Ergonomic Study for the Design of a Comfortable Office Workstation Environment for Work from Home Employees

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Abstract

Office ergonomics is a widely accepted means of providing an enabling environment that best facilitates employees' performance and general productivity. This study was conducted from employees of San Pedro City, Laguna. This study focuses on applying Ergonomics studies and tools to the employees most specially the employee's workplace during work hours at home. The study was based on a sample of 100 employees and the data for the study obtained mainly from the questionnaires analysed quantitatively using Microsoft Excel and presented with the aid of charts, tables, and pictures. The researchers analysed data gathered and give possible solutions to the problem in the design of the workplace. The employees should increase awareness of existing and potential ergonomic issues in the office, knowing how to adjust the office workstation to fit the office worker, using proper work practices, and following a proven ergonomic improvement process within the organization can improve overall comfort and productivity at work.

Keywords
Ergonomics, Employees, Work from home Ergonomic Checklist, Ovako Working Posture Analysis System

1. Introduction

Ever since the pandemic started, working from home has been implemented by most of the companies to continue their service and employees' job especially here in the Philippines. Most of the employees aren't used to this kind of set-up because they are already used to commuting and going back and forth to work so this is challenging for everyone. This kind of change has a lot to consider especially in terms of health and safety purposes. Considering their home environment, check if the space of the workplace is enough and can make them comfortable, or are there any places in the house that can work quietly, bearing in mind that their body posture must be appropriate to continue their job properly and wouldn't create pain in their back are only some of the factors to reflect. Work from home considers materials like laptops, the internet, etc. For instance, the alternative solution for this situation is to propose a guideline that will showcase a better set up for the environment of an employee while doing work from home. Consequently, this will be convenient for both employees who will do the job better and the employer that will receive the satisfying performance of the employees.

1.1 Background of the Study

According to Stevens (2020), about the challenges of working from home during the corona virus Pandemic, 54 % of employees have more distractions at home, 40 % of employees find it hard to focus on work at home and 15 % of

employees find it hard to focus on work with everything going on in the world. This only shows that working from home is a serious matter that the company should be focusing on.

Furthermore, a comfortable position during work from home is also a requirement because safe and health of the employee is an important matter so it has to maintain properly. Especially in this pandemic, getting sick will make the employee think differently. The employees' posture in the way of seating, using a computer, writing details should be in the right way to avoid getting hurt. Enough space should also consider the employee to be productive and feel like they are just like in the office. The environment has to be quiet and have enough lighting for the employee to be contented while executing their job.

1.2 Statement of the Problem

The study aims to create a new set-up or guidelines for the employer for them to give to their employees to perform the job more comfortable. These are the questions that the study aims to answer:
1. How employees feel about working from home?
2. Have the employees established a good work routine at home?
3. Is work from home make them less productive, equally productive, or more productive than working in the office?
4. Are there any problems that employees experiencing when started working from home?
5. Do the employees have a suitable workplace or own workspace at home?
6. Is there any preferred style of working place at home?

1.3 Objective of the Study

The main objectives of this project are to design a comfortable office working environment for work from home that includes performing the safety position of the employees while doing the job. But in a way that the design will be given as a guideline to the employer who is continuing their work in online mode. These are the specific objectives:
 - This ergonomic study wants to develop or innovate the current workplace of one employee as they continue this kind of job in the middle of a pandemic.
 - This ergonomic study wants to consider the matters of working from home like space of the workplace, the material needed, length of the table, the height of the chair, lighting, etc.
 - This ergonomic study wants to analyze the visual interference, the design that includes the vision, lighting, screen reflection, etc.
 - This ergonomic study wants to determine the manipulation, for having all things needed put in a place where can be seen together.
 - This ergonomic study wants to improve body support, like a chair that will make employees comfortable. It needs to check if it suits their weight, height, comfortable position, the right posture of the back, etc.
 These adjustments will provide better accommodation for employees who are working from home.

1.4 Scope and Delimitation of the study

The study will take place in San Pedro City, Laguna. The employees involved are those who are working from home in that area. The study will mainly have focused on the workplace, environment with the proper body position, or posture that makes the employees continue to finish the job correctly in a comfortable situation.
The basic goal that the researchers would want to achieve in this ergonomic study is to make it helpful to the employees experiencing difficulties in working from home to fulfil the objectives:
- Create guidelines for an employer that will make the set-up for workstation ergonomic to their employees
- Consider the employees' equipment if they have the needs for the online job idea
- Create a conceptual design of the workplace for the employees who work from home
- Re-arrange the environment
- Fixing the space into a workable one
- Perform ergonomics study in terms of safety of the body posture of employees
- The improvement from the existing workplace to the newly created design of the workplace based on the ergonomic analysis

1.5 Significance of the Study

The researchers would like to show this study as a meaningful case that considers employees physically and mentally situation. The researchers want to conduct this study to gain more information and idea about new normal that make the employees work from home in having their workplace and comfortable environment that body posture of employees needs to be considered. Another, the researchers want the be considered feel productive even in this new normal method that the company told them to do so, in a way they will be comfortable and healthy while doing this job. With the use of the researchers' recommendation on how to make home workstation as an ergonomic or suitable for them and environment recommendations that have safety consideration of their posture. As for the employer, the researches want to check their employees if they have equipment or materials during the online working job if they are able to allow their employees by the readiness of an employee to the new setup. The researchers also want the employer to consider in providing guidelines for a better workstation idea.

2. Literature Review

According to Ashraf A Shikdar and Mahmood Al Kind (2007), the fundamentals of a working system interact ever time the work is performed. The fundamentals include the worker, equipment, environment, task, and organization. In this research, they incorporated a research model wherein they found out that screen glare, fatigue, and awkward posture were the most important factors and are greatly contributing to the ocular, general musculoskeletal, upper body, and physical symptoms. With this, workstation designs significantly affect working posture.

According to the study of Kermit George Davis, and Susan Kotowski (2020), from this point forward, home offices will most likely be a mainstay for a large part of the population, both in the short term and in the long term. In the short term, companies will likely continue the stay-in-place home offices to reduce the potential of widespread COVID-19 infection within the work-place. As a result, millions of workers will need safe home offices. In the long term, companies have realized that work can be completed at home, and this will likely lead to regular work hours performed at home. Home offices are appealing to workers due to less commuting, better work-home balance, and less stress due to being in the comforts of home.

The present study of Lee Stadtlander et. al (2017) addressed a need in the current literature to understand how online workers (i.e., faculty) accommodate their work within their home and how the workplace affects their home environment. Given the results of the current study, virtual workers may find more work satisfaction by either separating their work area from the family home area or establishing separation by time. Understanding the needs of virtual workers provides employers with an opportunity to help new employees set up a controlled and secure work environment and better care for themselves, which may result in higher job satisfaction and productivity. Employers may be able to decrease the loneliness experienced by online faculty by establishing virtual communities where faculty can interact on a daily basis.

According to the study of Ghana, Asante (2012), Ergonomic elements such as office design, décor, illumination, and noise levels and furniture were found to be negatively affecting the performance of employees by between 20 - 80 percent. Also, few employees were found to have suffered musculoskeletal disorders which they attributed to their furniture. The researcher, therefore, asserted that Ghana National Petroleum Corporation was yet to leverage on its workplace environment as a means of motivating and enhancing the performance of its employees as the study identified substantial office ergonomic lapses.

From the study of Hagberg M et al. (2006), Workstation modifications frequently address the work surface and chair. Since the chair has a direct influence on body alignment (posture), individuals suffering from musculoskeletal symptoms related to prolonged sitting are often advised to alter the chair of their workstations. Changing the chair is also the most pragmatic action because altering the work surface may be limited by physical space constraints and an adjustable work surface is not always economically viable. Therefore, modifying the workstation's chair is often the most feasible initial step to ascertain whether the design of the workstation is associated with musculoskeletal symptoms.

3. Research Methodology

In this chapter, the researcher discusses the research design, research approach, sampling method, data collection method, data analysis method, and ergonomic assessment tools. It involves the process of how the researchers get the ideas from the study including related and relevant information. It also includes the researcher's information that is also contained by the previous chapter with the data that is related that will be used for this study.

3.1 Method of Research Used

In this study, this will serve as information that has been gathered from all the data that has been used for the research purpose in order to know what is the best solution for having a comfortable working station not just by creating design but implementing new guidelines that employer will be employed for the better improvement in having an online job at home. By the use of equipment and instruments that will be able to analyze all the data collected in the whole research process. The survey is qualitative research that the researchers find it useful in order to get the responses of the employees regarding working from home. The researchers also find similar studies in order to get the average for ergonomic assessment through anthropometry to know the design that will matter in the employees' posture and health matters. The data gathered and measured with the help of various tools. While conducting this study, the researchers came up to create a design that will produce a new set-up that will be a guideline for the employee that will be spread to their employees. Recommendation shows, body support, manipulation, and visual interference consideration.

3.2 Respondents of the Study

The respondents of this study were one hundred (100) employees, from the 71, 496 employed in San Pedro, City Province of Laguna. The researchers chooses employees of San Pedro, Laguna, Philippines as the most applicable focus of their by considering the total number of employees working at home based on their observation. The researchers considered other localities as well and San Pedro, Laguna is the best place to conduct this study.

3.3 Sampling Technique

The researchers gathered data to give accurate calculations for the study of a comfortable working environment for work from home employees. The researchers evaluate their study based on the data collected from the survey. The researchers chose this method to know how many samples the researchers need to have accurate data. The questions were all related to their working hours, comfort, and safety.
The researchers computed the number of samples using Slovin's Formula to know the accurate number of samples they will need to have at least 90% accuracy in the study. Since the researchers have limited time, they selected respondents working online in different places.
Slovin's Formula: $n = N / (1+Ne^2)$
Whereas:
n = number of samples
N= total population
e= margin of error
The researchers used the Slovin's formula to get the sample with a 10% margin of error. The sample size is 100 respondents from the employed in San Pedro City, Laguna with a total of 71, 946 employed populations.

3.4 Research Instrument

In this study, the researchers used questionnaires to gather specific data online. The researcher also used different applications like Excel to help encode the information and data gathered throughout the study. Various statistical and ergonomic tools are also used to help the researchers know the design of a comfortable office working environment for work from home employees. The questionnaire includes questions regarding how the employees feel about working from home, what design they prefer, what are the factors that affect their productivity, and if they have their workspace and equipment available at home. The researchers use Ergonomic Checklist for Computer Visual Display Terminal (VDT) Workstation as a guideline to help the researchers recognize high-risk Manual Material Handling tasks of the sample and choose effective options for a comfortable office working environment for work from home employees.

3.5 Data Gathering Procedure

The researchers gather data and information through online anthropometric assessment of the work from home employees during a pandemic. The data obtained was thoroughly analyzed and interpreted to find out the best design of a comfortable office working environment for work from home employees. The researchers analyzed all the data gathered to improve the design to the most comfortable and efficient way to perform their assigned jobs online and to ensure the health status of all work from home employees who have been using a poorly designed working environment.

4. Presentation, Analysis, and Interpretation of Data

(a)   Example of the current posture condition and workspace of a work from home employee specifying the Ovako Working Posture Analysis System

(b)   Example of an ideal posture condition and workspace of a work from home employee

Figure 1. Comparison of Postures

4.1 Posture and Workspace Analysis

From the survey that the researchers conducted, the current condition of the work from home employees has been identified. Since 56.6% of the respondents said that they are working 8 or more hours each day, they've also indicated various problems that they are experiencing when they started working from home. 55.4% said that it is hard to manage their time, 48.2% said that they have disordered working space (uncomfortable chair, messy and small-scale table), 38.9% said that it is hard to stay organized and focused because of the external noises and 15.1% said that there is no proper lighting (too light, too dark) in their workspace. For instance, 59% of the respondents said that they are equally productive at home than when working in the office but the thing is 31.3% do not have all the equipment needed to fulfill their usual standard and most of them do not have a suitable workspace at home. On behalf of, to further identify the needs of the workplace, Ovako Working Posture Analysis System (OWAS) was used and the results suggests that corrective actions are requires in the near future. The researchers were able to gather information for such postures that occur among employees by observing people who work from home in San Pedro, Laguna, Philippines.

As the researchers continue gathering the data, the researchers come up with the ideal posture that the employees should maintain even working from home. From the picture above, it shows that the person is seated properly and comfortably, the height of the chair and the table suits the employees' height to match in the visual interface that length of the monitor matters for the eye to be safe and avoid difficulties. Besides, the ideal posture shows not only the proper posture but also the good environment that can see as a clean and not so noisy place in which employees need to concentrate and do the job properly. The position of the materials is near the table just like in manipulation, and space is enough to move comfortably and do different things that need to be done while working in front of the device and

writing data as well. The level of the shoulder and height of the chair makes the employee enjoy the idea of work from home in this pandemic. The background or the situation inside the workplace will able the employee to focus on the job and make it more interesting even not in the office.
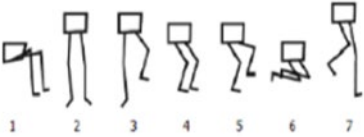
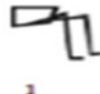| CATEGORY	CURRENT WORKING CONDITION	IDEAL WORKING CONDITION
1. BACK POSTURE	2	1
2. FOREARMS POSTURE	1	1
3. LEGS WORK	1	1
4. EXTERNAL LOAD VOLUME FOR MEN	1	1
Posture Code	2111	1111
Interpretation of the Result	Corrective actions should be done in the near future	No more actions required

Table 1. Ovako Working Posture Analysis System (OWAS) between current and ideal working condition of WFH employees

4.2 Pareto Analysis showing the risk factors from Ergonomic Checklist for Computer (VDT) Workstation for the design of comfortable office working environment.

The Pareto analysis is used to identify the risk factors that work from home employees are experiencing and help the researchers in terms of decision making in the design of a comfortable office working environment. Researchers provide four different Pareto analyses in terms of workstation seating, work surfaces, office lighting, and the environment to identify the needs that work from home employees anticipated.
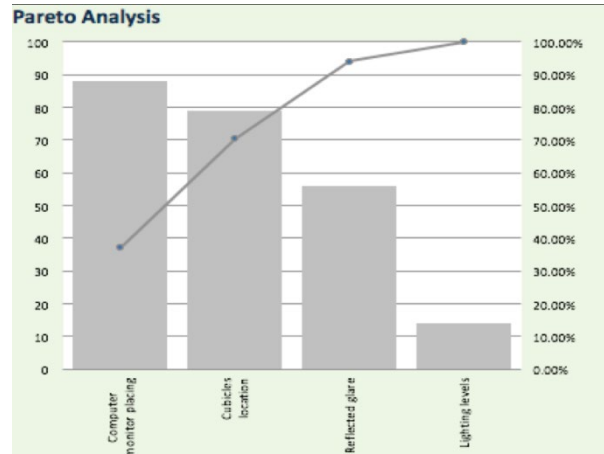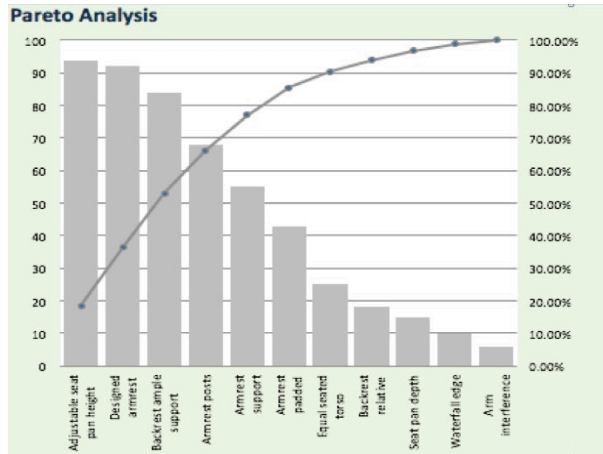
Figure 2. Pareto Analysis in terms of Workstation Seating   Figure 3. Pareto Analysis in terms of Work Surfaces
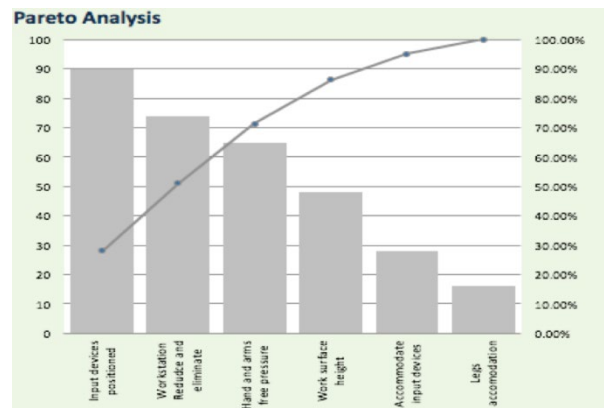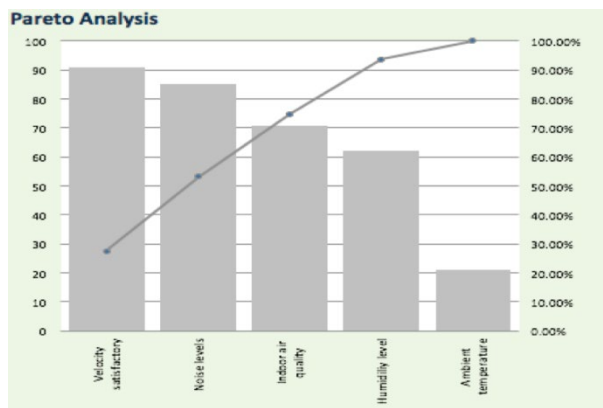
Figure 4 Pareto Analysis in terms of Office Lighting and Glare   Figure 5. Pareto Analysis in terms of Environment

4.3 Selection of Body Dimensions

Anthropometric measurements have great involvement in designing an ergonomic working environment for work from home employees. There are existing body dimensions that are essential in designing furniture, especially for office ergonomics. And for this research, the collection of all required anthropometric dimensions for the office workstation is adapted to the ISO 7250 as the standard for all office worker's body dimensions. Table 3 indicates the number and description of the selected worker's body dimensions. For the study, these body dimensions were prudently selected with the consideration in terms of enhancing comfort, safety, and ease of getting the required dimensions for designing office furniture.

Figure. 6. Anthropometric data required in ergonomic furniture for the work from home employees: sitting height (1), shoulder elbow height (2), shoulder elbow height (3), thigh clearance (4), knee height (5), popliteal height (6), Buttock knee length (7), eye height (8), forearm hand length (9), body mass (10)

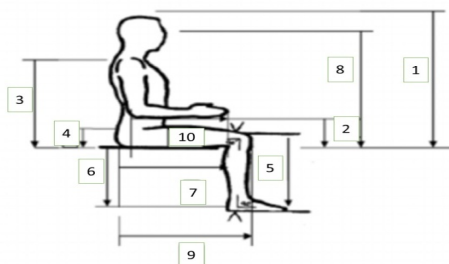Table 2. Table showing the basic worker's body dimensions and the description according to ISO 7250

No. according to Figure 6	Employees body dimension	Description of the body dimensions according to ISO 7250
1	Sitting Height	Vertical distance from a horizontal sitting surface to the highest point of the head (vertex)
2	Sitting Elbow Height	The vertical distance from the bottom of the tip of elbow (olecranon) to the sitting surface, measured with the elbow in 900 of flexion.
3	Sitting Shoulder Height	The vertical distance from the top of the shoulder at the acromion process to the sitting surface measured with a stadiometer.
4	Thigh clearance	Vertical distance from the sitting surface to the highest point on the thigh
5	Knee height	Vertical distance from the floor to the highest point of the superior body of the patella
6	Popliteal height	Vertical distance from the foot-rest surface to the lower surface of the thigh immediately behind the knee, bent at right angle
7	Buttock knee length	Horizontal distance from the foremost point of the knee-cap to the rearmost point of the buttock
8	Eye height, sitting	Vertical distance from a horizontal sitting surface to the outer corner of the eye
9	Forearm hand length	The distance from the posterior end of the elbow to the longest finger of the hand while the upper arm was at an angle of 900 with the lower arm measured with a vernier caliper
10	Body Mass	Total mass (weight of the body) which was measured with the help of weighing scale

4.4 Data analysis

The collected anthropometric data were thoroughly analyzed with the help of Microsoft Excel 2013. The data were analyzed in terms of minimum (min), maximum (max), Standard Deviation (SD) 5th, 95th percentile, and mean. All body dimensions are in centimeters (cm) except for body mass (weight) which is in kilogram (kg).

Table 3. Descriptive statistics for measured anthropometric dimensions for both male and female workers

BODY DIMENSIONS	MIN	MAX	Both Male and Female Percentile		Standard Deviation	Mean
			5th	95th		
Sitting Height	76 cm	125 cm	48.69 cm	121.73 cm	22.13 cm	85.21 cm
Sitting Elbow height	16 cm	28 cm	9.35 cm	37.4 cm	23.39 cm	8.52 cm
Sitting Shoulder height	52 cm	93 cm	34.59 cm	79.25 cm	13.53 cm	56.92 cm
Thigh clearance	20 cm	49 cm	25.98 cm	73.42 cm	14.37 cm	49.70 cm
Knee height	45 cm	61 cm	31.82 cm	64.47 cm	9.90 cm	48.14 cm
Popliteal height	42.5 cm	55.5 cm	28.81 cm	60.46 cm	4.56 cm	47.88 cm
Buttock knee length	36 cm	49 cm	28.08 cm	56.77 cm	8.70 cm	42.43 cm
Eye height	138 cm	164 cm	100.37 cm	192.06 cm	27.79 cm	146.22 cm
Forearm hand length	37 cm	49 cm	43.93 cm	44.15 cm	42.87 cm	44.37m

The following anthropometric measures were based on the average anthropometric measure of the people that is possible to work. These measurements are from the data of people who conducted an anthropometric measure for the requirement of their course. The data above has been obtained by the use of a survey which gives the data of employees' body dimensions, the data that has been gathered are computed by the use of excel to get the concrete information with the use of formula in getting the 5th and 95th percentile that the researchers will make as a basis to create adjustments or new set-up of guidelines for the right workplace of employees working from home. With these results, the researchers can suggest and give an opinion on the materials and equipment that the workstation has to do the job properly and comfortably.

4.5 Results and Discussion

Tables 2 and 3 present descriptive statistics of all the measured anthropometric measurements for all of the workers respectively. Having a working station for work from home employees is currently being preferable due to its capability of increasing comfortability while reducing the chance of MSDs in the long run. Table 4 shows various criteria that have been suggested as the guidelines for the employers at whatever time there can be a need of having a workstation.

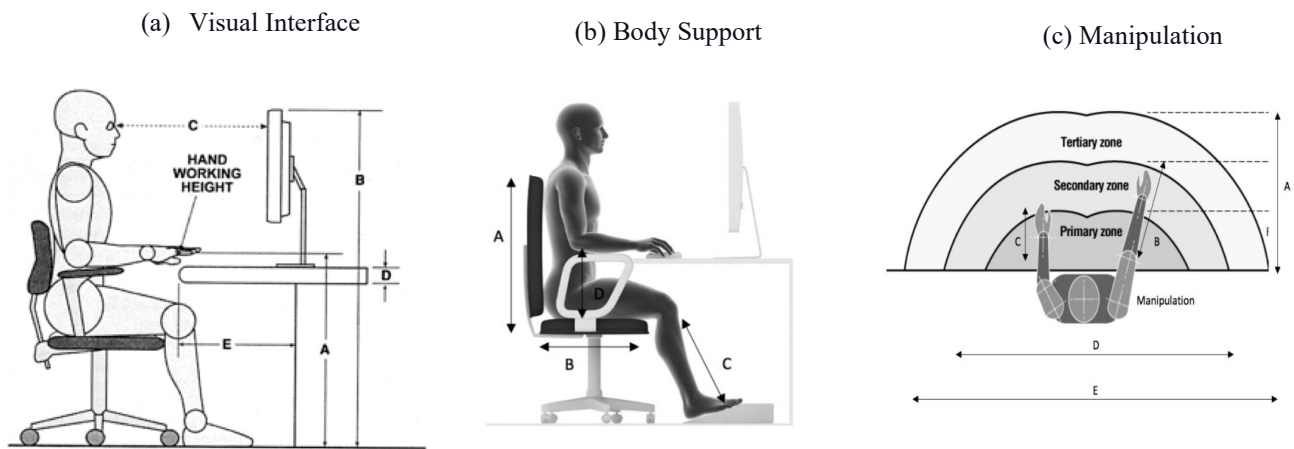   (a) Visual Interface   (b) Body Support   (c) Manipulation

Figure 7. Data Lenharth System (2017), Shaver (2015), and Silo Tips, Augustus (2018). Anthropometric data required in considering visual, manipulation and body support systems

Table 4. Determinant criteria for ergonomic design for work from home employee's workstation

Features	Anthropometric Measure	Design Dimension	Recommendations
VISUAL			
	A. Sitting Shoulder Height	79.25 cm	95th percentile of both female and male of Sitting shoulder height
	B. Eye Height	192.06 cm	95th percentile of both female and male of Eye height
	C. Forearm Hand Length	43.93-44.15 cm	5th and 95th percentile of both female and male of Forearm hand length
	D. Sitting Elbow Height	37.4 cm	95th percentile of both female and male of Sitting elbow height
	E. Knee Height	64.47 cm	95th percentile of both female and male of Knee height

MANIPULATION	A. Sitting Shoulder Height	79.25 + 5 cm	95th percentile of both female and male of Sitting shoulder height + 5 cm allowance for materials
	B. Sitting Shoulder Height	34.59 cm	5th percentile of both female and male of Sitting shoulder height
	C. Forearm hand length		5th and 95th percentile of both female and male of Forearm hand length
		43.93-44.15 cm	95th percentile of both female and male of elbow span
	D. Elbow Span		95th percentile of both female and male of arm span
	E. Arm Span		
		111.11 cm	
		209.37 cm	
BODY SUPPORT	A. Sitting Shoulder Height	34.59 cm	5th percentile of both female and male of Sitting shoulder height
	B. Forearm Hand Length	43.93-44.15 cm	5th and 95th percentile of both female and male of Forearm hand length
	C. Knee Height	31.82 cm	5th percentile of both female and male of Knee height
	D. Sitting Elbow Height	9.35 cm	5th percentile of both female and male of Sitting Elbow height

4.5 Design for the Proposed Workstation for Work from Home Employees

(side view)   (upper view)

Figure 8. Proposed design of the workstation

To design a proposed workstation for work from home employees. In workstation seating, the researchers design an adjustable chair wherein users can adjust the chair seat height so their feet are flat on the floor. Adding padding to the chair to bring them up to a comfortable level will also help the users to work at ease and move comfortably. In terms of workspaces, the design promotes to position the input device at approximately the same height and distance as the keyboard as well as placing the storage units in lower adjustable height as far as possible without interfering with monitor placement or other work. In-office lighting and glare, the proposed design used supplemental task lighting on

the side as well as a table lamp for more illumination. The window also has curtains and the walls are painted with light colors. Lastly, in terms of environment, the design has a portable fan to maintain a comfortable temperature as well as plants that are a good source of fresh air.

5. Summary of Findings, Conclusion, and Recommendation

5.1 Summary of Findings

The focus of this study was to determine the current condition that work from home employees are experiencing particularly the risk factors that their current posture may bring. It is achieved by using ergonomic tools for computation such as Ergonomic Checklist for Computer (VDT) Workstation and Ovako Working Posture Analysis System (OWAS) wherein they indicated that corrective action is required shortly. OWAS and REBA are the most appropriate tools to evaluate and re-design comfortable workstation for employees experiencing awful workstation.

To develop and innovate a proposed design of work from home employee's workspace.
By assessing the needs and current condition of work from home employees through the VDT checklist and OWAS, determining the features and dimensions that needed to give emphasis became possible to create the proposed work spaced   design.

To determine how important matters such as space of the workplace, the material needed, length of the table, the height of the chair, and lighting may affect the employees' overall performance.
Conducting a comparative analysis for current and ideal working posture and workspace was taken into consideration in determining the needs that are used in the proposed workspace design. In a comparative analysis, analyzing the difference between the current and ideal workspace was taken into contemplation.

To analyze the importance of visual interference, manipulation, and body support in improving the workspace of work from home employees ergonomically
Considering the factors in terms of visual interference, manipulation, and body support helps in computing the average anthropometric dimensions for both male and female in determining the design dimension. Summarizing the research study showed how the researchers applied their knowledge in course ergonomics by using ergonomic tools such as Ergonomic Checklist for Computer (VDT) Workstation and Ovako Working Posture Analysis System (OWAS).

5.2 Conclusion

The researchers came up in improving workstation because of the new normal that the company really deal with these days. And with the help of ergonomic workstation improved design that will be able for the employer to help their employees who are working-from-home to consider the measurements of every suggestion that the researchers suggested based from the research results. The newly designed set-up or guidelines of the workplace for the employer for them to consider and to distribute to their company employees would result in a positive outcome to overcome the common problems that most of the employees encounter that could give improvement and a worthy change for most of the employees which will make them feel motivated, productive, safe and comfortable on working from home in this new normal.

5.3 Recommendations

The researchers recommend based on the data from the anthropometric measurements results that is best for adjusting the office workstation for the employers for their employees. The employers should increase awareness of existing and potential ergonomic issues in the office, knowing how to adjust the office workstation to fit the office worker, using proper work practices, and following a proven ergonomic improvement process within the organization can improve overall comfort and productivity at work. Further research, the workstation that has chair, desk, mouse, keyboard, and other items should be optimally designed and positioned based on the tasks performed, specific body measurements, and personal factors that only a well-trained ergonomist can determine, evaluate, and synthesize.

References

Davis, K. Kotowski, S. Daniel, D. Gerding, T. (2019). The Home Office: Ergonomic Lessons From the "New Normal Retrieved from:https://www.researchgate.net/publication/342681325_The_Home_Office_Ergonomic_Lessons_From_the_New_Normal

Haynes, B.P. (2008) The Impact of Office Comfort on Productivity. Journal of Facilities Management, 6, 37-51. Retrieved from: https://www.emerald.com/insight/content/doi/10.1108/14725960810847459/full/html

Robertson, M. Moiser, K. (2020). Work from home: Human factors/ ergonomics considerations for teleworking. Retrieved from: http://ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_742061.pdf?fbclid=IwAR3-IQNwyW6n_Yhu7ONHCTeVdORXhK0cT6oiUNkbIGCQ0wFJS8NFs8et214

Shikdar, A. Al Kindi, M. (2007). Office Ergonomics: Deficiencies in Computer Workstation Design. Retrieved from:https://www.researchgate.net/publication/6237406_Office_Ergonomics_Deficiencies_in_Computer_Workstation_Design

Stadlander, L. Sickel, A. Civita, L. Giles M. (2017). Home as Workplace: A Qualitative Case Study of Online Faculty Using Photovoice. Retrieved from: https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=1220&context=jerap&fbclid=IwAR3K_v_trFwwexF-kvPKYydiq4aK6Gn_6TDbH6knY0UEZCFDM8lxWYmaK_I

Teerek, E. Sajfert, Z. , Isakov, S. Zoric, K. (2014) Positive outcomes of office ergonomics in terms of higher productivity. Retrieved from: https://www.researchgate.net/publication/285625501_Positive_outcomes_of_office_ergonomics_in_terms_of_higher_productivity?fbclid=IwAR1q1NWu4eNsjDK1wnhVaQuWVuXOEuJcLb-1nexNO8OTENqpxnlZOMDsKaw

Biographies

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