

Biomechanics, visual and carrying discomfort: The role of ergonomics among technology education professionals on the use of laptop in no-desk settings

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Abstract. The use of laptop computer in our daily activities due to rapid changes in technology and industries has a great role in the fourth industrial revolution and directly or indirectly affect the way we learn, live and work. The research study intends to investigate the role of ergonomics and the impact of the use of laptop computer on biomechanics, visual and carrying discomfort among technology education professionals in Nigeria. The study used questionnaires, in order to collect data and empirical data were used for the descriptive analysis. The objectives are to examine how the use of laptop computer affect the biomechanics, visualization and carrying discomfort of the technology educators. The research so far discovered how laptop computer users faced problems like back pains, muscular pains, visual and carrying discomfort and lack of ergonomic knowledge and awareness among technical and vocational education professionals.

1. Introduction

There is an increasing laptop-use compared to the use of a desktop computer [1]. The usage of laptop computer is continuously increasing due to so many reasons. However [2], cited Moffet et al carried out a study and reported that when the laptop was positioned in the subject's lap, an increase in discomfort in the neck and shoulder regions was reported. Both laptop positions resulted in high muscle load levels in the trapezius and deltoid muscles. According to [2], the risk of developing musculoskeletal complaints is correlated to the duration of the laptop computer usage. Few studies have reported on the numerous cases and complain on the use of laptop computer in no-desk settings on biomechanics, visual and carrying discomfort among Technology education professional in Nigeria.

Regular usage of laptop computer greater than three hours (3hrs) was associated with a higher prevalence of musculoskeletal complaints [3]. According to [1] complains about mental, physical and sleep problems significantly aggravate with an increasing duration. Study conducted by [4] revealed that 20% of the laptop users among students suffered from at least one of the musculoskeletal problems.



Literature in ergonomics and human factors shows that computer usage is usually related to visual problems. The impact of visual fatigue may affect working behavior and the human-system interaction [5]. Extensive viewing of the laptop computer screen can lead to eye discomfort, fatigue, blurred vision and headaches, dry eyes and other symptoms of eyestrain [6].

Alpay and Hedge [7] observed that ease of carrying in other words portability is the second most anticipated needs for a potential users of laptop computer. Unlike desktop which are fixed in one place but laptop computers are movable despite the laptop have been getting lighter and smaller, many people carry them with power supply cords, spare batteries, or external peripherals all adding weight to their laptop bag [8]. Studies carried out by [9] show that a considerable number of those carrying improper bags and backpacks which seen to be main culprits for those disorders.

The main aims of this study are to analyze the impact for the laptop on biomechanics, visual and carrying discomfort. While the research objectives of this paper were to examine how the use of laptop computer affect the biomechanics, visualization and the carrying discomfort.

2 Method

2.1 The participants

The participants were professionals of technology education in the northern Nigeria tertiary institutions such as universities and polytechnics from the departments of technical and vocational education. The population ($N = 60$) for the study comprised all the technology education in the four selected tertiary institutions in northern Nigeria. A total of 52 questionnaires were distributed to the sample based on [10] sample size table. Only fifty (50) questionnaires were returned for data analysis. Participants were selected using purposeful sampling. [11] states that in purposive sampling - also referred to as judgment sampling - sample elements judged to be typical, or representative, are chosen from the population. Non-probability sampling is used when the individual member of the population do not have an equal likelihood of being selected to be a member of the sample [12]. However, one of the shortcomings of this technique according to [13] is that, a researcher cannot estimate sampling error and he cannot generalize research findings beyond the sample studied.

2.2 Instruments

The instruments used for the research were structured questionnaire. The data were gathered through questionnaire which consist of 65 items. For many good reasons, a questionnaire is the most widely used technique for obtaining information from subjects. A questionnaire is relatively economical and can ensure anonymity [14]. The questionnaires were developed by the researcher after extensive review of the literature on ergonomics and technology education.

2.3 Validity and reliability of instruments

The instrument were reviewed and validated earlier by panel of experts from Abubakar Tafawa Balewa University Bauchi and some adjustments and edits were made based on the experts' observation. The reliability for the instruments Cronbach's Coefficient Alpha were used and was estimated to be $\alpha = .78$. The value obtained represented the reliability coefficient of the questionnaire based on the views that a value of around 0.70 or greater is widely considered desirable [15] and [16].

2.4 Data analysis

In this study, the data analysis for questionnaire were analyzed using international business machine, statistical package for social sciences (IBM SPSS) statistics version 23. Descriptive statistics were used in order to achieve objectives 1, 2 and 3. Also to investigate differences in responses and opinions across

many of demographic variables (gender, qualifications, age etc.). In this study, descriptive statistics such as frequency and percentage was used to describe the data where appropriate.

3. Results and discussion

3.1 Objective 1 Biomechanical effect on the use of laptop computer

The respondents' duration of laptop usage was quite impressive that, 30 (91%) possessed a laptop for more than 5 years which shows a long period of experience of the respondents and help the researcher findings. The figure 1 illustrate on each posture and shows how the respondents response to different postures. Desk sitting indicates that about 70% use desk sitting when using laptop and in the extreme end more than 80% never use their laptop in lying position. The remaining postures were averagely used occasionally, rarely or never and less than 15% use other postures constantly.

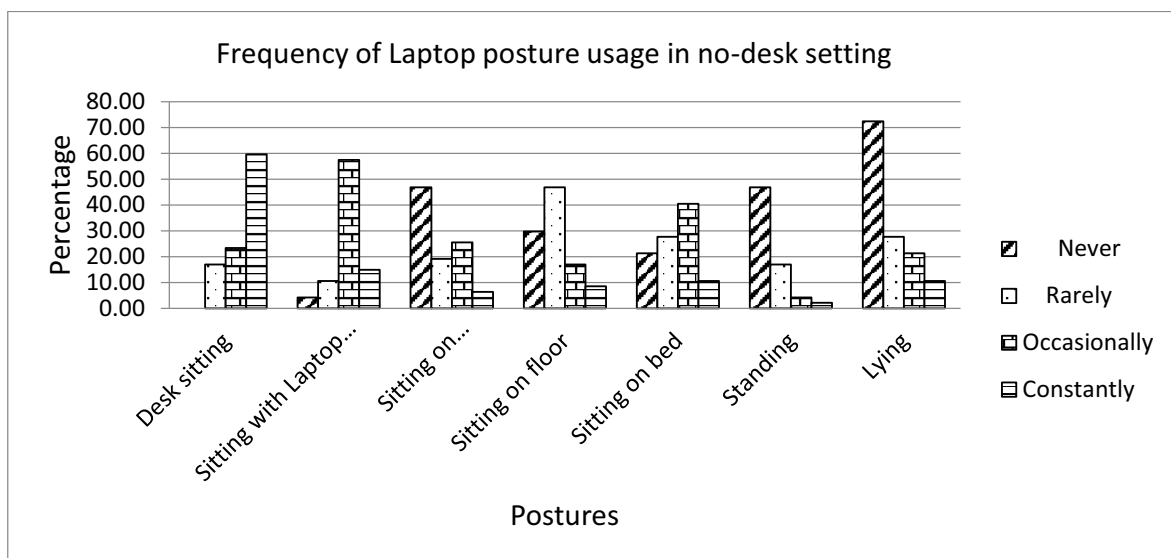


Figure 1. Laptop usage in no desk setting

The figure 2 indicate that, 60% to 70% of the respondent never used input devices such as mouse and external key board when using laptop in no-desk posture. While rarely 40% used external key board and touch pads. The result shows how laptop users do not used external devices and a such these will increase the rate of laptop hazard.

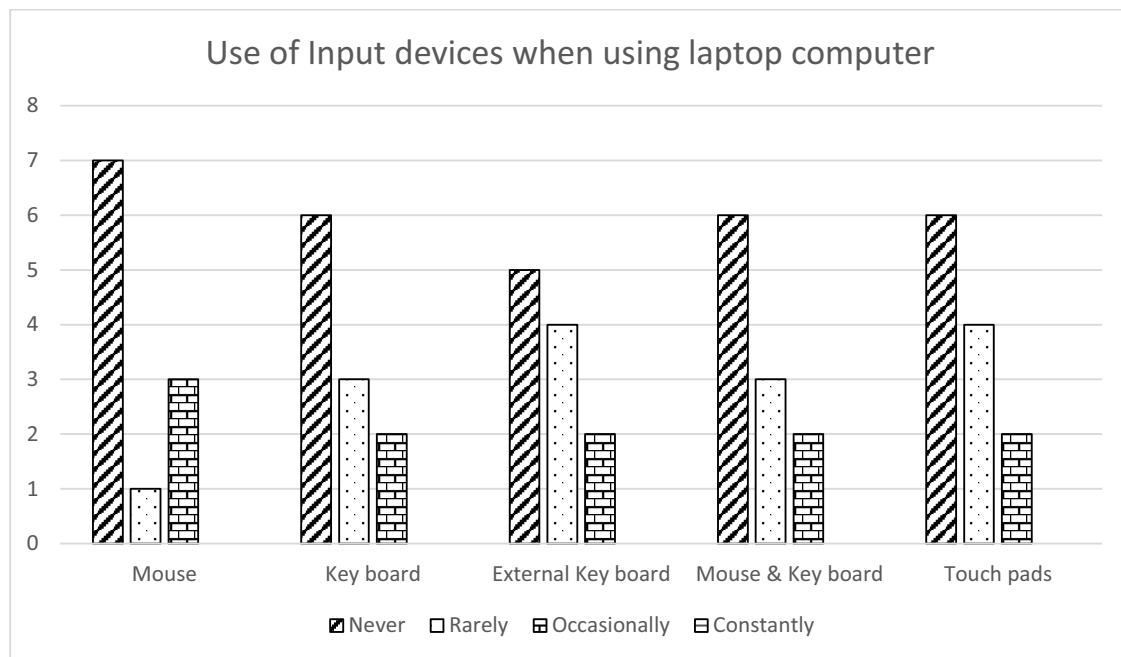


Figure 2. Input devices when using laptop computer

3.2 Objective 2 visualization affect/discomfort on the use of laptop computer

The figure 3 shows respondents highly discomfort feeling when visualizing laptop computer on eyes, hand and wrists 70%, while neck, back, arms and thigh 60%. Also moderately discomfort with head and thigh. As defined by Helander and Zhang cited in [17], unpleasant experience as not being at ease, fatiguing, straining, smarting, hurting – all term that indicate some degree of discomfort.

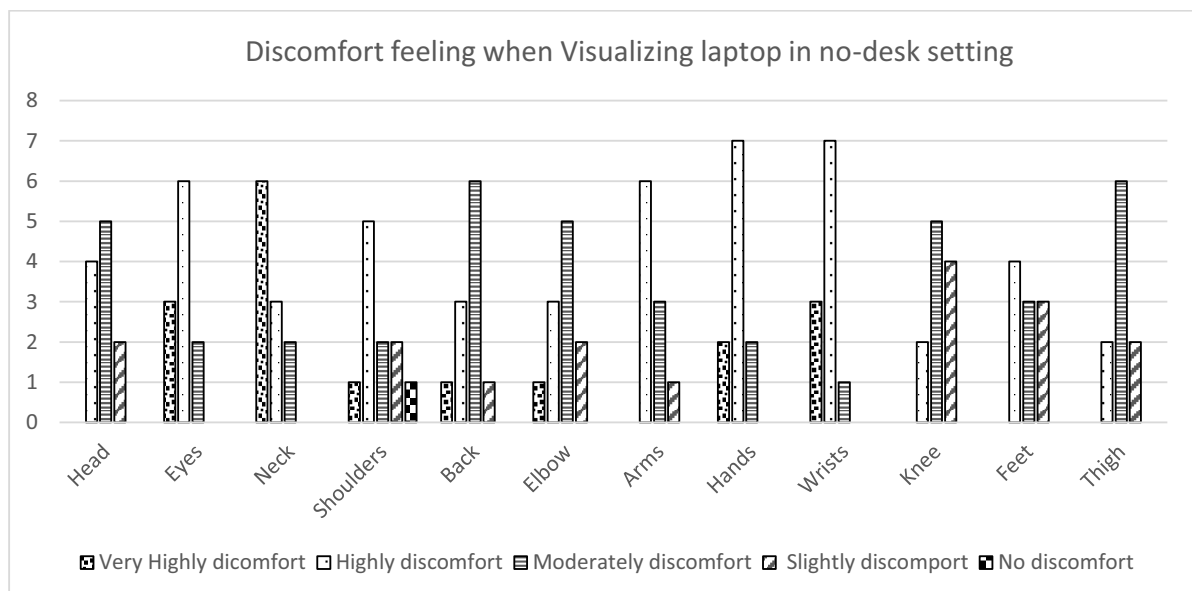


Figure 3. Discomfort feeling when visualizing laptop in no desk setting

3.3 Objective 3 carrying discomfort on the use of laptop computer

The respondent indicates their level of discomfort feeling when carrying laptop computer on many part of their body especially wrists, shoulders, arms and hands. The respondents show that no any styles/techniques that are mostly used with exception of wheel case carrying which has 75% never use that style/technique in carrying laptop. The level of discomfort is almost all of the body parts. These may be due to lack of ergonomics knowledge and ergonomics awareness.

Generally, the study focused on issues arising from the tasks performed by laptop users, which include screen-based tasks such as use of keyboard, mouse and possibly other input devices (e.g. track pads/touch pads, touch screen and pens). Technology education professional used laptop in an environment far from ideal and often induce poor work posture. It was found that most of the technologist faced problems of laptop hazard due to low level of ergonomic awareness.

4. Conclusion and recommendations

The research revealed that the respondent doesn't know much about laptop ergonomics knowledge. The respondents do not use external input devices such as keyboard and mouse in order to reduce the discomfort faced when using laptop for a longer period. The research discovered that, incorrect postures contribute in the muscular related problems and equipment and accessories were not ergonomically design or were used incorrectly which results to fatigue and discomfort.

Carrying laptop has a great impact on the laptop users and complains among the respondent is common. Carrying laptop cause a lot of body pains such as shoulder, back, arms, hands and wrist. The study discovered that, laptop was heavy, extra equipment add extra weight, and weight of the bag lead to carrying problems. Carrying of laptop bag may be by hands, shoulder, back pack, or wheeled carrying and research find out that, the immediate solution is frequent change of sides and hands, and use lightweight bag.

The study recommended an in depth awareness enlightens program/campaign which will help in dissemination of information about knowledge of ergonomics in general and laptop ergonomic in particular. Prevention is better than cure, therefore when technology education professional where enlighten about correct posture, right equipment and accessories, safety measures, and ergonomically laptop workstation will greatly help in reducing the laptop hazard.

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