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Digital Device Usage and Ergonomic Health Risks in Higher Education Students: A Survey-Based Study

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Abstract: Digital devices play an important role in teaching and learning in higher education. College and university students regularly use laptops, smartphones, and tablets for their learning content, clas assignments, and communication. While these devices support learning, long hours of use without proper posture or regular breaks can lead to ergonomic health problems.

This study investigates digital device usage patterns and ergonomic health risks among higher education students in Botswana. A survey was analyzed using SPSS statistical techniques including descriptive statistics, chi-square tests, and Pearson correlation. The results show high levels of daily screen exposure, particularly through smartphones, and a high prevalence of ergonomic symptoms such as eye strain, neck pain, headache, fatigue, and back pain. Findings suggest that increased screen time is associated with ergonomic health risks, highlighting the need for ergonomic awareness and institutional interventions in higher education environments.

Keywords: Digital Device Usage, Ergonomic Health Risks, descriptive statistics, chi-square tests, and Pearson correlation.

INTRODUCTION

Digital devices are an important part of higher education today. Students use laptops, smartphones, tablets, and other devices for learning activities, class assignments, research, communication, and entertainment. In Botswana, the use of technology in education has made learning more flexible and accessible. Long hours of using digital devices without proper posture, breaks, or ergonomic practices can cause health problems. Common issues include back and neck pain, eye strain, headaches, and fatigue.

Ergonomics is the study of designing work and study environments to match the user's needs. Good ergonomic practices can help prevent health problems caused by prolonged device use. Many students do not follow ergonomic practices. They may sit in poor posture, use devices for long periods without breaks, or study in unsuitable environments. These habits increase the risk of developing health issues.

Research on digital device usage and ergonomic health risks among students in Botswana is limited, especially in multiple institutions. Studying students' device usage patterns, ergonomic behaviors, and related health problems is important. It can help educators, administrators, and policymakers improve student well-being and create healthier learning environments.

This study looks at digital device usage, ergonomic practices, and health risks among students from three colleges and one university in Botswana using a survey-based approach.

RESEARCH OBJECTIVES

This study aims to:

- Examine digital device usage patterns among higher education students in Botswana.
- Identify the prevalence of ergonomic health symptoms associated with device usage.
- Analyze the relationship between screen time and ergonomic health risks using statistical methods.

LITERATURE REVIEW

Recent research from 2020 to 2025 shows an increasing focus on digital device usage and its ergonomic health effects among students and young adults. Prolonged use of laptops, smartphones, and tablets has been linked to visual discomfort, musculoskeletal symptoms, and postural strain in university and college populations.

Studies on digital eye strain (DES) highlight that prolonged screen exposure produces symptoms such as dry eyes, blurred

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vision, headache, neck stiffness, and fatigue, especially when devices are used for long hours without ergonomic practices such as breaks or correct viewing distance (Kaur, 2022); (Chowdhury et al., 2025) and (Sharma et al., 2023). A cross-sectional survey among health sciences students reported that over 68% of participants experienced DES, with symptoms strongly associated with virtual learning and smartphone use (AlQarni et al., 2023) and (Sharma et al., 2023). Research has also shown that high screen time and poor posture are linked with both visual and neck pain among university students, indicating combined effects on ocular and musculoskeletal health (Almutairi et al., 2024).

Musculoskeletal discomfort due to device use is well documented. A study on mobile devices related musculoskeletal pain found significant prevalence of back and shoulder symptoms among working university students, emphasizing the role of poor posture and long exposure (Legan & Zupan, 2022); (Alamri et al., 2023) and (Deivendran et al., 2025). Research into smartphone holding posture and usage duration revealed that specific hand and finger discomfort were common and significantly related to how devices were held (Banadaki et al., 2024). Another survey linked smartphone addiction and posture with increased hand pain among students, suggesting behavioral as well as mechanical risk factors (Özalp et al., 2025) and (Bagaji and Rao, 2025).

Further, work has explored the relationship between specific ergonomic characteristics and physical symptoms, emphasizing how repetitive strain, posture, and lack of breaks contribute to cumulative musculoskeletal burden (Kristanto et al., 2023). Some studies also integrate both visual and musculoskeletal outcomes, indicating that high screen time correlates with both eye discomfort and neck pain, demonstrating the need for integrated ergonomic solutions (Gushgari, 2024).

The literature shows that extended digital device use without ergonomic awareness increases the risk of health issues among students, supporting the need for education on posture, regular breaks, and ergonomic habits in higher education settings.

METHODOLOGY

This study used a descriptive cross-sectional survey design to investigate digital device usage patterns, ergonomic practices, and related health symptoms among higher education students. The study was conducted among students from selected higher education institutions in Botswana. A total of 108 students participated in the study. The participants included students from different academic levels and both genders to ensure representation of the student population. Data were collected using a structured questionnaire consisting of 28 survey variables grouped into four main categories: demographic information (age, gender, level of study, and institution), digital device usage patterns, ergonomic practices during device use, and health-related symptoms associated with prolonged device usage. The questionnaire was designed to capture information about the duration and type of digital device use, posture habits, break frequency, workstation setup, and the presence of common ergonomic health symptoms such as neck pain, back pain, eye strain, and fatigue.

The survey responses were coded and initially entered into Microsoft Excel before being imported into SPSS for statistical analysis. Descriptive statistical techniques including frequency distributions, percentages, means, and standard deviations were used to summarize the demographic characteristics, digital device usage patterns, ergonomic practices, and reported health symptoms of the participants. In addition, Chi-square tests were conducted to examine the association between selected variables such as device usage duration, ergonomic practices, and reported health symptoms. A p-value of less than 0.05 was considered statistically significant. Ethical considerations were maintained throughout the study by ensuring that participation was voluntary, responses were kept confidential, and no personally identifiable information was included in the dataset or analysis.

4. RESULTS

A total of 108 students participated in the survey. Descriptive statistical analysis was conducted to examine digital device usage patterns, ergonomic practices, and reported health symptoms among students.

4.1 Demographic Characteristics

Table 1: Demographic Distribution of Participants

Variable	Category	Frequency	Percentage
Gender	Male	40	37.0%
	Female	68	63.0%
Age	Mean	22.25 years	
	Standard Deviation	4.07	

Table 1 presents the demographic distribution of the participants. The mean age of the respondents was 22.25 years (SD = 4.07), indicating that the sample predominantly consisted of young adults, which is typical of students enrolled in higher education institutions. In terms of gender distribution, female participants constituted a larger proportion of the sample (63%) compared to male participants (37%). This suggests a moderate gender imbalance, with female students being more represented in the study.

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4.2 Digital Device Usage Patterns

Table 2: Types of Digital Devices Used

Device Type	Frequency	Percentage
Smartphone	102	94.4%
Laptop	41	38.0%
Tablet	24	22.2%
Desktop	13	12.0%

Table 2 illustrates the types of digital devices used by the participants. Students reported using multiple devices for both academic and personal purposes. Smartphones were the most commonly used device, with 94.4% of participants reporting regular use, followed by laptops (38.0%), tablets (22.2%), and desktops (12.0%). The predominance of smartphone usage highlights the central role of mobile technology in students' daily lives, reflecting global trends where mobile devices have become the primary tool for learning, communication, and information access. The lower usage of desktops and tablets suggests that portable devices are preferred for convenience and accessibility.

4.3 Academic and Personal Screen Time USE_ACAD and Personal Device Usage (USE_PERSON)

Table 3: Academic and Personal Device Usage (Hours per Day)

Usage Hours	Frequency	Percentage USE_ACAD	Frequency	Percentage USE_ACAD
Less than 2 hours	22	20.4%	5	4.6%
2–4 hours	63	58.3%	16	14.8%
4–6 hours	0	0	1	0.9%
More than 6 hours	23	21.3%	86	79.6%

Table 3 shows the distribution of daily digital device usage for academic and personal purposes. The majority of students (58.3%) reported using digital devices for 2–4 hours per day for academic activities, while 21.3% reported more than 6 hours of academic screen time. Personal device usage was considerably higher than academic usage. Nearly 80% of students reported using digital devices for more than 6 hours per day for personal purposes, indicating extensive daily exposure to screens beyond academic requirements. This finding highlights the importance of considering the potential impact of prolonged personal screen time on student well-being and academic performance.

4.4 Reported Ergonomic Health Symptoms

Table 5: Prevalence of Health Symptoms Among Students

Symptom	Frequency	Percentage
Eye strain	86	79.6%
Neck pain	65	60.2%
Headache	65	60.2%
Fatigue	63	58.3%
Back pain	61	56.5%

Table 5 shows the prevalence of reported ergonomic health symptoms among participants. Eye strain was the most commonly reported symptom, affecting 79.6% of students. This was followed by neck pain and headaches, both reported by 60.2% of participants. Fatigue (58.3%) and back pain (56.5%) were also common. These findings suggest that prolonged use of digital devices is associated with a range of musculoskeletal and visual discomforts among students. The high prevalence of eye strain, neck pain, and headaches highlights the need for ergonomic interventions and awareness of proper device use to reduce health risks.

4.5 Chi-Square Analysis

To examine the relationship between academic screen time and reported ergonomic health symptoms, a Chi-square test was conducted.

Table 6: Academic Screen Time vs Health Symptoms

Academic Hours	Eye strain		Neck Pain		Headache		Fatigue		Back pain	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<2 hours	20	2	12	10	9	13	13	9	12	10
2–4 hours	46	17	43	20	43	20	35	28	36	27

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>6 hours	20	3	10	13	13	10	15	8	13	10

Table 7: Chi-square Test Results

Symptom	Chi-square(χ^2)	df	p-value
Eye strain	4.19	2	0.123
Neck pain	4.68	2	0.096
Headache	5.25	2	0.072
Fatigue	0.65	2	0.721
Back pain	0.04	2	0.978

The Chi-square analysis indicates that, while higher academic screen time is associated with greater frequencies of eye strain, neck pain, and headaches, none of these relationships reached statistical significance at the 0.05 level. Notably, neck pain ($p = 0.096$) and headache ($p = 0.072$) were marginally above the threshold, suggesting a potential trend whereby extended academic device use may contribute to musculoskeletal discomfort. These results imply that prolonged academic screen time could be a contributing factor to certain ergonomic symptoms, even though the associations were not statistically significant in this sample. Future studies with larger sample sizes may clarify these potential relationships.

4.6 Pearson Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships between total screen time (academic and personal) and reported ergonomic health symptoms.

Table 7: Pearson Correlation Results

Variables	Correlation (r)	Significance (p)
Academic hours vs Eye strain	0.020	0.834
Academic hours vs Neck pain	-0.122	0.210
Academic hours vs Headache	0.048	0.620
Academic hours vs Fatigue	0.056	0.564
Academic hours vs Back pain	0.008	0.932
Personal hours vs Eye strain	0.234	0.015
Personal hours vs Neck pain	0.165	0.089
Personal hours vs Headache	-0.002	0.981
Personal hours vs Fatigue	0.021	0.831
Personal hours vs Back pain	0.167	0.084

The results show a statistically significant positive correlation between personal device usage and eye strain ($r = 0.234$, $p = 0.015$), indicating that increased personal screen exposure is associated with greater visual discomfort among students. Other correlations were weak and did not reach statistical significance. Although not significant, personal screen time exhibited mild positive relationships with neck pain ($r = 0.165$, $p = 0.089$) and back pain ($r = 0.167$, $p = 0.084$), suggesting a potential trend between higher personal device use and musculoskeletal discomfort. Academic screen time showed no significant correlations with any of the reported symptoms. Overall, these findings highlight that personal screen exposure, rather than academic screen time, is more strongly linked to ergonomic health concerns, particularly eye strain.

5. DISCUSSION

The findings of this study highlight the widespread use of digital devices among higher education students in Botswana and the associated ergonomic health risks. Smartphones were identified as the most frequently used devices, reflecting global trends where mobile devices dominate digital engagement among young adults. Laptops, tablets, and desktops were used less frequently, suggesting that portability and convenience drive device preference.

A significant proportion of students reported more than six hours of personal screen time per day, indicating prolonged exposure to digital screens. This aligns with the findings of AlQarni et al. (2023), who reported that high screen time among university students is strongly associated with symptoms of digital eye strain and fatigue. The high prevalence of eye strain (79.6%) in the current study further supports this pattern, underscoring visual discomfort as a primary ergonomic concern among students.

Although the analysis of academic screen time and musculoskeletal symptoms (e.g., neck pain, headaches) did not yield statistically significant results at the 0.05 level, the near-significant p-values suggest a possible trend. This indicates that extended academic screen time may contribute to ergonomic risks, a pattern that could become clearer in larger or more diverse samples. These findings are consistent with Janc et al. (2023), who reported that poor workstation ergonomics and prolonged screen exposure are linked to musculoskeletal discomfort among students.

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Pearson correlation analysis further highlighted that personal screen time is positively associated with eye strain and showed mild positive relationships with neck pain and back pain. These results confirm that personal digital device use may be a stronger predictor of ergonomic symptoms than academic use, emphasizing the role of lifestyle and recreational device use in students' overall screen exposure. Similar associations between extended device usage and both visual and musculoskeletal symptoms have been reported by Kristanto et al. (2023) and Tsang et al. (2023).

The study underscores the importance of promoting ergonomic awareness and healthy digital habits among students to mitigate the risk of visual and musculoskeletal problems. Interventions such as regular screen breaks, proper workstation setup, and educational programs on device ergonomics are recommended to reduce potential health risks associated with prolonged digital device use.

6. IMPLICATIONS AND RECOMMENDATIONS

The findings of this study have several practical implications for higher education institutions and students:

- Universities should introduce targeted programs to educate students on proper posture, device handling, and strategies to reduce the risk of musculoskeletal and visual health problems.
- Students should be encouraged to follow the 20-20-20 rule (looking at an object 20 feet away for 20 seconds every 20 minutes) to alleviate eye strain during prolonged screen use.
- Higher education institutions should consider providing ergonomically designed workstations in libraries, computer laboratories, and study areas to support healthy device use.

7. LIMITATIONS OF THE STUDY

While this study provides valuable insights into digital device usage and associated ergonomic health risks, several limitations should be acknowledged.

- The study used self-reported data, which may be subject to response bias.
- The sample size was limited to 108 students, which may not fully represent all higher education students in Botswana.
- The study used a cross-sectional design, which limits the ability to establish causal relationships.
- Future studies could include larger samples and longitudinal analysis to better understand the long-term effects of digital device usage on student health.

8. CONCLUSION

This study investigated digital device usage patterns and associated ergonomic health risks among higher education students in Botswana. The findings indicate that students spend substantial time using digital devices for both academic and personal purposes, with smartphones being the most frequently used devices. A high prevalence of ergonomic health symptoms, including eye strain, neck pain, headaches, fatigue, and back pain, was observed among participants. Statistical analyses revealed that personal screen time was significantly associated with eye strain, while trends were observed for neck pain and other musculoskeletal symptoms. Although some associations with academic screen time were not statistically significant, near-significant trends suggest that prolonged device use may contribute to ergonomic discomfort.

These results underscore the importance of promoting ergonomic awareness and healthy digital usage habits among students. Interventions such as maintaining proper posture, taking regular breaks, adhering to the 20-20-20 rule, and providing ergonomic study environments can help mitigate the health risks associated with prolonged digital device use in higher education settings. Overall, the study highlights the need for both students and institutions to adopt strategies that support safe and sustainable use of digital technologies, fostering better health and well-being in academic contexts.

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