Relationship of Work Posture During WFH Setup on Musculoskeletal Discomfort of Students

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Abstract

The introduction of the COVID-19 had a huge impact on the delivery of education. To make the most out of the time spent at home during quarantine, students are now taking up online classes implemented to them by their respective schools. This means prolonged sitting behind their computers while learning. The objective of this study is to find various relationships between the postures of students and their corresponding discomforts experienced during online classes. The ROSA method together with the application of the Corlett and Bishop's discomfort scale are used. The researchers found out that long durations of sitting while having online classes does lead to students experiencing more painful discomforts thus affecting the efficiency of how they study. It can also be concluded that the majority of the dimensions based on the ROSA method have the most effect on the lower back of the respondents, were more particularly the dimensions of the Monitor and Headset are the only dimensions that do not play a role in affecting any body parts.

Keywords
Musculoskeletal discomfort, posture, online class, work from home

1. Introduction
As COVID -19 pandemic spread in early 2020, the world has drastically changed into a new era where the lifestyle of every person shifted into a new form. Every country was sent to different isolation/quarantine to mitigate the spread of the virus. As a result, offices and schools were closed indefinitely and continued into a new platform, in an online/virtual world.

The business casual wear and school uniform have evolved into home casual wear, in-person meetings have evolved into web conferences, and in-person school rooms have evolved into online assignments and virtual lessons, because of the modern standard or New Normal (Gruman, 2020). In this current time, people specifically students spend more time in front of screens and monitors than ever before, where they spend a lengthy period in one sitting area having only a work posture in a work from home (WFH) set up as the new form of study condition.

As WFH setup is being promoted and strengthens over time, it becomes one of the ideal alternatives to continue the phase of life. Thus, the home environment cannot be compared to the workplace/classrooms. In particular, the absence of ergonomic office/school furniture at home may hinder a healthy posture and may promote the onset of (MSD) Musculoskeletal Disorders (CCOHS, n.d.). According to Bernard & Putz-Anderson (1997) Musculoskeletal disorders (MSDs) are defined as a group of inflammatory and degenerative conditions that affect muscles, tendons, joints, ligaments, peripheral nerves, and the supporting blood vessels. So for students studying in a sedentary position with no other alternative for prolonged periods increases the risk of neck and back pains.

In other alternatives, some homes have a complete set of desks and chairs but may not have the adjustability needed to provide a suitable long-term work environment. When setting up the homework environment, remember to implement ergonomics basics to ensure the safety and health of the people (Fernandez, Miller, & Subramanian, 2020). Having a WFH setup may help to redefine the new system of living as people have the chance to stay home and help to mitigate the spread of the virus, nevertheless, work from home didn't gain a strong impetus, as homes of every individual have different settings, having different environmental conditions that affect the performance of the students/worker, the workstation may also have a different environment as not all have the same household.

1.1 Background of the Study

As health is one of the priorities of all people it is important that amidst the pandemic, health should not be compromised. As of now working from home is currently a global scenario and a need of the hour considering the COVID-19 Pandemic. According to the study of Tanvee Deepak Vora (2020) Around 90 % of the world, the population is opting for work from a home culture which might continue for a few years even post the global pandemic. Though it is the need of the hour and has many advantages like saving an individual's travel time etc., it does make an individual get accustomed to the comfortable home environment allowing them to assume relaxed postures which can sometimes prove to be deleterious for their musculoskeletal system by overburdening the spine. As many things are happening outside of our homes, some factors are happening inside the house that people may not notice or sometimes ignore.

In the working environment, where people especially students do different activities with regards to their online classes, their working postures tend to change into different forms wherein a longer period, different symptoms may be experienced. This study merely focuses on the relationship of the new setup. To ensure that there is a solid correlation between the work posture in a WFH to the musculoskeletal discomfort of students, the researchers gather respondents to identify varied factors that students encounter in a WFH setup. In addition, the presence of ergonomic intervention should always be present in every household to ensure the working condition of every student/worker is in a good phase.

1.2 Review of Related Literature

According to Matos, M., & Arezes, P. M. (2015, October 23), a study called "Ergonomic evaluation of office workplaces with Rapid Office Strain Assessment (ROSA)", conducted a study where they implemented the ROSA method and conducted their study in an insurance broker located in Porto, Portugal. The sample size that they gathered is composed of 38 office workers. Instead of providing surveys for all the office workers involved in the study, what they planned was that they had a brief meeting and interview with the office workers to gain a general understanding of their work composition and what they do. Afterward, they will then get a picture of their work posture for analysis. In their conclusion, they found out that the interaction of workers with the tasks and the adopted sitting posture at the computer throughout the day tends to produce repercussions at a muscular level, more specifically under the cervical and shoulders segments.

Based on the research of Jusoh, F., & Zahid, M. N. O. (2018, March 1), a study called “Ergonomics Risk Assessment among support staff in Universiti Malaysia Pahang”, their study was conducted in the Universiti Malaysia Pahang. Their sample consists of the operational staff from faculties and Human Resources Department in the university. When performing this study, they executed the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) which is an assessment used to determine the musculoskeletal discomfort among office workers related to their ergonomic situation, as well as the Rapid Office Strain Assessment (ROSA). They obtained their data and information from their respondents by handing out surveys. These surveys have two types of questionnaires where the first type is about the general condition in UMP. Where it specifies the discomfort scenario at the present workplace, time spent at the workplace, the current symptom, and the discomfort scale. The second type revolves more on background data of the staff such as their gender, weight, and height. In their results and conclusion, they found out from the CMDQ assessment that the staff was experiencing different areas of discomfort more particularly the lower back as this does vary among the departments. While for the ROSA method, based on the final ROSA score (overall result) they obtained a value of 3.42, they found out that further actions need to be done to improve the working environment for their employees because the value of this final ROSA score indicates a medium level of risk.

According to the study of Lotfollahzadeh, A., et al. (2020, February 23), a study called “Musculoskeletal Disorders among Healthcare Network Staff using Rapid Office Strain Assessment", this study was conducted in Ardabil Province, Iran with a sample size of 105 staffs where the participants were selected using the census sampling. The two assessments the researchers used in this study are the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) and the Rapid Office Strain Assessment (ROSA). After getting the final ROSA score, they also performed the Analysis of variance (ANOVA), T-test, and Chi-square tests to determine the relationship between the demographic variables of the final ROSA score. Based on their findings and conclusion, It was observed that musculoskeletal discomforts and pains were more common in the neck and hip area compared to other body parts. According to Dormohammadi et al., this is all due to the inappropriate design of workstations, positioning adverse postures while working with computers, and spending long hours in a sitting position. Therefore, corrective measures are needed to ease or reduce those pains. For the ROSA, they observed that the Analyses of the ROSA scores obtained indicate that the condition of workstations was inappropriate. But when it came to the Chi-square test, it did not show a significant relationship between the final ROSA score and the prevalence of MSDs.

A study conducted by Sethi et al. (2011) suggests that the workload of professionals using computers tend to put in long hours in doing tasks behind their computers than giving prioritization to their health, therefore may lead to an increase of their weight thus resulting in an unhealthy Body Mass Index (BMI) which may worsen work-related musculoskeletal discomfort and occupational-psychosocial stress. Their study focused on the objective of finding out the effect of the BMI on work-related musculoskeletal discomforts and occupational stress of computer workers in a developed ergonomic setup. With the use of Cornell University's musculoskeletal discomfort questionnaire (CMDQ) and occupational stress index (OSI), the work-related musculoskeletal discomfort and occupational stress of the workers were assessed with a focus also on the relationship with their BMI. The results show that the BMI is a significant predictor of work-related musculoskeletal discomfort and occupational-psychosocial stress among workers using computers in a built ergonomic setup.

Studies of researchers in the past have obtained high levels of discomfort despite having relatively low-level demands, but with jobs that are always inactive and sitting. Only a few aids are discovered up to date that has been efficient in lowering worker discomfort. A research study performed by Davis and Kotowski (2014) aims to investigate if various methods of interventions with a cause of promoting a change in posture could enhance body motion throughout the work shift and lessen musculoskeletal discomfort. A sample of Thirty-seven call center operators was assessed in four different conditions in the respective workstations: conventional workstation, sit-stand workstation, conventional workstation with reminder software, and sit-stand workstation with break reminder software–prompt to remind workers to take a break. The results show that there are significant decreases in short-term discomfort described in the shoulders, upper back, and lower back in the usage of the software that comes with reminders, in the separation of the workstation type. This led to an increase of 10% in productivity. Variability in posture seems to be correlated to reduced short-term discomfort at the end of work without giving hindrance to productivity.

A study in the working population was done by the group of Viester et al. (2013), the purpose of their study is to examine the relationship between BMI and musculoskeletal symptoms in dealing with the physical workload. An additional aim was to get insights into whether a person being overweight and obese elevates the frequency of symptoms and the recovery from these symptoms. The study was conducted with a large sample size of 44,793, making use of the data from The Netherlands Working Conditions Survey (NWCS), the relationship between BMI and musculoskeletal symptoms was assessed with the means of logistic regression analyses with considerations for the confounders. Another research conducted was with the use of Longitudinal data from the Netherlands Working Conditions Cohort Study (NWCCS) of 7,909 respondents to identify the transition in the musculoskeletal symptoms. The results showed that for people with high BMI, a surge of visible musculoskeletal symptoms worth 12 months was discovered. Obesity was associated with the development of musculoskeletal symptoms and at the same time is also indirectly proportional to recovering from these symptoms. It can be concluded that BMI is correlated to musculoskeletal symptoms with an emphasis on the lower extremity.

A study focusing on the prevalence rate of neck, shoulder, and lower back pain in association with age, body mass index, and gender by Shariat et al. (2018) aims to investigate the prevalence of lower back, shoulder, and neck pain among Malaysian office workers. The workers situated in offices usually experience Musculoskeletal Discomfort (MSD) which is mostly related to the disorders experienced in the lower back, shoulders, and neck. The study included 752 subjects (478 women and 274 men) that were randomly selected from a population of 10,000 office workers dorm Malaysia, with ages of 20–50 years old and with a minimum of one-year work experience. It was discovered that women are more likely to encounter MSD in the shoulders and the neck compared to men. This was obtained from a study made by Mahmud et al. (2012) where they found out that women are more vulnerable to pain in the upper body and the neck regions as opposed to men. That's why gender is also identified and is being tested in this study. They were asked to answer the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). They were classified into different BMI groups. The results of the study show that there was a significant relationship between pain severity in gender and both sides of the shoulders. There was also a significant relationship between BMI and the severity of pain experienced in the lower back. Age also played a factor.

In addition, to the literature review stated above, some studies can conclude that the physical attributes of a certain individual such as age, sex, height, and weight and the time exposure correlate to the musculoskeletal disorder of a certain individual having an awkward posture during an online class set up. According to Yang et al. (2014) a body mass index (BMI), which is a measure of body adiposity and is described as the weight (in kilograms) divided by height (in square meters), is also known to be related to the development of MSDs. It is known that people with an increased body weight (elevated BMI) tend to have more musculoskeletal pain than do people with lower body weight. BMI is an independent risk factor for the development of MSDs, and it can also increase the 12-month prevalence of MSDs. Further, according to Dallman et al. (2003), that there is a relationship between MSDs and stress, and confirmed that stress, especially high levels of stress, can lead to an increase in body weight and, therefore, an increase in BMI. Individuals with high levels of perceived stress and those who lead stressful lives are at a greater risk of increased BMI over time as compared to those with lower stress levels (Harding et al. 2014).

Also, some studies have investigated the relationship of WFH to MSDs among students, but most studies confined their student population to a single academic program, in which the only respondents are in a single level or scope only by the researchers. The current study also aimed to identify the in-depth relationship of work posture during the WFH setup in the MSD and discomfort of the students. Using statistical analysis to determine and analyze the data to confirm if it has a solid correlation between the independent and dependent variables of the research study. To overall state, even there is a correlation the physical attributes, there are also other external factors that are connected to the MSD, as it is not only limited to the stated physical attributes presented in this study.

1.3 Gap of Missing Information

As the phase of education has drastically shifted to the virtual world, teachers and students opted to adapt to recent changes to continue the learning process that every student needs to meet. The virtual platform helps to connect every student from various locations to supplement the face-to-face classes. The gap of problems is being filled out as Work from Home (WFH) set-up with the online delivery classes, helps to link every student to interact with other students as well. But also, it is important to observe the working environment and the set-up of the student if it is conducive and proper for them to work efficiently and perform well in the class.

1.4. Objectives

Given this current condition of the students, the following are the aim of this study. First, to identify the relationship of work posture during WFH setup on musculoskeletal discomfort of students, determine different factors that affect the working condition of the student in a WFH setup, and lastly, to provide an efficient ergonomic intervention on musculoskeletal discomfort of students

1.5. Significance of the Study

This study aims to know the in-depth relationship of Work Posture during WFH setup on musculoskeletal discomfort of students as the education has drastically shifted to the online/virtual world. Analyzing different working conditions of every respondent and applying concepts of ergonomics to reassess and develop the sitting to eliminate inadequate posture and idle position that affects the performance of the students. This study can provide more insights and relevance to remind students at collegiate levels to try to find different solutions that make the online learning experience more bearable for our body to withstand long periods of sitting in front of the computer. Since the better we feel about our body and the less pain we experience, the easier it will be for students to learn efficiently over longer periods. The purpose of this study can also be applicable or brought upon to any student studying during online classes as well as those who are working away from home.

1.6. Scope and Limitation

This study focuses on the relationship of work posture during WFH setup on musculoskeletal discomfort of students in the conducting of online classes. The respondents were limited to college students with ages 18-22 who are currently undertaking online classes. A survey questionnaire was prepared by the researchers. The data were collected from a total of 30 respondents. The study was conducted for two weeks in consideration of the course syllabus and academic calendar.

This study will not focus on other factors relating to the relationship of work posture during WFH setup on musculoskeletal discomfort of students other than the factors evaluated in the study. Other unknown variables that may be affecting the relationship of work posture during WFH setup may not all have been identified. The results of this study will only apply to the respondents of this study, and it will not be utilized as an assumption or estimate of the whole population of Filipino college students.

2. Methodology

2.1 Conceptual Framework

The conceptual framework has been developed as an outcome of the systematic literature review. The conceptual framework is presented in Figure 1. The independent variables under work posture are identified as the Physical Attributes (age, gender, height, weight) and Time Exposure (less than 4, 4-6, 6-8, more than 8 hrs.) meanwhile the dependent variables are under the Treatment of Statistical Analysis of MSD and Level of Discomfort of the students who have a WFH set-up in an online class.

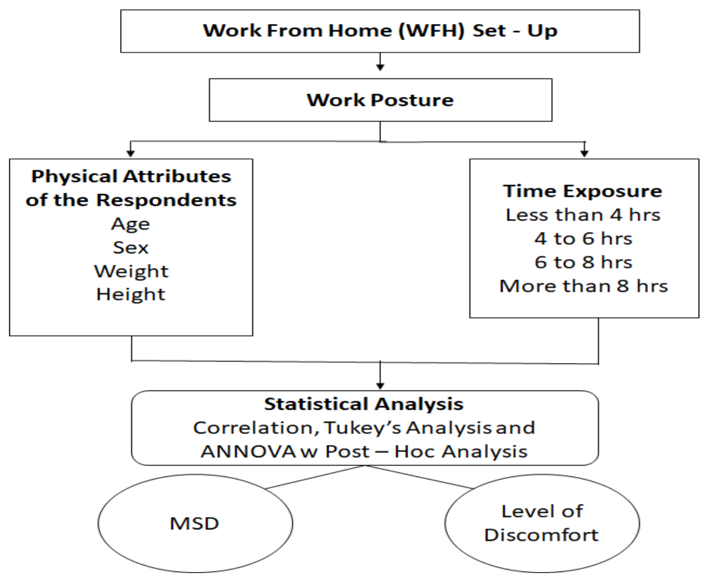

Figure 1. Conceptual Framework

2.2 Respondents of the Study

When it comes down to the respondents of the study, they consist of only college students from various universities learning through the online structure as implemented to them by their respective schools. Where our respondents are a diverse group of students in terms of the current year level, they're currently in. The choice that the researchers decided on including the higher year levels together with the lower year levels provides a more compelling comparison when differentiating the factors that the researchers took into account when doing this study.

2.3 Ergonomic Tools

The Rapid Office Strain Assessment (ROSA) is the ergonomic tool utilized in this study. This ergonomic assessment tool is designed to quickly provide a quantification of the risks of work-related to computer usage at a computer workstation, which can, in turn, provide the level of change based on the risk associated with the work task/work posture. The ROSA final scoring ranges from 1 to 10, with the higher score indicating an increased risk for work-related musculoskeletal disorders (Physiopedia, 2020). In addition, this ergonomic tool is appropriate to use in a WFH setup where students mostly utilized computers/laptops to supplement the face-to-face classes.

2.4 Statistical Treatment of Data

Responses to the questionnaire by the college students were statistically analyzed with the required data of the study. The students were assessed with the ROSA and were asked to answer the Corlett and Bishop discomfort scale. The data were analyzed using descriptive statistics such as mean, frequency, count, and percentage. In the summary of the respondents' profile, count and percentage were utilized. In the table of the summary of the body discomfort level, % frequency is used to identify the frequency of scores for each body part listed. The mean of the scores for each body part was obtained to know what parts the respondents experience discomforts the most. The frequency and percentage frequency were acquired from the assessment of the workstation parts relating to the postural risk factors to identify what category of the assessment for each part was the most answered.

The analysis of variance was used to test if there is a significant difference between the discomfort level of the respondents with regards to their BMI and if there is a significant difference between the discomfort level of the respondents with the number of class hours per day. A post hoc test was used after this to identify where does the difference occur. Tukey's post hoc test was used to strengthen the claim of the result and to know where the data differ. The test of correlation was used between the ROSA score and the discomfort level. The ROSA score is compared to each workstation part to identify if each increase or change in the ROSA score has a relationship with the experienced discomfort level of the respondents.

3. Results and Discussion

3.1. Result of Discomfort Scores

Table 2. Summary of Body Discomfort Level (% Frequency)

Discomfort Level	Head and Neck	Shoulder	Arm	Middle back	Lower back	Buttock	Thigh	Knee	Leg and Foot
1	10.00%	26.67%	33.33%	13.33%	13.33%	13.33%	36.67%	46.67%	40.00%
2	20.00%	16.67%	26.67%	26.67%	20.00%	30.00%	26.67%	30.00%	30.00%
3	26.67%	26.67%	20.00%	20.00%	16.67%	26.67%	13.33%	10.00%	16.67%
4	33.33%	26.67%	10.00%	23.33%	33.33%	26.67%	23.33%	13.33%	13.33%
5	10.00%	3.33%	10.00%	16.67%	16.67%	3.33%	0.00%	0.00%	0.00%

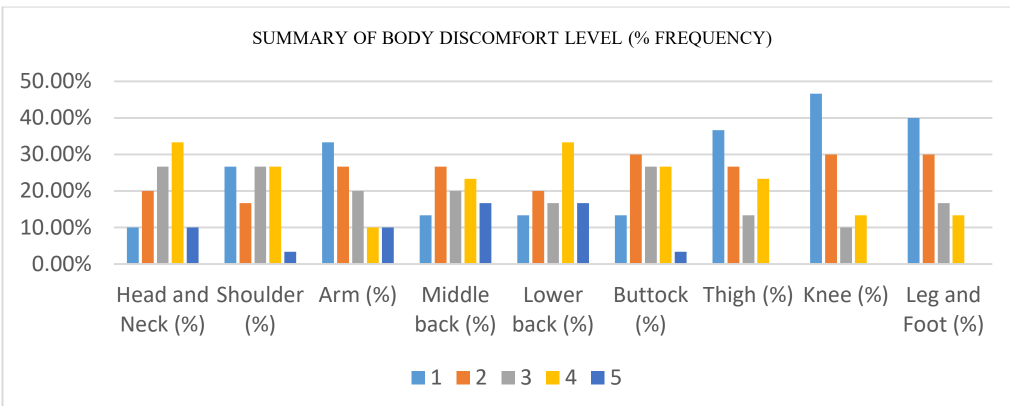

Figure 2. Summary of Body Discomfort Level (% Frequency)

The discomfort level obtained from the Corlett and Bishop discomfort scale is summarized and shown here in Figure 2. The frequency of answers for scores 1-5 is highlighted for the different body parts. For the head and neck, 4 was the most answered. There is equal frequency for scores 1,3 and 4 for the shoulders. In the arm, only a score of 1 is the common answer. The middle back has a score of 2 for the most answer. The lower back obtained 4 as the highest count, this shows that many students experience body discomfort in the lower back are even though the respondents are still young, the factor of the implementation of online classes kicks in and exposes them to early signs of musculoskeletal disorder. The thigh, knee, leg, and foot all got 1 for the most answer, denoting that there is little to no discomfort experienced in these body parts.

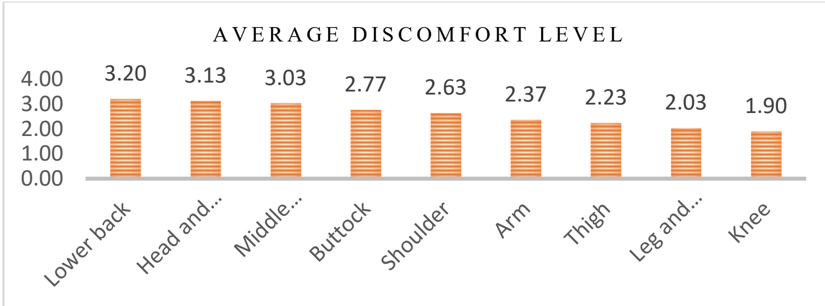

Figure 3. Average Discomfort Level

The average of the discomfort level answers of the respondents is shown in Figure 3. The lower back has the highest average with 3.20, next is head and neck with a 3.13, middle back with 3.03. The higher scores are experienced in the head, neck, and back which are usually the parts adjusted and given strain when seated for long hours behind the computer. The buttock has an average of 2.77, the shoulder has 2.63 and 2.37 for the arm. The thigh has an average score of 2.23, leg and foot have 2.03, and the lowest value of 1.90 for the knee. The lower extremities have scored in the lower end, meaning that there isn't much discomfort experienced by the respondents in these body parts.

Table 4. Postural Risk Factors (% Frequency)

Workstation Parts	Position	Frequency	%
Chair Height	Neutral	13	43.33%
	Too low	9	30.00%
	Too high	8	26.67%
	No foot contact	0	0.00%
	Insufficient space under desk	1	3.33%
Chair depth	Neutral	16	53.33%
	Too long	4	13.33%
	Too short	10	33.33%
Armrest	Neutral	20	66.67%
	Too low	4	13.33%
	Too high	6	20.00%
	Hard surfaced	7	23.33%
	Too wide	1	3.33%
Back support	Neutral	10	33.33%
	No lumbar support	2	6.67%
	Angled too far	2	6.67%
	No back support	16	53.33%
	Work surface too high	2	6.67%
Monitor	Neutral	6	20.00%
	Too low	21	70.00%
	Too high	1	3.33%
	Neck twist	0	0.00%
	Glare on screen	3	10.00%
	Documents no holder	1	3.33%
Headset	Neutral	30	100.00%
	Too far to reach	0	0.00%
	Neck and shoulder hold	0	0.00%
Mouse	Neutral	25	83.33%
	Reaching to mouse	7	23.33%
	Mouse on different surface	0	0.00%
	Pinch grip on mouse	21	70.00%

	Palm rest in front of mouse	1	3.33%
Keyboard	Neutral	24	80.00%
	Wrists extended	6	20.00%
	Deviation while typing	0	0.00%
	Keyboard too high	0	0.00%
	Reaching to overhead items	0	0.00%

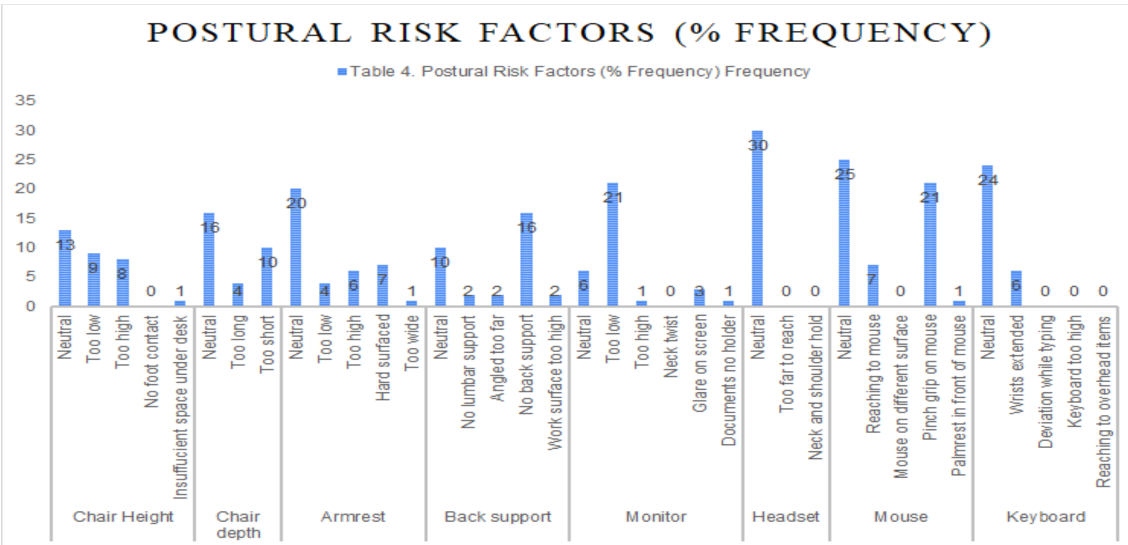

Figure 4. Postural Risk Factors (% Frequency)

The postural risk assessment obtained from the ROSA is shown in figure 4. Most of the respondents have neutral chair height and chair depth. The armrest of the majority is neutral but there are respondents with hard-surfaced armrests at the same time and this is due to the placement of their arms in their desks or tables which most don't have an additional soft surface to place on. There is no back support for most of the respondents and a factor causing this is the leaning of the respondents in their posture leading to an unsupported back. Most of the respondents have a monitor that is too low for them. The assessment for the headset is neutral for all. The mouse position of the respondents is mostly neutral and at pinch grip, at the same time because this is the more common type of mouse. The keyboard is neutral for most with a few having their wrists extended.

The monitor position being too low is the most frequent risk that is observed with a value of 21 out of 30 respondents, this causes the respondents to look lower than their normal eye level thus leading to a slouched head and neck position. This explains why the head and neck position obtained the second-highest average for the discomfort score in figure 3. This is tied with the pinch grip which is explainable because the common mouse causes you to have a pinch grip. The one having the next most notable frequent risk is coming from having no back support with a value of 16 and this is in line with the highest discomfort scores of the respondents in Figure 3 which are coming from the back.

3.2. Result of Statistical Analysis

Based on the results of using the method of ANOVA with posthoc analysis using Tukey's test, the following data are obtained:

Table 5. Summary of ANOVA Results

Respondents' Profile	Category	Mean	Std. Dev.	p-value	Remarks
BMI	underweight/overweight	23.8	5.87	0.011	significant
	normal	17.5	3.89		

No. of class hrs per day	4 - 6 hrs	18.9	4.43	0.01	significant
	6 -8 hrs	24.2	7.79		
	> 8 hrs	28.7	7.24		

For the BMI factor, with the computed p-value being 0.011 is less than the p alpha value of 0.05 we can conclude that we reject the null hypothesis and claim that there is a significant difference in the discomfort level of respondents based on BMI. Since there is a significant difference, it can be concluded that from the researchers' respondents, those with underweight/overweight BMI have higher discomfort levels compared to normal. For the number of class hours per day, With the computed p-value of 0.01 being less than the p alpha value of 0.05 we can conclude that we reject the null hypothesis and claim that there is a significant difference in the discomfort level of respondents studying between 4-6hours to those studying more than 8 hours. But for the 4-6hrs and 6-8hrs, they do not have a significant difference. The same can be said for the 6-8hrs and more than 8 hours as they also do not have a significant difference based on the result of Tukey's post hoc test

Table 6. Result of Correlation Analysis between ROSA Score and Discomfort Level

Dimensions:	Head and Neck	Shoulder	Arm	Middle back	Lower back	Buttock	Thigh	Knee	Leg and Foot
Chair Height	R = 0.155	R = 0.378	R = 0.183	R = -0.075	R = 0.540	R = 0.066	R = 0.591	R = 0.029	R = 0.116
	P-value = 0.412	P-value = 0.039	P-value = 0.334	P-value = 0.693	P-value = 0.002	P-value = 0.729	P-value = 0.001	P-value = 0.878	P-value = 0.543
Pan Depth	R = 0.286	R = 0.456	R = 0.358	R = 0.240	R = 0.672	R = 0.203	R = 0.533	R = 0.182	R = 0.200
	P-value = 0.126	P-value = 0.011	P-value = 0.052	P-value = 0.202	P-value = 0.000	P-value = 0.282	P-value = 0.002	P-value = 0.337	P-value = 0.288
Arm rest	R = 0.165	R = 0.613	R = 0.629	R = 0.352	R = 0.475	R = 0.418	R = 0.446	R = 0.365	R = 0.188
	P-value = 0.383	P-value = 0.000	P-value = 0.000	P-value = 0.057	P-value = 0.008	P-value = 0.022	P-value = 0.013	P-value = 0.047	P-value = 0.320
Back support	R = 0.137	R = 0.436	R = 0.169	R = -0.012	R = 0.734	R = 0.146	R = 0.744	R = 0.174	R = 0.238
	P-value = 0.472	P-value = 0.016	P-value = 0.372	P-value = 0.948	P-value = 0.000	P-value = 0.443	P-value = 0.000	P-value = 0.358	P-value = 0.205
Monitor	R = -0.012	R = -0.055	R = -0.030	R = -0.165	R = -0.200	R = 0.218	R = -0.022	R = 0.162	R = 0.300
	P-value = 0.948	P-value = 0.774	P-value = 0.876	P-value = 0.383	P-value = 0.290	P-value = 0.247	P-value = 0.909	P-value = 0.391	P-value = 0.107
Headset	R = 0.345	R = 0.248	R = 0.195	R = 0.290	R = 0.277	R = 0.131	R = 0.325	R = 0.160	R = 0.183
	P-value = 0.062	P-value = 0.187	P-value = 0.303	P-value = 0.120	P-value = 0.138	P-value = 0.490	P-value = 0.080	P-value = 0.398	P-value = 0.333
Mouse	R = 0.320	R = 0.876	R = 0.629	R = 0.242	R = 0.500	R = 0.375	R = 0.336	R = 0.445	R = 0.399
	P-value = 0.085	P-value = 0.000	P-value = 0.000	P-value = 0.198	P-value = 0.005	P-value = 0.041	P-value = 0.069	P-value = 0.014	P-value = 0.029
Keyboard	R = 0.234	R = 0.435	R = 0.835	R = 0.623	R = 0.396	R = 0.356	R = 0.202	R = 0.303	R = 0.379
	P-value = 0.212	P-value = 0.016	P-value = 0.000	P-value = 0.000	P-value = 0.030	P-value = 0.053	P-value = 0.285	P-value = 0.103	P-value = 0.039

Table 7. Correlation Analysis between ROSA Score and Discomfort Level

Dimensions:	Head and Neck	Shoulder	Arm	Middle back	Lower back	Buttock	Thigh	Knee	Leg and Foot
Chair Height	not significant	*significant	not significant	not significant	**significant	not significant	**significant	not significant	not significant
Pan Depth	not significant	*significant	not significant	not significant	**significant	not significant	**significant	not significant	not significant
Arm rest	not significant	**significant	**significant	not significant	**significant	*significant	*significant	*significant	not significant
Back support	not significant	*significant	not significant	not significant	**significant	not significant	**significant	not significant	not significant
Monitor	not significant	not significant	not significant	not significant	not significant	not significant	not significant	not significant	not significant
Headset	not significant	not significant	not significant	not significant	not significant	not significant	not significant	not significant	not significant
Mouse	not significant	**significant	**significant	not significant	**significant	*significant	not significant	*significant	*significant
Keyboard	not significant	*significant	**significant	**significant	*significant	not significant	not significant	not significant	*significant

The basis of the ranges used to regard the values of R or strength of the relationship utilized by the researchers is Pearson's correlation coefficient. An R-value of 0.3 and below represents a weak relationship, 0.3 to 0.5 represents a moderate relationship, while 0.5 and above represent a strong relationship. All p-values less than 0.05 mean there is a significant relationship between the two variables. While all p-values greater than 0.05 mean that there is no significant relationship.

Table 6 and Table 7 represent the results obtained with the use of the correlation between the ROSA score and discomfort level. Table 6, represents the values gathered for R and p-value where the R is located at the top while the p-value at the bottom. Table 7 represents whether the intersecting variables have a significant or non-significant relationship.

As shown above, of the obtained values, the dimension of chair height has a moderately significant relationship with the shoulder but has a strong significant relationship with the lower back and thigh. As a result, we can conclude that when a mismatch occurs for the chair height or whenever it is too low or too high, the body parts experiencing a strong relationship in discomfort are the lower back and thigh, as well as a moderate relationship in discomfort for the shoulder.

As shown above, of the obtained values, the dimension of pan depth has a moderately significant relationship with the shoulder and has a strong significant relationship with the lower back and thigh. As a result, we can conclude that when a mismatch occurs for the pan depth or whenever it is too low or too high, the subjects experience discomfort on the lower back and thigh, as well as moderate discomfort on the shoulder.

As shown above, of the obtained values, the dimension of the armrest has a strong significant relationship with the shoulder, arm, lower back, buttock. Thigh and knee. As a result, we can conclude that when a mismatch occurs for the armrest or whenever it is too low or too high, the subjects may experience discomfort on the shoulder and arms, as well as moderate discomfort on the lower back, buttock, thigh, and knee.

As shown above, of the obtained values, the dimension of back support has a moderately significant relationship with the shoulder lower back and thigh. As a result, we can conclude that when a mismatch occurs for the back support or whenever it is too low or too high, the subjects may experience discomfort on the lower back and thigh, as well as moderate discomfort on the shoulder.

The dimension of the monitor and headset in comparison to all the discomfort scores does not have a significant relationship since the p-values of all of them are above the p alpha value of 0.05. Therefore, it can be concluded that the monitor and headset do not affect the body discomfort scores.

As shown above, of the obtained values, the dimension of the mouse has a strong significant relationship with the shoulder, arm, lower back, buttock, knee, foot, and leg. That’s because the value obtained for R is 0.876 indicating a strong strength as it is above 0.5. As a result, we can conclude that when a mismatch occurs for the mouse or whenever it is too low or too high, the subjects may experience discomfort on the shoulder, arm, and lower back as well as a moderate discomfort on the buttock, knee and the leg and foot.

As shown above, of the obtained values, the dimension of the keyboard has a moderately significant relationship with the shoulder and lower back, leg and foot while the strong relationship with the arm and middle back. As a result, we can conclude that when a mismatch occurs for the keyboard or whenever it is too low or too high, the subjects may experience discomfort on the arm and the middle back, as well as a moderate discomfort on the shoulder, lower back, and the leg and foot.

5. Conclusion

The obtained results gave a proper indication that students with underweight/overweight BMI tend to experience higher discomfort levels compared to normal BMI. While longer periods of class hours do lead to students experiencing more painful discomforts thus affecting the efficiency of how they study. It can also be concluded that all the dimensions do not greatly affect the head and neck of the respondents. Where more particularly the dimensions of the Monitor and Headset are the only dimensions that do not play a role in affecting any body parts according to the calculations computed by the researchers based on the data given by the respondents. This study certainly does not entirely indicate or represent the many students out there around the world studying in online classes, which is why we should consider that not everyone has the necessities to achieve the best possible ergonomic setup that is suitable and convenient for their bodies. Therefore, conducting a similar study in the future that is more diverse in terms of the national origin of the respondents and where they live can provide a more realistic view when trying to acquire a comparison between the work posture and MSD of students at a projected view. Overall, the ROSA method together with the application of the Corlett and Bishop’s discomfort scale made the comparison of the relationship of this study more constructive and deliverable.

The conducted study is done within a restricted duration, and it should also be considered that it was also under an abnormal situation due to the ongoing COVID-19 pandemic. The researchers used all the resources available given the limited period. It is recommended for future researchers interested in this field of the topic to consider gathering more respondents to collect data from. It is best to get respondents from each category indicated in your questionnaire to compare them easily and to have equal counts under each classification. The recommended number of respondents is 100 to have the required data and not experience data shortage, thus resulting in the most accurate data. It is recommended to replicate this study to have a more diverse representation of the students undergoing online classes because the result of the study only applies to the respondents of the study itself. If possible, it is best to take the pictures of the respondents for the ROSA by the researchers themselves to get the best photo possible. It is recommended to consider all possible factors contributing to the musculoskeletal discomfort and problems of future respondents because the study only focused on the BMI and the hours of study.

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