

Ergonomics, Students' Well-being, and Technology-Enhanced Learning at

Usmanu Danfodiyo University, Sokoto, Nigeria

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Abstract

Ergonomics is the study of designing equipment and devices that fit the human body, its movements, and its cognitive abilities. In the context of students in the 21st century, ergonomics is important because of the increasing amount of time that students spend using technology, such as computers, tablets, and smartphones. Poor ergonomics can lead to physical discomfort, pain, and even long-term injuries, such as carpal tunnel syndrome and back problems. This article assessed the relationship between students, some ergonomic factors they may come into contact with during their stay at the university, and how the relationship can be improved. The study adopted a correlational survey research design. All the undergraduate students from the faculty of sciences formed the population of the study. 357 students were randomly selected to participate in the study. The determination of the sample size was guided by Research Advisors (2006). An instrument titled "Ergonomics and Students' Health" was developed and used for data collection. It was validated, and it was used to conduct a pilot study. A reliability index of 0.98 was obtained using Chronbach Alpha at the 0.05 level of significance. Descriptive and inferential statistics were used for data analysis. Results from the study found that most of the students do not see ergonomics as a factor of concern. A negative relationship was also found between ergonomics and students' health conditions at the university. It was concluded that ergonomics is a silent issue with numerous negative health effects that needs urgent responses from both students and university management. It was therefore recommended that the university management take the necessary measures to improve the ergonomic conditions of its students.

Keywords: Ergonomics, students, health, 21st century.

Introduction

Education is seen as a key factor in any nation's economic development. Education can be gained through an active and continuous learning process (formal or informal). Many factors may come into play to unsettle the educational process. Among these factors are insecurity, migration, and outbreaks such as COVID-19. In many countries around the world, technologies were embraced to aid learning during the COVID-19 pandemic. This is an attempt not to allow students' learning processes to be affected by the pandemic. Even though the attempt to support education was successful to some extent, a lot of complaints were also recorded as having stagnated the process. This includes the difficulties experienced by learners when learning using technology. The fact remains that we cannot run away from the use of technology, but its integration into the learning process needs to be carefully studied. This is because unguided use of technology for learning has been reported to have some negative effects on learners' health, which in turn affects the learning process. Users of technologies such as computers and other portable devices in the

twenty-first century are dealing with musculoskeletal conditions and ocular complaints. Musculoskeletal diseases may arise as a result of prolonged computer workstation sitting in improper, uncomfortable, and immobile positions. Visual problems are also related to improper computer display positioning, lighting, and other elements, including the extended use of portable electronics like cellphones (Kibria, Parvez, Saha & Talapatra, 2023).

The participants in the study by Kibria, Parvez, Saha and Talapatra (2023) were employees of a specific organization. They reported that during the previous 12 months, there were musculoskeletal disorders in several body regions, including the lower back (62%), upper back (53%), shoulders (47%), and neck (25%). These disorders were all caused by ergonomic deficiencies, including the excessive use of handheld devices. Furthermore, the most prevalent visual discomforts or symptoms among the participants were scratchy eyes (69%), fatigued eyes (83%), and blurry vision (56.73%). The results also showed a strong correlation between ocular discomfort, monitor ergonomics (blue rays), and its

orientation deficiencies. Many schools of higher learning, including universities, had deployed learning management systems (LMSs) to rescue education during the pandemic. Usmanu Danfodiyo University Sokoto was not excluded from that effort. Apart from the introduction of the Moodle learning management system by the university, students make use of their personal computers and handheld devices to support their learning process. This study aims to look at the relationship between students' use of technology for learning and their health condition taking into consideration some environmental, organizational, and cognitive factors.

Ergonomics is a key component in efforts to promote a productive and healthy learning environment and solve the issues related to technology-enhanced learning. The International Ergonomics Association (IEA) defines ergonomics, also known as human factors, as the scientific discipline that examines how people interact with other elements of a system and as a profession that follows theories, principles, data, and techniques to maximize both the performance of the system as a whole and the well-being of its members. Ergonomics is the study of designing instruments and equipment that are

suitable for the human body, its movements, and its mental abilities. Given the amount of time students spend using technology in the twenty-first century, such as computers, tablets, and smartphones, ergonomics is crucial for students. Poor ergonomics can lead to physical discomfort, pain, and even long-term injuries, such as carpal tunnel syndrome and back problems (Gumsing, Dela-Cruz, Pinon, Rebong & Sahagun, 2023).

The three main categories of ergonomics are organizational, cognitive, and physical (Gamper, 2022). The study of physical ergonomics focuses on how the human body reacts to biological elements in the surroundings, including temperature, sound, light, and air quality. In order to reduce the possibility of accidents and injuries, it also entails developing equipment, machinery, and workstation layouts (Singleton, 2022). The study of cognitive ergonomics focuses on how the human mind absorbs information and makes judgments. It involves researching people's perceptions, recall, acquisition, and decision-making processes (Branaghan & Lafko, 2020). Organizational ergonomics focuses on the design of work systems, including job duties, work schedules, and communication systems. It also entails

researching the potential effects that organizational structures and work environments may have on employee safety, health, and productivity. As scientists discover more about how people interact with their surroundings, the discipline of ergonomics is expanding and always changing (Fernandez-Perez & Martin-Rojas, 2022). Distance learning organizations and individuals can lessen physical discomfort, improve focus, and advance general well-being by attending to ergonomic concerns. Consequently, there may be an increase in learning results, student engagement, and general happiness with the remote learning process. Some ways ergonomics can affect students in the 21st century include:

1. **Posture:** Poor posture while using technology can lead to back, neck, and shoulder pain. Proper ergonomics can help students maintain good posture and reduce the risk of developing musculoskeletal issues.
2. **Eye strain:** Prolonged use of screens can cause eye strain and discomfort. Proper ergonomics, such as adjusting screen height and distance, can help reduce eye strain.
3. **Repetitive strain injuries:** Students who spend a lot of time typing or using a mouse are at risk of developing repetitive

strain injuries. Ergonomic keyboards, mice, and proper workstation setup can help prevent these injuries. However, some ways to improve ergonomics for students include: using adjustable chairs and desks that can be customized to fit the individual student's body size and shape; positioning computer monitors at eye level to reduce neck and eye strain; using ergonomic keyboards and mice that reduce the strain on the hands and wrists; and taking regular breaks to stretch and move around. Numerous studies have shown inconsistent results about the association between ergonomic aspects and students' learning in the technological age, which makes this study worthwhile. In terms of macro-ergonomics, learning management systems (LMSs), technology access, and instructional strategies all have a significant impact on how motivated students are to succeed academically (Bradley, 2020). Research conducted in the Philippines demonstrated how crucial collaboration between information and communication technology and LMS use is for students' academic progress (Tus, 2021). Comparable results about the influence of LMS use on students' engagement with online learning during COVID-19 in Saudi Arabia have been released. According to students, learning

management systems (LMSs) are a dependable and effective teaching approach that facilitates effective administration and the value of remote learning as a continuous engagement with fewer time and resource requirements (Alturki & Aldraiweesh, 2021). The notion that students who invest more time in their online education are more likely to participate in active learning and reap its benefits is supported by evidence. According to research by Gumasing, Dela-Cruz, Piñon, Rebong, and Sahagun (2023), socioeconomic living conditions of students may have an impact on how their environment influences their motivation to learn. According to the findings of a study by Jansz, Walker, Bay, Paudel, Swapan, and Smith (2018), organizational ergonomics is deemed by students to be the most crucial of the five ergonomic factors for creating a productive online learning environment. Cognitive, physical, environmental, and social ergonomic factors come next in decreasing order of significance. Technical problems with insufficient access to the Blackboard learning platform, which impede and disrupt students' online learning, were the organizational ergonomic element that was deemed to be of the most concern.

The design of the workstation, the use of LMS, access to technology, the way that instruction is delivered, the temperature, and the visual learning style all have a significant impact on students' learning motivation, which in turn affects their academic performance, according to research by Gumasing and Castro (2023). Therefore, it is crucial for individuals who are assisting with distance learning to consider the things that could inspire the learner. Moreover, Abdul-Latip and Tamrin (2023) asserted that the learning environment is vital to ensure that students perform well in their studies as it significantly influences their motivation, focus, safety, health, overall learning experience, and academic success.

Objectives

The primary objective of this study was to determine the relationship among ergonomics, students' well-being, and technology-enhanced learning at Usmanu Danfodiyo University, Sokoto. Specifically, the study intends to:

1. determine how students, perceive ergonomic factors in Usmanu Danfodiyo University, Sokoto.
2. ascertain the relationship between ergonomic factors and students' well-being in the University.

3. find out the relationship between ergonomic factors and students' learning through the use of technology in the University.

Research Questions

The following questions were posed to guide the study:

1. How do students perceive poor ergonomic factors in Usmanu Danfodiyo University, Sokoto?
2. What is the relationship between poor ergonomic factors and students' well-being in Usmanu Danfodiyo University, Sokoto?
3. What is the relationship between poor ergonomic factors and students' learning through the use of technology in the University?

Research Hypotheses

The following hypotheses were formulated to guide the study:

Ho₁: there is no significant relationship between poor ergonomic factors and students' well-being in Usmanu Danfodiyo University, Sokoto.

was obtained using Cronbach Alpha at the 0.05 level of significance. Descriptive and inferential statistics were used for data analysis.

Research question 1: How do students perceive poor ergonomic factors in Usmanu Danfodiyo University, Sokot

Ho₂: there is no relationship between poor ergonomic factors and students' learning through the use of technology in Usmanu Danfodiyo University, Sokoto.

Methodology

The study adopted a correlational survey research design. All the undergraduate students from the faculty of sciences formed the population of the study. 357 students were randomly selected to participate in the study. The determination of the sample size was guided by Research Advisors (2006). The faculty was purposefully selected because students from the faculty make use of laboratories for experiments on a daily basis, and they also utilize handheld devices (technology) for learning. The determination of the sample size was guided by Research Advisors (2006). An instrument titled "Ergonomics and Students' Health" was developed and used for data collection. It was validated, and it was used to conduct a pilot study. A reliability index of 0.98

Results

This section presents the results found during the study.

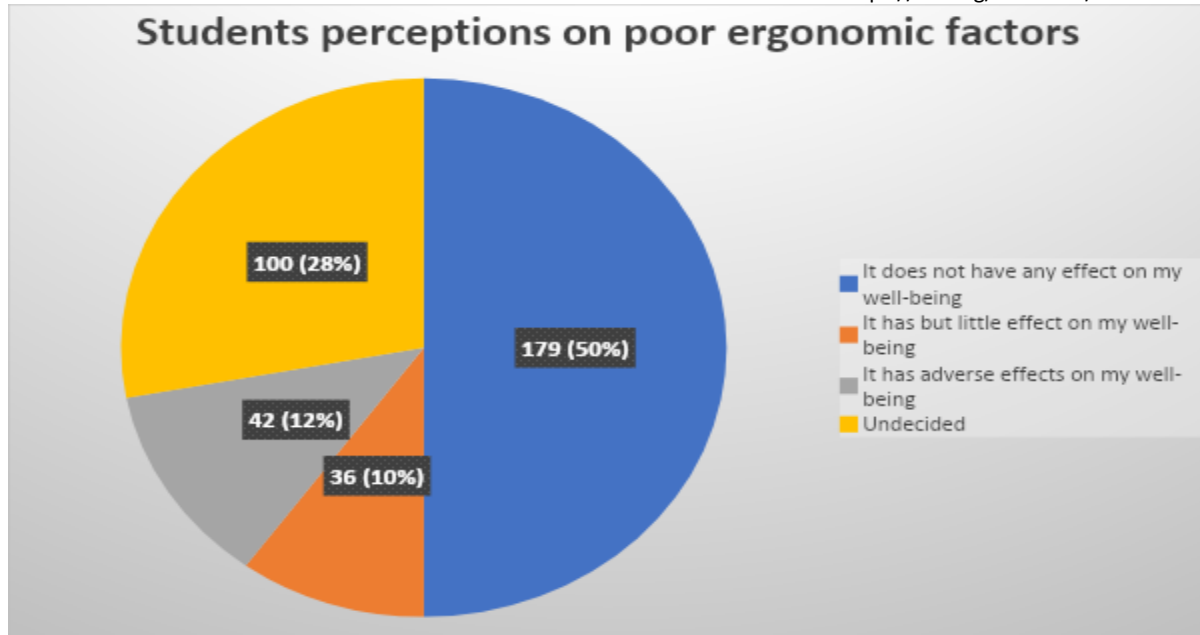


Figure 1: Students’ perceptions of poor ergonomic factors at Usmanu Danfodiyo University, Sokoto.

From Figure 1, it can be seen that 179 (50%), representing the majority of the respondents, opined that ergonomics does not have any effect on their well-being. 100 (28%) of them could not decide on the effect of ergonomics on their well-being. 42 (12%) were of the opinion that improper handling of ergonomic

factors has adverse effects on their well-being. The remaining 36 (10%) believed that ergonomic factors had little effect on their well-being.

Hypotheses Testing

Ho1: there is no significant relationship between poor ergonomic factors and students’ well-being in Usmanu Danfodiyo University, Sokoto.

Table 1: PPMC Result of the Relationship between Poor Ergonomic Factors and Students’ Well-being

Variables	N	Mean	Std. Dev.	Df	r	p	Remark
Ergonomic factors (Not prepared for)	357	41.06	2.69	355	-0.71	0.00	Sig.

Students' well-being 357 27.93 1.96

Table 1 shows the Pearson correlation result with respect to the null hypothesis. The mean scores for the ergonomic factors (not prepared for) and students' well-being were respectively 41.06 and 27.93, while the standard deviation for the two groups was 2.69 and 1.96, respectively. The $r(355) = -0.71$, $p < 0.05$ (two-tailed) revealed that there

was a significant but inverse relationship between poor ergonomic factors and students' well-being in the university. Thus, the null hypothesis was rejected.

Ho2: there is no relationship between poor ergonomic factors and students' learning through the use of technology in Usmanu Danfodiyo University, Sokoto.

Table 2: PPMC Result of the Relationship between Poor Ergonomic Factors and Students' Learning through the use of Technology

Variables	N	Mean	Std. Dev.	Df	r	p	Remark
Poor ergonomic factors	357	41.06	2.69	355	-0.83	0.00	Sig.
Learning with technology	357	20.21	1.23				

Table 2 shows the Pearson correlation result with respect to the null hypothesis. The mean scores for the poor ergonomic factors and students' well-being were respectively 41.06 and 20.21, while the standard deviation for the two groups was 2.69 and 1.23, respectively. The $r(355) = -0.83$, $p < 0.05$ (two-tailed) revealed that there was a significant but inverse relationship between ergonomic factors and students' learning

with technology at the university. Thus, the null hypothesis was rejected.

Discussions: The study's findings showed that most respondents did not believe ergonomic considerations had a detrimental impact on their wellbeing. Because they are unaware, some students could believe that ergonomic considerations have no detrimental impact on their wellbeing. It's possible that some students are unaware of

the possible harm that ergonomic issues might do to their health (Ravindran, 2019). They might not be aware that pain or discomfort they feel when using technology or studying has anything to do with ergonomics. Another explanation can be youthful resiliency. Students and other younger people might be more tolerant to discomfort or more able to adjust to uncomfortable ergonomic settings without suffering immediate consequences. This may give them the impression that ergonomics has no bearing on their overall health. Students may also hold false beliefs about ergonomics, thinking it is exclusively important for professionals or office workers who spend a lot of time at a desk (Masson, 2024). They might be unaware of the significance of good ergonomics for anyone who uses technology or studies for prolonged periods of time. Some students could put aesthetics or convenience ahead of ergonomics. It is possible that they will choose for less ergonomic work environments when studying or working because they find them more visually pleasing or handy. Because they believe it would be cumbersome or unnecessary, students may be resistant to making changes to their work environment or study habits in

order to improve ergonomics (Zunjic, Tsaklis, & Yue, 2017). They might not notice the advantages of adopting ergonomic changes right away. Teaching students about the value of ergonomics and how it may affect their long-term health is crucial. By increasing knowledge and offering direction on appropriate ergonomic procedures, students are better equipped to make decisions that will result in a cozier and encouraging learning environment (Yazdani & Wells, 2018).

A significant relationship was found between poor ergonomic factors and students' well-being. This finding is in line with the assertion made by Abdul-Latip and Tamrin (2023) that the learning environment is vital to ensure that students perform well in their studies as it significantly influences their motivation, focus, safety, health, overall learning experience, and academic success. This is because bad ergonomic design can result in physical discomfort, musculoskeletal disorders, and general health issues that can negatively impact students' mental and physical health, there is an inverse association between ergonomic characteristics and students' well-being. Students may feel more stressed, tired, and less well-rounded when they are in an

atmosphere that does not adhere to basic ergonomic principles (Ogunlana, Govender & Oyewole, 2021). By putting appropriate ergonomic design ideas into practice, schools can make their learning environments cozier and encouraging for kids, which will improve their general well-being and learning process. The study found a significant inverse relationship between poor ergonomic factors and students' technology-based learning. The relationship between ergonomic aspects and students' technology-based learning is inverse because poorly designed ergonomics can induce physical strain, weariness, and discomfort that can impair students' capacity to concentrate, focus, and learn (Gumasing, Dela-Cruz, Piñon, Rebong & Sahagun, 2023). Students are less inclined to use technology and may have trouble remembering material when they are uneasy or physically uncomfortable.

Some common poor ergonomic factors that can impact learning with technology include: incorrect posture while sitting or standing; improper placement of computer equipment such as monitors, keyboards, and mice; inadequate lighting or glare on screens; lack of proper wrist support while typing or using a mouse; and using technology for extended periods without breaks. To mitigate the

negative effects of poor ergonomic factors on learning with technology, it is important to ensure that individuals have access to ergonomic equipment and resources, such as adjustable chairs, monitor stands, and ergonomic keyboards and mice. Additionally, promoting good ergonomic practices, such as taking regular breaks, stretching, and maintaining proper posture, can help improve comfort and productivity while using technology for learning (Kibria, Parvez, Saha & Talapatra, 2023).

Conclusion

Ergonomics aims to optimize the interaction between people, equipment, and their environment to improve performance. By designing learning spaces and tools that are comfortable and efficient to use, ergonomics can help learners to study more effectively and productively. Ergonomics focuses on preventing musculoskeletal disorders and other physical ailments that can result from poor learning environment design. By promoting proper posture, movement, and equipment usage, ergonomics can reduce the risk of injuries and long-term health issues. Ergonomics considers the physical and cognitive capabilities of individual learners to create environments that are comfortable and supportive. By reducing physical strain

and mental fatigue, ergonomics can enhance overall well-being and students' academic achievements. Implementing ergonomic principles can lead to cost savings for schools and universities by reducing absenteeism, worker compensation claims, and healthcare expenses associated with workplace and learning environment injuries. Additionally, improved productivity and efficiency can contribute to financial gains. Many countries have regulations and standards related to learning environment ergonomics to ensure the health and safety of workers and learners. By studying ergonomics and implementing best practices, schools and universities can comply with these regulations and create safer work and learning environments.

Recommendations

Based on the findings of the study, the following are recommended:

1. In order to improve learning outcomes, teachers should be cognizant of and take into account the effects of physical, cognitive, and macro-ergonomic aspects on students' motivation to learn.
2. The value of ergonomics and how it may affect students' long-term health should be taught to them. This can be accomplished by educating students about ergonomic best practices and assisting them in making

decisions that will make their study spaces cozier and more encouraging.

3. To curbe the effects of poor ergonomic factors, promoting good ergonomic practices, such as taking regular breaks, stretching, and maintaining proper posture, can help improve comfort and productivity while using technology for learning.

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