1.** Study Room View 1  
(Source: Alberta Amelia, 2021)



**Figure 2.** Study Room View 2  
(Source: Alberta Amelia, 2021)

3.1. Study Chair



Figure 3. Study Chair Dimensions (Source: Alberta Amelia, 2021)

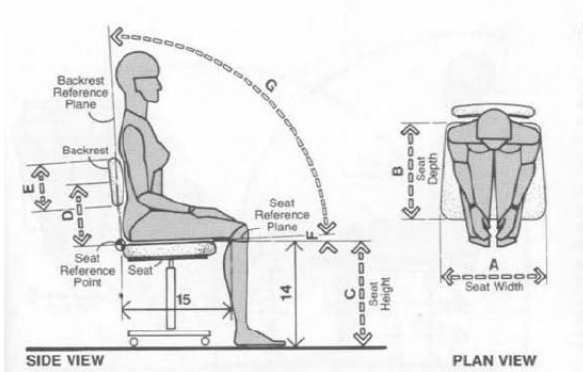


Figure 4. Critical Work Chair Measurement (Source: Panero, J.P and Zenlik, M, 1979)

Table 1 Study Chair Dimension Comparison

	Literature Data	Field Data
Seat Width	43,2-48,3 cm	45,2 cm
Seat Depth	39,4-40,6 cm	40,5 cm
Seat Height	35,6-50,8 cm	42,5 cm
Backrest Height from Seat Surface	19,2-25,4 cm	21,6 cm
Backrest Height	15,2-22,9 cm	16,5
Seat Tilt Angle	0°-5°	0°
Backrest Tilt Angle	95°-105°	100°

(Source: Panero, J.P and Zenlik, M, 1979)

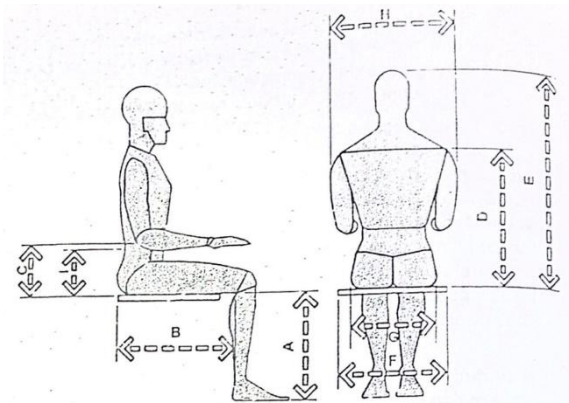


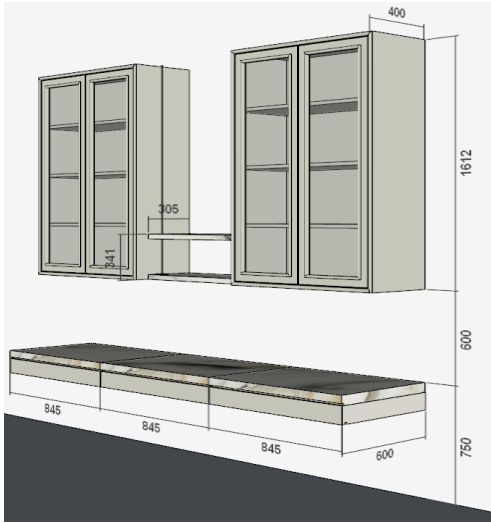
Figure 5. Anthropometric Dimensional Guidelines for Chair Design (Source: Panero, J.P and Zenlik, M, 1979)

In designing a chair, the designer must recognize and pay attention to anthropometric aspects to produce an ergonomic chair. The basic dimensions used as a guide for seating design consist of seat height, seat width, seat depth, backrest height, armrest height, and armrest spacing [6].

Anthropometric analysis of the study chair:

1. The height, width, and depth of the seat of the study chair have met anthropometric considerations so that users can feel comfortable, do not hinder blood circulation, and make the body more stable.
2. The backrest is a support for the lumbar region, the lumbar support does not need to be designed up to the head because the study chair is used for work activities.
3. The angle of the backrest and the slope of the seat on the chair have met the rules of ergonomics so that the user becomes comfortable when leaning because it is not too upright.
4. The study chair also has armrests so that users can support their arms and help when standing and sitting from the chair.

### 3.2. Study Tables with Cupboards & Bookshelves

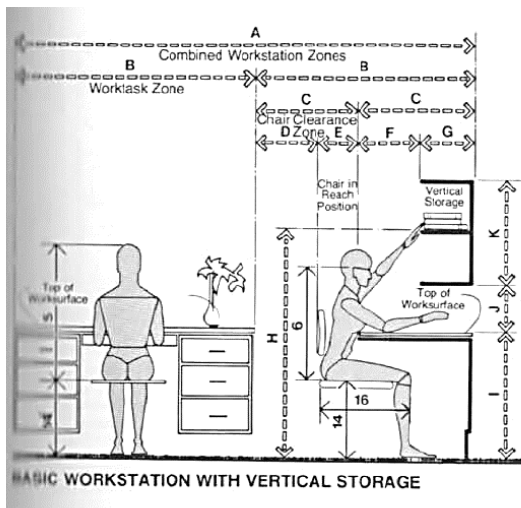


**Figure 6.** Study Tables with Cupboards & Bookshelves Dimensions  
(Source: Alberta Amelia, 2021)

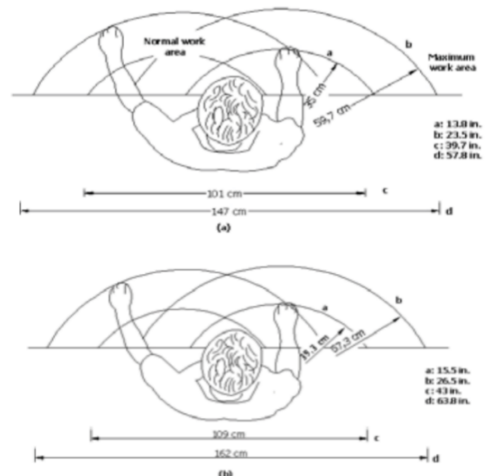
**Table 2** Study Tables with Cupboards & Bookshelves Dimension Comparison

	Literature Data	Field Data
Table Length (1 Table)	152,4-182,9 cm	85 cm
Table Width	76,2-91,4 cm	60 cm
Study Table Height from the Floor	73,7-76,2 cm	75 cm
Storage Cabinet Width	30,5 cm	40 cm
Storage Rack Width	30,5 cm	30,5 cm
Storage Rack Height from the Floor	134,6-147,3 cm	169,1 cm
Table and Cabinet Distance	Min 38,1 cm	60 cm

(Source: Panero, J. P. and Zenlik, M, 1979)



**Figure 7.** Work Table with Vertical Storage Dimensions  
(Source: Panero, J.P and Zenlik, M, 1979)



**Figure 8.** Work Area for Women and Men  
(Source: Pulat, 1992)

When doing activities at the study table, humans have a horizontal work area that consists of normal and maximum work areas. The normal work area is an activity that only moves the forearm and then the elbow remains in place. While the maximum work area is an activity where humans stretch their upper arms and rotate them around their shoulders [2]. Men and women have different work areas because they have different anthropometric data. Because the study area is not too large, the study table is combined with a vertical storage area.

1. The study table are still not wide enough, so users will feel cramped and not free when doing activities.
2. The height of the table has met anthropometric considerations so that when the user works, they will have good posture and do not bend over to sit and move.
3. The width of the storage rack is appropriate and meets the ergonomic criteria.
4. The width of the vertical storage cabinet should be reduced because there is a study table at the bottom so that users can feel more comfortable and spacious while on the move.
5. In terms of comfort, the height of the storage rack from the floor is too high. So that when the user is sitting, the user cannot directly reach the items on the shelf and must stand up first when he wants to take the item.

### 3.3. Storage Cabinets

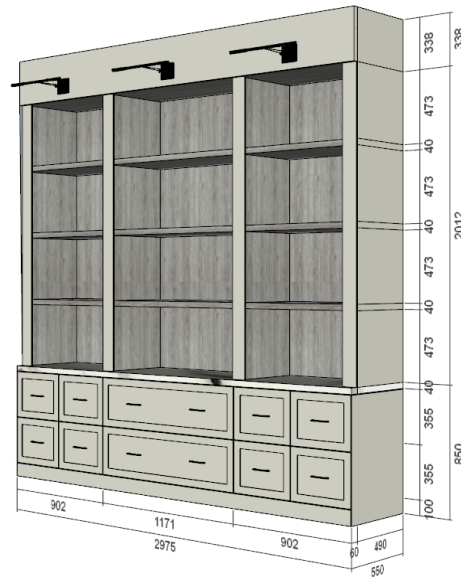


Figure 9. Storage Cabinets Dimensions (Source: Alberta Amelia, 2021)

Table 3 Storage Cabinets Dimension Comparison

	Literature Data	Field Data
Storage Cabinet Width	45,7-61 cm	55 cm
Storage Rack Width	30,5 cm	49 cm
Storage Cabinet Table Height	71,1-76,2 cm	85 cm
Storage Rack Height (Maximum)	182,9 cm (Men) 175,3 cm (Women)	136,3 cm (1) 187,6 cm (2) 238,9 cm (3)
Storage Cabinet Length	Varied	297,5 cm

(Source: Panero, J.P and Zenlik, M, 1979)

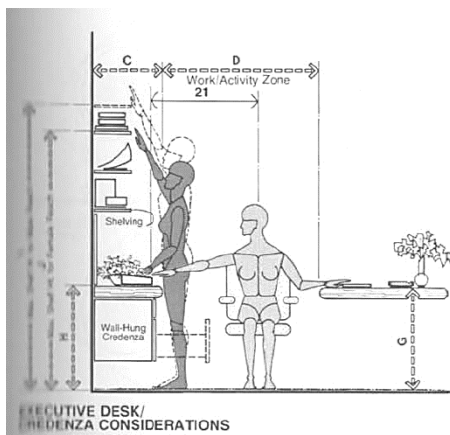


Figure 10. Measurement of Vertical Cabinets and Storage Racks

(Source: Panero, J.P and Zenlik, M, 1979)

In designing storage cabinets, it is very important to consider the maximum shelf height so that users do not have any difficulties when they want to reach a shelf [6]. The maximum shelf height for men and women is different.

Anthropometric analysis of the storage cabinets:

1. The maximum shelf height in the storage cabinet is still too high. Users can only reach the 1st shelf comfortably. For the 2nd and 3rd shelves, you have to tiptoe or use a tool when you want to take something.
2. The height of the cabinet table that is close to the workbench is a little too high compared to the literature data, so the user becomes a little uncomfortable.
3. The width of the storage rack for books and decorations is better shortened so that it utilizes more space and is following ergonomic criteria.
4. The width of the storage cabinet is following the literature data.

#### 4. CONCLUSION

Based on the results of the comparison of literature data on anthropometric studies on furniture design and data analysis that has been carried out with the research title "Study of Anthropometry & Ergonomics for Study Room Furniture at Pantai Mutiara Residence", it can be concluded as follows:

1. Study Chairs  
In terms of function and comfort, judging from the width of the seat, the depth of the seat, the height of the seat, the height of the backrest, the angle of the seat surface, and the angle of the backrest following the ergonomics standard.
2. Study Tables with Cupboards & Bookshelves  
The height of the table, the width of the storage rack, and the distance between the table and cabinet have met ergonomic standards. Meanwhile, the length of the table, the width of the table, the width of the storage cabinet, and the height of the storage rack still need to be considered again so that users feel more comfortable.
3. Storage Cabinets  
The width of the storage cabinet is following the ergonomic standards, but it needs to be considered again for the width of the storage rack, the height of the cabinet table, and the maximum height of the storage rack so that users feel comfortable while on the move.

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