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Ergonomic Challenges of Employees Using Computers at Work in a Tertiary Institution in Ghana

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Abstract

Objective: Ergonomically designed workstations have direct bearing on the comfort and safety of office computer users. Tremendous usage of computers in most offices of emerging economies have however, not seen accompanying applications of ergonomics in the design of computer workstations despite the numerous benefits. Injuries and discomforts therefore have higher propensity to occur since most offices formally designed for paper-based work now accommodate computer workstations, without corresponding redesigning. The study therefore sought to assess computer workstation designs in administrative offices at Kwame Nkrumah University of Science and Technology, with the aim of creating awareness of ergonomics and its application among administrative office computer users.

Method: A total of 150 office employees purposively sampled participated in this study. Respondents selected included secretaries, research assistants and data and account processors. This cross-sectional study consisted of a checklist (computer workstation components, visual complaints and ergonomics knowledge), work posture observations and measurements of workstation linear distances and monitor tilt angle. Descriptive statistics using Statistical Package for Social Sciences (SPSS) Version 20.0 was used for data analysis.

Results: Almost half (50%) of respondents had monitors facing windows without appropriate blinds, 42% with monitor tilt angle less than 10 degrees and majority (76%) observed monitors either at or above horizontal eye level. Most (70%) of the workers acknowledged not having knowledge of ergonomics whiles 100% noted that they did not have any ergonomic assessment of their workstations. Neck, back and shoulder pains were reported by 85% of respondents while 73% complained of eyestrain.

Conclusion: The study revealed lack of information and skills in ergonomics contributing to poor ergonomic conditions and consequent visual discomforts among computer users in the work place.

Keywords: Computer; Workstation; Ergonomics; Administrative; Tilt angle; Musculoskeletal disorders

Introduction

Office work is rapidly changing, as new developments in computer technology which make jobs easier are emerging. This emergence presents occupational health and safety problems for both management and employees [1]. While the first few decades of the development of the computer for business focused mainly on automating a wide range of industrial processes, the next step brought personal computers as productivity tools and entertainment devices to homes and workplaces everywhere. More recent refinements in computers and information technology such as mobile devices have led to a host of business and consumer-focused "apps" designed to help people to be more organized, efficient and productive [2].

Sitting at a desk and conducting daily routines on the computer for hours on end demands a computer workstation setup. Considering the long working hours and demands on a modern office worker, the nature and design of such workstation should be proper to ensure the comfort, safety and the total well-being of the worker. The application of the scientific discipline of ergonomics, defined as the "the science of fitting workplace conditions and job demands to the capabilities and inabilities of the individual worker" [3], is a vital element in the crafting of properly designed workstation. The concept of an ergonomically designed workstation is complex and depends on a myriad of elements. However, this simply should consist of a proper seating, adequate desk height, and proper distance of computer from the users' eyes as well as environmental issues such as proper lighting, noise levels among others [4].

The problem of an improper workstation design may be due to lack of knowledge or inappropriate application of ergonomic principles. Workstation designs significantly affect working posture, which in turn, contributes to physical symptoms experienced by Visual Display Unit (VDU) operators [5,6]. The adverse health consequences of this discrepancy mostly include musculoskeletal disorders and visual discomforts. For instance, ergonomic workstation deficiency hazards in a report presented to the United States Bureau of Labor Statistics has been noted as the fastest growing category of work-related illnesses [7] and worker compensation claims as well as absenteeism are drastically soaring due to same [8].

In most cases, symptoms of computer vision syndrome or digital eye strain occur because the visual demands of the task exceed the visual

abilities of the individual to comfortably perform them. These symptoms may be caused by ergonomic workstation failures such as poor lighting, glare on digital screens, improper viewing distances, poor seating procedure, uncorrected vision problems and a combination of these factors [9].

Proper ergonomic design and adjustment of the computer and the work environment therefore play an important role in every office setting as it can increase productivity and worker comfort by decreasing the visual demands of the task.

Literature review on this subject revealed little information on ergonomic assessment in Ghana. Furthermore, very little is known amongst professionals regarding conducive workstation and the health consequences associated with prolonged computer use as well as improper workstation design.

This study was therefore carried out to assess computer workstations setup in administrative offices and the challenges workers face at the work place in the tertiary institution, with the aim of creating awareness of ergonomics and its application among administrative office computer users and by extension the larger university community.

Methods

This descriptive cross-sectional study was undertaken at administrative offices of the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi. The University is situated approximately on a 16 km^2 facility, about 7 km away from the central business district of the city of Kumasi. The staff strength of the University as at 2012 was 3,698 comprising of 1,010 senior members (senior lecturers, junior lecturers and senior administrators), 992 senior staff (non-teaching support staff with first degree) and 1,696 junior staff (support staff with less than first degree) [10]. The participants recruited for the study were administrative workers (secretaries, research assistants and data and account processors) who routinely work at a computer for a total of 4 hours or more during an 8-hour period of work, a close definition based on generally accepted ergonomic guidelines [11].

The study area was divided into seven clusters, comprising the University's six colleges and the school administration. Out of these, four clusters were randomly selected using a simple random sampling technique. One hundred and fifty (150) respondents present on the days of the visits who consented to participate in the study were sampled from these clusters for the study.

Data collection technique

The major instrument used for the study was a structured questionnaire (Supplementary 1). The questionnaire was designed with Likert scale questions based on ergonomic guidelines at computer workstation designs found in literature [12]. The questionnaires were self-administered and certain physical measurements of workstations were taken. The questionnaire consisted of four sections: Questions on demographics, physical workstation characteristics, visual strain symptoms as related to computer usage and ergonomics knowledge.

Instruments

Tape measure was used to measure linear distances and protractor used to measure angle of tilt of the monitor.

Measurements of linear distances and angles

The measurements were designed to quantify the actual working posture of each individual employee while at his/her computer workstation. The employee was asked to maintain his/her usual working postures while measurements were taken using measuring tape. This also helped in the determination of the sitting postures adopted as well as the relative position of top of monitor to horizontal eye level. The linear measurement indicators included: current seat height from the floor, monitor height from the floor, and distance between the eyes and the computer monitor.

The linear measurements of the following variables were measured as follows:

Seat height: This was measured as the distance from the floor to the top surface of the seat using the tape measure. Ideal seat height is between 38 cm-52 cm [13].

Monitor height: This was measured as the distance from the floor to the middle of the monitor using the tape measure. Ideal monitor height is between 90 cm-115 cm [13].

Eye-to-monitor distance: This was measured as the distance from the eye to the top of the monitor using the tape measure. Ideal eye-to-monitor distance is between 60 cm-90 cm [13].

Postural positions

Gaze angle and sitting posture were evaluated by observation. These were noted by asking each participant to perform his or her usual key-entry task in his or her usual keying position. Gaze angle was taken based on the relative eye position to the middle of the monitor whilst the sitting posture took cognizance of the bend of the head from the "neutral" straight-up position.

Ethical consideration

Permission to carry out the study was obtained from the relevant heads of the various administrative units prior to the initiation of the project. Informed consent was obtained from the participants. The purpose of the study was explained to the study subjects and they were assured about the confidentiality and anonymity of the information so obtained.

Data analysis

The collected data was coded and entered in the Statistical Package for Social Sciences (SPSS) version 20.0 compatible with Windows. Descriptive and frequency analysis were used to summarize the data distribution, including demographic information, work practices, physical workstation characteristics and work posture.

Results

Demographic information of respondents

Table 1 below presents the demographic profile of study respondents. The respondents comprised 62.7% males and had a mean age of 37.4 ± 11.5 years.

Physical attributes of the workstations are reported in table 2. Of the 150 workstations assessed, 85.0% had the monitor placed on the table

or desk surface and 12.0% had the monitor placed on the processor, which in turn was placed on the desk surface.

Gender Distribution Of Respondents	
Male	94(62.7%)
Female	56(37.3%)
Total	150 (100%)
Age of Respondents	
Age Range (years)	Mean Age (Mean ± SD) in years
20 to 59	37.4 ±11.5
Nature of job undertaken by respondents	
Administrative assistants	96(64.0%)
Data and account processors	42(28.0%)
Research assistants	12(8.0%)
Total	150 (100%)
Hours spent in front of a computer	
1-4 h/day	15 (10.0%)
5-8 h/day	94 (62.7%)
8 h/day	41 (27.3%)
Total	150 (100%)

Table 1: Demographic profile of study participants.

Furniture

Eye to monitor distance (cm)	**n (%)**
< 60	22 (14.7)
60-90	91 (60.7)
> 90	37 (24.6)
Tilt angle (degree)	
< 10	63 (42.0)
10-20	68 (45.3)
>20	19 (12.7)
Height of monitor (cm)	
< 90	1 (0.7)
90-115	135 (90.0)
>115	14 (9.3)
Height of chair (cm)	
38-52	92 (61.3)
>52	58 (38.7)

Table 2: Measured workstation attributes among study respondents.

Nearly all, (85.0%) of the workstations evaluated used office tables, 104 (69.3%) respondents used semi adjustable chairs (only the height could be adjusted) and the remaining 46 (30.7%) used non-adjustable office chairs.`

In table 3, the worker's eye level at the monitor measurements are displayed. It shows that only 24.0% of the respondents had their eye level below the horizontal.

Horizontal eye level to monitor	**n (%)**
Upward (Above User's eye level)	53 (35.3)
Horizontal (At User's eye level)	61 (40.7)
Downward (Below User's eye level)	36 (24.0)

Table 3: Worker Eye Level at Monitor.

Computer Vision Syndrome (CVS) Symptoms

In table 4a the symptoms associated with computer vision syndrome are displayed. Musculoskeletal symptoms (neck, back and shoulder pains) have the highest prevalence among the respondents (85%) followed by eyestrain (74%).

S/N	**Symptoms**	**n (%)**
1	Eyestrain	111 (74.0)
2	Blurred near vision	35 (23.3)
3	Glare	30 (20.0)
4	Difficulty focusing	32 (21.3)
5	Blurred distance vision	30 (20.0)
6	Burning, itching	87 (58.0)
7	Dry eye	67 (44.7)
8	Headaches	72 (48.0)
9	Neck, back, shoulder pain	128 (85.3)
10	Double vision	21 (14.0)

Table 4a: Computer vision syndrome symptom distribution among respondents.

Tables 4b and 4c illustrate the degree of discomfort and the frequency with which the various symptoms of Computer Vision Syndrome occurred among users while working on the computer respectively. The highest degree of discomfort was reported as those of neck, back and shoulder pains with a total of 55.0% describing the symptom as either severe or moderate. Other details are displayed in Table 4b.

Knowledge of ergonomics

Most (70%) of the workers acknowledged not having knowledge of ergonomics whiles all the respondents (100%) noted that they did not have any ergonomic assessment of their workstations. An individual's knowledge base plays a crucial role in the behavioral patterns he or she adopts. Thus, the low knowledge base of the respondents in this survey

regarding ergonomics could affect their work habits, postures adopted and their perceptions towards the discomforts they were experiencing.

S/N	Symptoms	Severe	Moderate	Mild	Never
1	Eyestrain	8.0	24.0	42.0	26.0
2	Blurred near vision	5.3	2.0	16.0	76.7
3	Glare	2.0	5.0	13.0	80.0
4	Difficulty focusing	0.0	8.0	13.3	78.7
5	Blurred distance vision	3.0	4.0	13.0	80.0
6	Burning, itching	6.0	14.0	38.0	42.0
7	Dry eye	8.7	10.0	26.0	55.3
8	Headaches	7.0	9.0	32.0	52.0
9	Neck, back, shoulder pain	17.3	38.0	30.0	14.7
10	Double vision	2.0	3.0	9.0	86.0

Table 4b: Symptoms Severity and Number of Respondents (%).

S/N	Symptoms	Never	Occasionally	Frequently
1	Eyestrain	26.0	66.0	8.0
2	Blurred near vision	76.7	17.3	6.0
3	Glare	80.0	16.0	4.0
4	Difficulty focusing	78.7	18.0	3.3
5	Blurred distance vision	80.0	14.0	6.0
6	Burning, itching	42.0	50.0	8.0
7	Dry eye	55.3	38.0	6.7
8	Headaches	52.0	41.0	7.0
9	Neck, back, shoulder pain	14.7	58.0	27.3
10	Double vision	86.0	12.0	2.0

Table 4c: Symptoms Frequency and Number of Respondents (%).

Discussion

According to this study, deviations in the physical layout and measurement of certain key dimensions of a safe and adequate workstation from recommended designs and parameters were observed. Most of the workstations surveyed in the present study had the normal office tables and chairs (with no ergonomic features), some semi-adjustable chairs, poor lighting condition and computer monitors facing windows. These deviations from recommendations greatly contribute to ergonomic problems.

Our results were similar to and consistent with a study conducted by Shikdar and Al-Kindi among forty employees and forty workstations in an oil company in Sultanate of Oman. In that study, 45% of the employees used nonadjustable chairs, 48% of computers faced windows, 45% of the employees adopted bent and unsupported back postures, and 20% used office tables for computers [14]. These results lead credence to the sort of workstations used in the developing world. Thus most workstations being used by prolonged VDU users in developing countries still lack ergonomically designed furniture for comfortable computer work. In addition, the research shows significant level of neck, back and shoulder pain, which could be attributed to the ergonomic deficiencies at the workstations surveyed. This observation is consistent with research studies that indicate that many cases of shoulder and neck pain were caused by inappropriate design or use of furniture [14,15].

The findings from this study also revealed that all respondents suffer one form or another of visual discomfort as a result of prolonged computer usage. Prominent amongst these discomforts were neck, back and shoulder pains, eyestrain, burning and itchy, headache and red eyes. A study by Sheedy [16], also showed the five most common symptoms of CVS as eyestrain, headache, blurred vision, dry eyes, and neck/back pain. These symptoms could be attributed to poor workstation ergonomics ranging from bad lighting conditions, bad ventilation, and monitor placement [17] amongst others.

Our study, however, revealed a relatively low prevalence of the symptoms of CVS as compared with other studies. For instance, a research work conducted among clerical VDT workers by Smith et al., revealed burning eyes (80%), irritated eyes (74%) and blurred vision (71%) as the most frequent complaints [18]. This difference could be attributed to several reasons, notable among them are the low level of knowledge of CVS among study population, differences in pain threshold, differences in sampling technique and sample size as well as the methodologies adopted. According to Anshel and Sheedy, though the problem of CVS is very prevalent, CVS still remains unknown to a lot of computer users including professional computer users [16,19]. Thus a lot of the respondents in this present survey might have been experiencing these symptoms, but very few of them were well informed enough to be able to attribute these symptoms to prolonged computer work.

Conclusion and Recommendation

Workstations employed for computer work at the university deviate considerably from the ergonomic workstation design per standards and recommendations from industrialized world. Respondents lacked knowledge regarding ergonomic principles and their applications within a Visual Display Unit (VDU) office environment. Therefore, the workstations surveyed were not ergonomically safe and comfortable for prolonged computer use.

We recommend that:

1. Computer workstations in offices should be laid out following ergonomics standards, guidelines, and recommendations.

2. Ergonomically designed facilities (workstation components) should be provided in order to better maintain and follow ergonomics standards.

Limitation of Study

As a cross-sectional study, comprehensive ocular and general health assessment were not carried out for any respondent. The authors acknowledge this as a limitation as musculoskeletal disorders could arise also as a result of medical complications and not from ergonomic deficiencies in workstations only. The study did not look at the causal relationship between the postures as adopted by respondents in the study with the ocular symptoms they experience. We could thus not tell the extent to which the "supposed" poor postures contributed to the development of these symptoms.

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