

Original Research Article

Ergonomics Workstation Assessment of Musculoskeletal Disorders in University of Port Harcourt

ABSTRACT

This study examines the experiences of musculoskeletal discomfort among staff and students of the University of Port Harcourt as it relates to their workstations. Questionnaires were designed to extract information from respondents on their experience of musculoskeletal pains and other discomfort. A total of 400 questionnaires were distributed randomly to staff and students across the 3No.campuses of the University of Port Harcourt. Two hundred (200) questionnaires were distributed to staff (academic, 100 and non-academic, 100) out of which 115 were retrieved. Similarly, 200 questionnaires were distributed to students out of which 163 were retrieved; altogether 278 out of 400 yielded a 70% response rate. The study revealed that there is a significant relationship between the workstation set up and development of musculoskeletal discomfort in classrooms and offices in University of Port Harcourt. Most staff and students experience low back and neck pains due to poor ergonomic practices. Furthermore, most of the students respondents spend their reasonable time sitting in class receiving lectures (47%) and studying/reading (18.3%), respectively. While a handful of students (9%) stand for most of the time receiving lecture; due to limited number of seats.

Key words: *Ergonomics workstations, Assessment, Musculoskeletal Disorder, University of Port Harcourt.*

1. INTRODUCTION

The academic environment is not usually thought of when considering occupational health issues, yet, this environment demands high productivity and excellent performance from staff and students. These demands come with some penalty on staff and students particularly with respect to musculoskeletal disorders (MSDs). MSDs are prevalent where ergonomic workstation setup are not practiced. The academic institution is a highly active environment with multi-disciplinary programs, activities and individuals with various functions that are exposed to different hazards. However, due to the nature of most of the activities, it is likely that musculoskeletal disorder (such as body aches and pains) may be a problem. The classroom for instance just like any other work environment, good implementation of ergonomics is required for the maintenance of good health, improvement in work performance, learning and motivation (Patron, 2009).

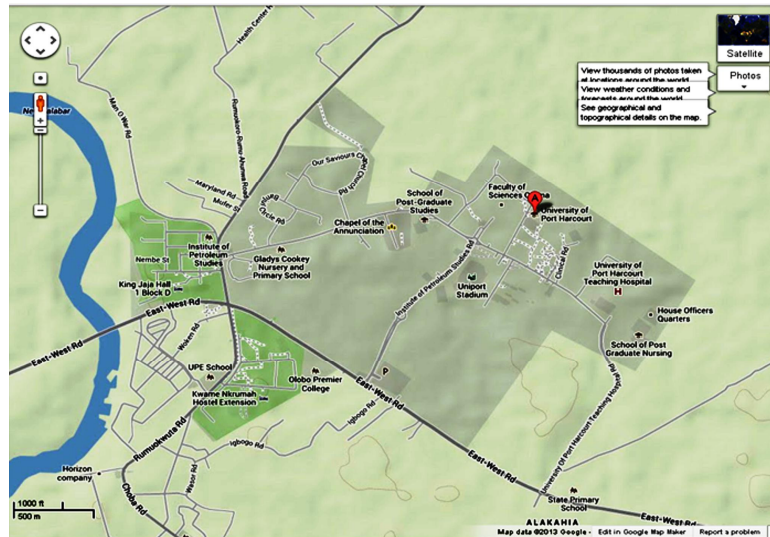
39 According to the Centre for Disease Control and Prevention (CDC, 1997), musculoskeletal
40 disorders are classified as injuries that affect the joints, muscles, nerves, cartilages, tendons
41 and discs in the spine. Musculoskeletal disorders are pains which can be caused by the
42 sedentary nature of a job or task. It is said that holding same position slowly diminishes
43 elasticity in the soft tissues in the back. Selby and Triano (2006) affirmed that a healthy body
44 can only tolerate staying in a position for about twenty (20) minutes. There have been
45 widespread agreements that ergonomics workstation set up fosters creative and innovative
46 performance (Mfon, 2009), and lack of it would result in a decline in higher situational
47 control, thereby threatening the performance and productivity. The use of a good workstation
48 design improves the posture of the staff and students in their daily functions to enhance
49 performance and productivity and thus, the possibility of musculoskeletal disorders
50 associated with these functions is significantly reduced.

51 Some studies have identified among other things poor health status of workers arising from
52 constant exposure to occupational health hazard as one of the cardinal factors militating
53 against employees' effective performance and productivity (CDC, 1997; Omokhodion and
54 Osungbade, 2002). According to Patron (2009), students spend at least eight (8) or more hours
55 in the academic environment and many of the chronic diseases that may manifest later in
56 their lives may be due at least in part to unfavourable environment or exposure.

57 **2. MATERIALS AND METHODS**

58 **2.1 STUDY AREA**

59 University of Port Harcourt was selected as the study area on the basis of size. It is located
60 within the coordinates of Latitude 4°5'19.24" and Longitude 6°55'25.41" in Choba, Port
61 Harcourt, the administrative capital of Rivers State. Port Harcourt metropolis is
62 predominantly made up of traders, civil servants and oil company workers, with an estimated
63 population of 1,005,904 (2006) inhabitants. The city is host to the University of Port
64 Harcourt, Choba; University of Port Harcourt Teaching Hospital, Alakahia; Rivers State
65 University of Science and Technology, Nkpolu; University of Education, Rumuolumini;
66 College of Arts and Science, several broadcast stations and many oil servicing companies,
67 respectively.



Sources: Google map (2015)
Figure 1: Map of the study area (University of Port Harcourt)

2.2 STUDY POPULATION

The study population comprises of teaching staff, non-teaching staff and students of the University of Port Harcourt. The probability sampling technique, precisely the stratified sampling technique was used to select the respondents for the study. The Yaro's Yamen's formula was adopted to determine the sample size (see Equation 1):

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where N = population size; n = sample size; and e = level of significance
 In this study, N = 49, 179 (VNTI , 2013); and Confidence level (e) = 0.05.
 Thus, the sample size for the study is obtained via Equation (1) as follows:

$$n = \frac{49,179}{1 + 49,179(0.05)^2} = 396.8 (\approx 400 \text{ persons})$$

2.3 DATA COLLECTION

Data collection involved selection of the sample population, questionnaire design and distribution, collation, and tabulation in frequency tables for analysis. The data for this study

were obtained through questionnaire as the primary source while the secondary sources were those from literature, observations and personal communication with the participants.

2.3.1 Inclusion Criteria

The criterion includes academic and non-academic staff as well as students who were 18 years and above at the time of study who gave their informed written consent for the study/research

2.3.2 Exclusion Criteria

The criteria excluded women who were pregnant and other staff and students that were sick at the time of data collection (questionnaire distribution) or those that may have suffered one kind of pain or another due to physical deformity.

2.3.3 Participants

Essentially, the population of this study comprises teaching staff, non-teaching staff and students of the University of Port Harcourt. The sample population was chosen, as we intend to investigate the experience of musculoskeletal discomfort among staff and students at different workstations associated with the University environment. However, because it is quite challenging to study the entire population of both staff and students of the University numbering over 25,000, a study population of 400 was selected. The participants distribution is as follows: 100 each for academic and non-academic staff and 200 for students, respectively. The socio-demographic information of the sample population (participants) is all about gender, age distribution, education, hour spent on work stations, etc (see Table 1).

2.3.4 Questionnaire

The questionnaire design is of two major parts. The first part addresses the background information of the participants with respect to Age, gender, and status on campus, that is, staff (academic/ non-academic) or students (see Table1). The second part consists of 31 No. Questions distributed as follows: i) 5 No. Questions on time at various work schedules; ii) 6 No. Questions on Break schedules; iii) 7 No. Questions on simple ergonomics checklist for eliminating possible MSDs; iv) 8 No. Questions on experience with lower back pains; and v) 5 No. Questions on experience with Neck and shoulder pains. The questionnaires are of self-completion format; and thus have three answer options, namely 'yes', 'no' and 'undecided'. Given that 'yes' is the correct answer, then 'no' and 'undecided'

become the wrong options. Examples of the questionnaires (part 2) are found as “Key” in Figures 2-6 (see Results & Discussion Section).

2.3.5 Procedure

Prior to the questionnaire administration a pre-test was carried out on twenty randomly selected staff and students from the target population to get their inputs and know where improvement could be made. The questionnaires were subsequently revised based on the information and feedback provided by these participants. The questions are based on information obtained from literature and personal communications with staff and students of the study Area.

2.4 DATA ANALYSIS

The questionnaire was designed on three answer options with the following ratings: 3 for ‘yes’, 2 for ‘no’, and 1 for ‘undecided’, respectively. Frequency tables were constructed to record the responses for each question which were subsequently transcribed to bar graphs to avoid duplication of results in both tables and graphs. Kendall’s Coefficient of Concordance (w) was adopted to test for the degree of agreement between respondents on the questionnaire parameters. Kendall’s coefficient is a non-parametric statistic used to assess degree of agreement among respondents (Nwaogazie, 2011). Its values range from zero (no agreement) to unity (complete agreement). Intermediate values signify low or high degree of unanimity between respondents.

The formula for calculating Kendall’s Coefficient (w) is given as Equations (2) – (4):

$$w = \frac{12 \sum (R_i - \bar{R})^2}{m^2 n (n^2 - 1)} \quad (2)$$

$$R_i = \sum_{j=1}^m r_i \times j \quad (3)$$

$$\bar{R} = \frac{1}{2} m (n + 1) \quad (4)$$

Where R_i is given by Equation (3) and it represents the total rank or rating given by respondents; i is an object, given a rank/rating, r_i by respondent j ; m represents the total number of respondents while n represents the total number of objects (in this case, questions); and $\bar{R}$ is the mean value of the total rating and is given by Equation (4).

3. RESULTS AND DISCUSSION

3.1 Socio-demographic Data Distribution

The data collected were represented in bar graphs and analyzed using Kendall's w-statistic (coefficient of concordance or level of agreement). Table 1 shows the demograph survey of the respondents. The socio-demographic feature of the respondents, showed that 66.9% of the sampled population were male, while 33.1% were female. Forty-eight percent (48%) of the sampled population are within the age bracket of 18-30 years while, 30.6% and 21.2% are within the age brackets of 31-50, and 51 years and above. The students represent the largest group.

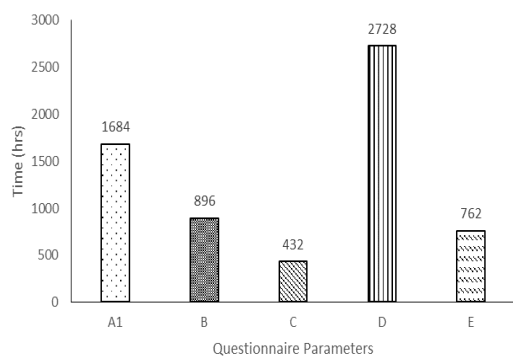
Table 1: Socio-demographic Statistics

Gender	No. of Respondents	Percentage (%)	Age Bracket	No. of Respondents	Percentage (%)	Sample frame	No. of Respondents	Percentage (%)
			18-30	134	48.2	Teaching Staff	32	11.5
Male	186	66.9	31-50	85	30.6	Non-Teaching staff	83	29.9
Female	92	33.1	51 and above	59	21.2	Students	163	58.6
	Σ 278	100		Σ 278	100		Σ 278	100

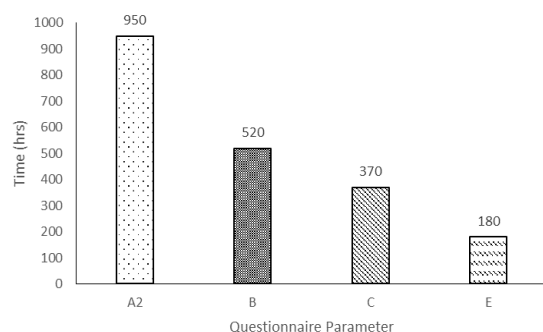
Results obtained from the field survey were first transcribed into frequency tables and subsequently plotted as bar charts. This approach is to avoid presenting same data sets in both tables and bar charts.

3.2 Time versus work schedule

Figure 2a shows that staff spend the largest amount of time sitting and this is followed by time on computer, reading, standing and on telephones, respectively. On the part of the students the largest amount of time is spent on receiving lectures, studying/reading, telephones and standing, respectively. For both staff and students more than fifty percent (50%) of their time is spent sitting for either computer & reading (staff) or receiving lectures & reading (for students). The issue of poor workstation in the university and reported cases of musculoskeletal disorder, particularly waist pains due to prolong sitting were established.



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(a) Staff

(b) Students

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Key for Figures 2a & b:

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A1: Time spent using computer; A2: Time spent receiving lectures B: Time spent studying/reading; C: Time spent on the telephone; D: Time spent standing.

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Figure 2: Time at various work schedules

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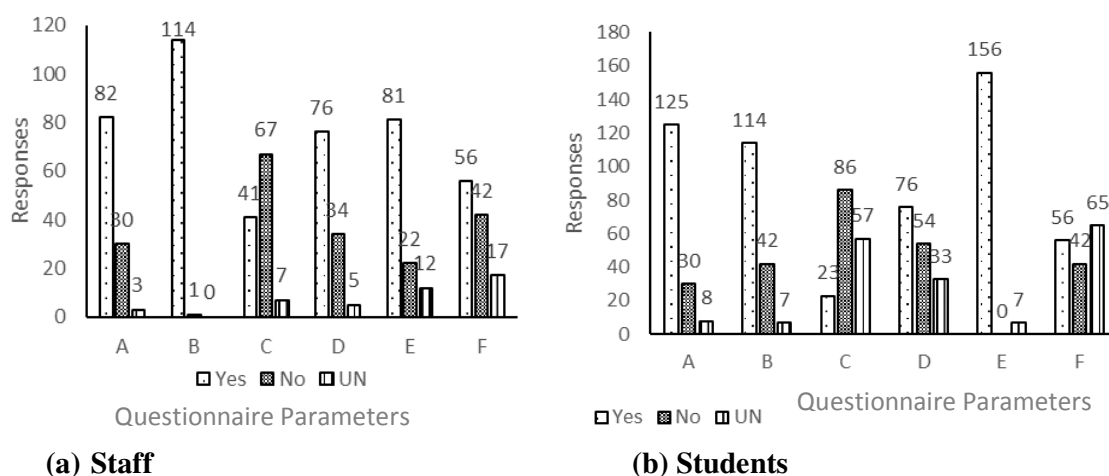
3.3 Break Schedule

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Given the staff response on break schedule, it is observed that they take break away from the office amidst prolonged computer use (see Figure 3a). The largest number of students agreed that breaks are taken between study hours (see Figure 3b). However, the Kendall's w-statistic for staff and students responses on break schedule indicates very low values of 8.4 and 38.9% (see Table 2), respectively. These values indicate lack of agreement amongst respondents on break schedule, which is apparent in Figures 3a & b. The combined values of 'No' and 'undecided' seem to outweigh the 'yes' response option. This indicated a gap on level of awareness on the subject matter.

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Key 3a & b:

A: Breaks taken during office hours (for staff) or after each class (for students); **B:** Breaks taken after prolonged computer use (staff) or between prolong lecture hours (for students); **C1:** Time taken to stretch after sitting for long; **C2:** Breaks are sufficient between lectures; **D:** Are breaks sufficient?; **E:** No breaks; **F1:** Is annual leave always taken?; **F2:** Sufficient break is given before and after examination

Figure 3 :Break schedule

Table 2: Summary of Kendall's statistic (w)[‡] for staff and students responses on break schedule

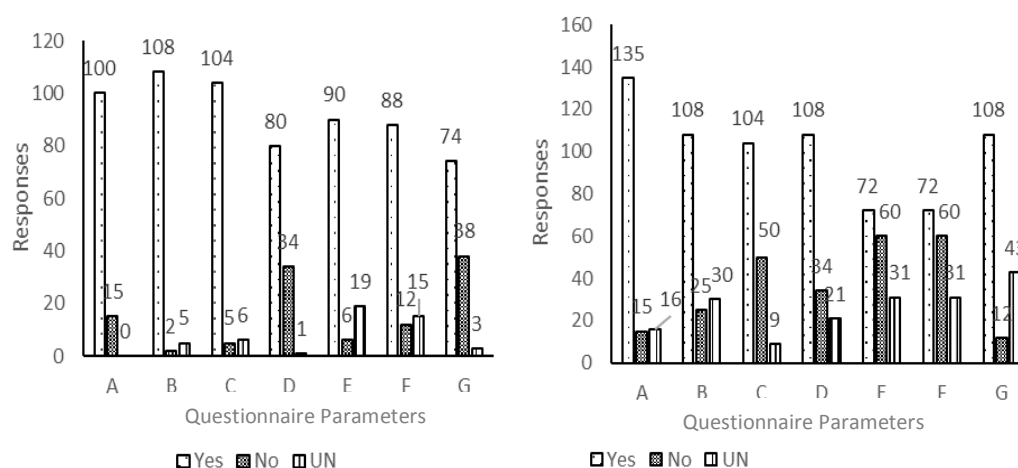
PARAMETER	Staff			Students		
	R_i	$\bar{R}$	$(R_i - \bar{R})^2$	R_i	$\bar{R}$	$(R_i - \bar{R})^2$
Q1	309	348	1521	314	492	31684
Q2	344	348	16	351	492	19881
Q3	264	348	7056	311	492	32761
Q4	301	348	2209	329	492	26569
Q5	299	348	2401	294	492	39204
Q6	269	348	6241	317	492	30625
TOTAL	$\Sigma 19444$			$\Sigma 180724$		
W	0.084014 (8.4%)			0.388689 (38.86%)		

[‡]The same procedure is employed for the analyses of the other questionnaire responses by applying Equations (2) – (4) to determine the degree of agreement amongst respondents.

3.4 Response at Simple Ergonomics Checklist

The staff and students' responses to simple ergonomics checklist are both complimentary and high positive values (the 'yes' option) across the seven questionnaire parameters (questions) for staff and 5 out of 7 for students. The positive response indicate the respondents who answered "yes" are in the range of 64.3 – 93.9% for staff and 63.8 - 81% for students as against two other options ("No" and "undecided"). Only 2 out of 7 questionnaire parameters that a gap was observed for which the wrong answer on the part of students recorded 56% (that is, 'no' and 'undecided' combined)

In addition, Figure 4a shows teaching and non-teaching staff workstations in the University of Port Harcourt are likely to cause MSDs challenge of muscle and joint ache. Apparently, the level of Safety education on Ergonomics workstation set-up is very low. Also, Figure 4b shows a good number of students that are likely to experience musculoskeletal aches / pains due to poor ergonomic set up at their lecture halls and study areas. Also, this highlights the level of Safety education on Ergonomics and workstation set-up for which there is a gap.



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209 a) Staff

b) Students

210 **Key for Figures 4a & b:**

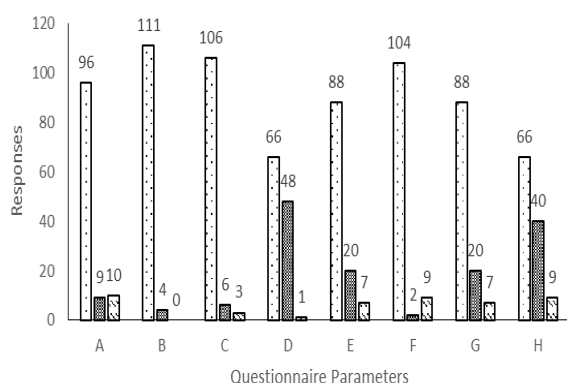
211 *A: No working clearance between leg, knee and desk; B: No standing alternative with sitting & working; C: You don't work*
 212 *within normal reach of arms/legs; D: There is not enough room for a tall staff; E: No comfortable space between edge of*
 213 *seat and back of knees; F: Keyboard is at a height which places the forearms approximately parallel with the floor; and G:*
 214 *Arm rest is not used or adjusted to support or suit arms movement.*

215 **Figure 4: Staff/ Students response to simple ergonomics checklist**

216 3.5 Response on Experience of Lower Back Aches

217 The number of staff and students that answered 'yes' option to all the questions are by
 218 far higher than those with 'No' and 'undecided' options with the exception of questions D &
 219 H for staff (see Figure 5a) and question H for students (Figure 5b). The range of the positive
 220 responses of the questions is 7 out of 8 for both staff and students. The Kendall's w-statistic
 221 for staff and students on the experience of back aches are 32.4 and 47.0%, respectively. This
 222 implies that the level of agreement amongst the respondents on the issue of lower backaches
 223 is moderately low for both staff and students. The level of agreement may be blamed on the
 224 level of awareness of the respondents on effects of poor workstation setup.

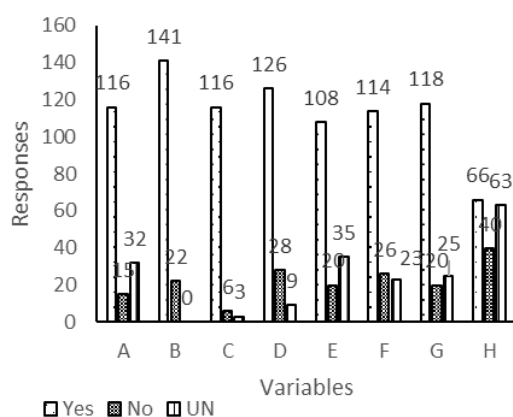
225 The high positive responses of staff and students on the experience of lower back ache
 226 show to a large extent that the teaching and non-teaching staff as well as students
 227 workstations in the University of Port Harcourt are prone to cause MSDs of disc and spine,
 228 leading to back ache. In effect continuous neglect of proper ergonomics in the workstation
 229 set up of offices, may result into temporary injuries in a short term or permanent injuries in a
 230 long term. In turn this would lead to poor performance, decreased efficiency and loss of
 231 time. The students' responses also highlighted the fact that most seats used in their lecture
 232 rooms have no Back Rest. Hence, it is likely that continuously neglect of proper ergonomics
 233 in the workstation set up of class rooms, may result to injuries which would in turn lead to
 234 poor performance, decreased efficiency and loss of time.



235 ☐ Yes ☐ No ☐ UN

Questionnaire Parameters

235



236 ☐ Yes ☐ No ☐ UN

Variables

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237 a) Staff

b) Students

238 **Key for Figures 5a & b:**

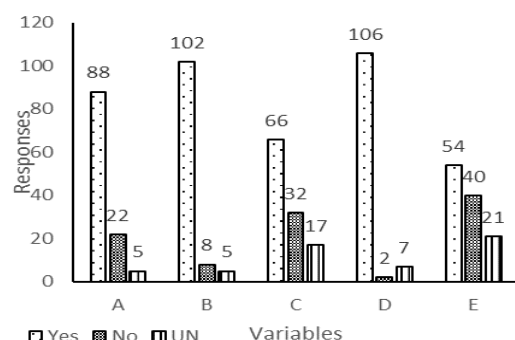
239 **A:** You bend over to use monitor, keyboard, input device or while making notes?; **B:** Backrest that provides support in the
 240 low back is absent; **C:** Your feet touch the floor when seated

D: Your feet do not touch the floor when sitted; E: Absence of comfortable space between the edge of the seat and the back of the knees; F: You lean forward to read blurry text; G: You lift loads away from the body, thereby increasing load on the low back and results in reaching and bending; and H: You stand for several hours.

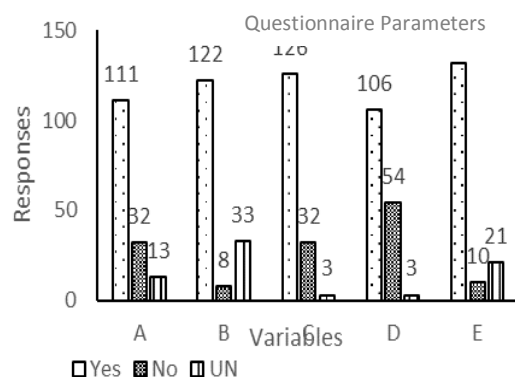
Figure 5: Staff and Students responses on experience of lower back aches

3.6 Response on Experience of Neck and Shoulder Aches

The positive response level of 57.4 – 92.2% for staff and 68.1 – 81.0% for students on the issue of neck and shoulder aches are supportive of poor ergonomics workstation setup at the University of Port Harcourt. On the responses to the questions, a total of 4 out of 5 and 5 out of 5 were recorded for staff and students with high positive values, respectively. As evident in Figure 6a, poor workstations and ergonomic practice make a number of the University staff prone to neck and shoulder aches/pain which could lead to development of MSDs. Better ergonomics awareness and proper workstation design can curb this menace. To a great extent the students' workstations in the University of Port Harcourt are likely to cause Neck and Shoulder Aches (see Figure 6b) which may result to MSDs. Physical observation indicates that there are no real ergonomic considerations in the procurement of classroom furniture as some seats or desks are either too high or too low. Thus, continuous neglect of proper ergonomics in the workstation set up of class rooms, may result to discomfort which apparently leads to poor performance on the part of students.



C D E
Questionnaire Parameters



a) Staff

b) Students

Key for Figures 6a & b:

A: Long reaches to frequently used input devices; **B:** When hunching the shoulders due to high work surface; **C:** When placing work above the shoulder; **D:** There is no arm rest; and **E:** The seat is too low or desk too high.

Figure 6: Staff and Students response to neck and shoulder aches

It is interesting to note that the major findings from this study which includes poor awareness of ergonomic workstation, the resultant effects of poor ergonomic (pains in lower and upper backs, necks) in staff and students are in agreement with the findings of Nwaogazie et al. (2016), where most Office – Based Civil servants in Rivers State, Nigeria suffers from pains in their lower back. Also, with reference to the finding on poor workstation for staff and ergonomical compliance furnitures for lecture hall/classrooms, this agrees with the affirmation of Devereux et al. (2002) that the ergonomical compliance of the office and workstation environment is a major contributing factor to musculoskeletal disorder.

4. CONCLUSION & RECOMMENDATION

4.1 CONCLUSION

Based on the results of this study, the following conclusion can be made:

- i) The awareness of ergonomics workstation is low at the University of Port Harcourt;
- ii) Most respondents experience pain in lower and upper backs, and necks;
- iii) Most respondents maintain awkward postures at work or in the classroom as they frequently lean forward, bend their necks or sit in classrooms or offices that do not allow enough leg room or knee clearance;
- iv) Most of the staff respondents spend reasonable part of their time using computer (26%) and standing while teaching (42%);
- v) Most of the students respondents spend their reasonable time sitting in class receiving lectures (47%) and studying/reading (18.3%), respectively;
- vi) A handful of students (9%) stand for most of the time receiving lecture due to limited number of seats;
- vii) Some seats and desks are too high, while some are too low leading to hunching of shoulders or slouching resulting in shoulder and back pain; and
- viii) Due consideration is not given to ergonomics in the procurement of furniture.

4.2 RECOMMENDATION

From this study, Musculoskeletal Disorder (MSD) amongst staff and students from the University of Port Harcourt can be reduced to its barest minimum by the following actions:

- i) The workstations for staff and students within the University of Port Harcourt should be upgraded and ergonomically compliant;
- ii) The University management should frequently organize safety seminar on ergonomic workstation set-up for students and staff of the institution;
- iii) The University should carry out frequent ergonomic audit of all its workstations including the students lecture hall; and
- iv) There should be sufficient breaks between lectures for students of the institution.

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