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Evaluation of Ergonomic Conditions of University Students with Distance Learning

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Abstract

Purpose: Distance learning is an educational system where students receive instruction remotely and outside of the physical space of the teacher. This is becoming increasingly popular as students can learn according to their own speed and capacity while also utilizing high-quality and innovative technology. One of the most important conditions for the effectiveness of distance learning is that the ergonomic features of the educational environment are suitable. This study aims to determine the ergonomic characteristics of university students during the distance education process.

Methods: Within the scope of the study, 140 students participated and shared their ergonomic features and pain status with the researchers. The data collection form was created via Google forms.

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Results: Approximately half of the students had healthy sitting ergonomics, and the effect of sitting height on neck pain was significant (p=0.025).

Conclusion: Maintaining and improving the ergonomic standards of students during distance learning positively affects course efficiency.

Key Words: Distance Learning, Ergonomic, Pain, University Students.

Introduction

Distance Learning: This involves bringing together students, teachers, and educational tools in different places through communication technologies (1).

It is an education system in which learners who are physically located in different places from the teacher can adjust their learning according to their own speed and capacity, benefit from educational technologies, and continue their learning and teaching activities efficiently and in a quality way (2). As of March 2020, university education in Turkey and all over the world transitioned from face-to-face education to distance education due to the pandemic. This transition from face to face to an online format was to ensure that students could maintian and reach their learning goals despite being physically distanced from a traditional classroom.

Ergonomics, which refers to labor law in Latin, ensures the health and safety of people in working environments. Ergonomics can also be defined as the organization of work in accordance with human characteristics (3). Employees are able to work efficiently in work conditions where they feel comfortable, and when they are affected by all kinds of environmental stress, this productive work begins to fail. These findings for employees can also be expected for university students that are participating in distance learning. Characteristics of a static working environmeent can include sitting or standing for long periods in a stationary position, highbackrest of the seat, bending forward, shoulder working from side

to side and head tilting side to side. Using tools and equipment incorrectly can also lead to poor work environment (4).

Restrictions on movement due to curfews during the pandemic combined with learning from a stationary screeen led us to consider problems this may have on the musculoskeletal system of students. To further understand this possible consequence of distance learning we recorded the conditions under which students listened to lectures to determine if this caused joint pain. Evaluation of the ergonomic conditions of students while learning remotely can yield useful information to protect students who are recieiving instruction in a distance learning environment. It is also important to determine the effect of long-term distance education models on the musculoskeletal system and ergonomics, instead of face-to-face education.

Materials and Methods

This study, which aimed to evaluate the ergonomic conditions of university students during the distance education period, was started after the approval of the Non-Interventional Ethics Committee of Biruni University (2021756-11). The research was carried out at Biruni and Istanbul Bilgi Universities. The population of the research was university students who had received distance education. The sample group consisted of Biruni University and Istanbul Bilgi University students who were studying remotely in the 2020-2021 academic year.

The only criterion for inclusion in the study was that the students participating in the study received distance education in the 2020-2021 academic year.

Research support was not provided in this study.

Data collection tools:

Data collection form was created using Google Forms and the following information about the participants was recorded:

- Gender
- Place of training
- Device used
- Lecture area
- Screen-Eye distance
- Seat height
- Position of the feet
- Area lighting
- Way of listening

- Participant support
- Screen angle
- Neck pain
- Back pain
- Backache

The participants were shown the informed consent form at the beginning of the form, and after accepting the consent form, they continued the research. Data were collected and analyzed by researchers. The G-Power 3.1 program was used to determine the study sample size. In order to determine the power analysis, we conduct the analysis based on Kayabınar and Erdi's research (5). According to this study, 140 participants were required in the study to be determined to have 95% power and 5% margin of error.

SPSS version 26.0 was used for data analysis. Descriptive analysis was used to determine the minimum, maximum, mean, standard deviation and frequency of data. An independent t-test was used to determine the significant differences between the two parametric groups.

Results

In total, 140 individuals participated in this study. Of the participants, 113 (80.7%) were female and 27 (19.3%) were male. All participants stated that they had received complete online training during the survey. The distribution of ergonomic characteristics of the participants is given in Table 1. While 131 (93.6%) participants reported that they were at home during the online training, 2 (1.4%) participants reported that they attended the training outdoors and 7 (5%) in the workplace environment. While 86 (61.4%) of the participants attended classes with a laptop, 6 (4.3%) reported that they attended classes with a desktop computer and 48 (34.3%) attended lessons with their smartphones.

Nearly half of the participants (68 participants, 48.6%) took the course at their study desks, 25 participants (17.9%) were on their bergere, 22 participants (15.7%) were in their beds, 13 participants (9.3%) were at their home's dinner table, 5 participants (3.6%) stated that they were listening on the couch. 7 participants who marked the "other" option stated that they listened to their lessons on the bus, anywhere the phone was picked up, and on a chair.

In terms of ergonomic study, the screen eye distance is expected to be between 45-70 cm. When the participants were asked about the screen-eye distance, it was seen that more than half (72 participants 51.4%) followed this distance rule. However, 61 participants (43.6%) reported that they looked at the screen from a distance closer than 45 cm, and 7 participants (5%) reported that they looked at the screen from a distance of more than 70 cm.

When the sitting elements of the participants were examined, it was found that 101 (72.1%) were fixed in height and 39 (27.9%) were adjustable in height. It was determined that 124 (88.6%) of the participants who used these sitting elements touched the ground while listening to the lecture, 3 (2.1%) used to support to bring their feet to the ground, but 13 (9.3%) participants did not touch the ground. When the heights of the sitting elements of the participants were examined, it was determined that the average height was 53.80±16.14 cm (Table 2). It was found significant that this value was higher than the ergonomic value of 43-45 cm.

When the angle of the screens of the participants with the desks and similar platforms they use was questioned, it was determined that the average slope was 78.64±16.87° (Table 3).

When the lighting of the areas where the participants listened to the lecture was questioned, 78 (55.7%) of them benefited from sunlight, 18 (12.9%) yellow incandescent lamps, 42 (30%) white fluorescent lamps and 2 (1%) 4) It was determined that they used LED lamps. It was learned that 50 (35.7%) of the participants listened to the lecture with headphones, whereas 90 (64.3%) used the loudspeaker while listening to the lecture.

While 89 (63.6%) of the participants stated that they lean on a support while listening to the lecture, 51 (36.4%) reported that they sat without support, while the majority of the participants (94 participants, 67.1%) rested their elbows on their desk while listening to the lecture.

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Table 1. Distribution of the ergonomic characteristics of the participants

Parameter	Sub Parameter	N	Percent
Sex	Female	113	%80,7
	Male	27	%19,3
Place of study	Home	131	%93,6
	Outdoor	2	%1,4
	Workplace	7	%5
Used device	Laptop	86	%61,4
	Desktop	6	%4,3
	Smart phone	48	%34,3
Area of lesson	Desk	68	%48,6
	Bergere	25	%17,9
	Bed	22	%15,7
	Dining table	13	%9,3
	Couch	5	%3,6
	Other	7	%4,9
Eye-screen distance	Closer than 45 cm	61	%43,6
	45-70 cm	72	%51,4
	Far from 70 cm	7	%5
Sitting height	Height adjustable	39	%27,9
	Fixed height	101	%72,1
Position of feet	Feet on the ground	124	%88,6
	Feet on the support	3	%2,1
	Feet in space	13	%9,3
Area enlightling	Sunlight	78	%55,7
	Yellow lamp	18	%12,9
	White flouresant	42	%30
	LED Lamp	2	%1,4
Listening type	Headphones	50	%35,7
	Speaker	90	%64,3
Support of participant	Back support	89	%63,6
	Elbow support	94	%67,1
	No support	51	%36,4

Table 2. Sitting heights of the participants

Parameter	Minimum	Maksimum	Mean	Std. Dev.
Sitting height	4,00	100,00	53,80	16,14

Table 3. Screen angles of the participants

Parameter	Minimum	Maksimum	Mean	Std. Dev.
Screen Angle	30,00	100,00	78,64	16,87

Finally, it was learned that 48 (34.3%) of the participants had neck pain, 48 (34.3%) had back pain and 37 (26.4%) had low back pain.

When the significant effect of sitting height on individuals with or without neck, back and low back pain was investigated, the sitting heights of individuals without neck pain were found to be significantly lower than those with neck pain (p=0.025) (Table 4).

Table 4. Effect of sitting height on joint pain

Parameter	Mean of sitting heights	*p value*
Participants with neck pain	49,58±17,34	**0,025**
Participants without neck pain	56,00±15,10	
Participants with back pain	51,20±16,93	0,171
Participants without back pain	55,12±15,63	
Participants with low-back pain	53,72±13,44	0,976
Participants without low-back pain	53,82±17,06	

When the significant effect of the screen angle on individuals with or without neck, back and low back pain was investigated, it was observed that the screen angle did not make a significant difference in neck, back or low back pain ($p>0.05$) (Table 5).

Table 5. Effect of screen angle on joint pain

Parameter	Mean of screen angle	*p value*
Participants with neck pain	76,25±16,25	0,227
Participants without neck pain	79,89±17,14	
Participants with back pain	79,27±16,17	0,752
Participants without back pain	78,31±17,30	
Participants with low-back pain	80,27±16,15	0,496
Participants without low-back pain	78,05±17,16	

Discussion

In our study, in which the ergonomic conditions of the students were evaluated during the pandemic period, we determined that the students had different ergonomic conditions. The majority of the participants were women; they mostly listened to lessons at home, used laptops and smartphones, and benefited from sunlight. Approximately 30% of the students reported experiencing musculoskeletal pain.

The numbers of students that participated in this study was 140. The larger the group of participants increases the reliability of the study. In a study with 1212 students (6), the perspectives of the students of the Faculty of Theology were investigated. In a study with 338 students (7), the perspectives of the students of a foundation university in Istanbul were

evaluated based on the distance learning of the students of the Faculty of Fine Arts and Design in Kastamonu. A total of 88 individuals participated in the study (8) and their opinions were evaluated.

Due to the curfew during the pandemic period, most students entered online classes from their homes. In a study by Altın and Ülker (9), 80.8% of the students attended classes from their homes. The rate was 93.6% in the present study. Students returned to their home because of pandemic restrictions. Although this situation provided psychological benefits, it did not allow them to use study halls. It cannot be assumed that students can comply with ergonomic features under these conditions.

Universities' online education infrastructure allows desktop laptop computers as well as smart mobile phones. For this reason, students can connect to lessons from their smartphones for ease of use. In Altin and Ulker's research, the majority of students used laptops and smartphones. In a study by Tarlakazan, 93.2% of the participants used computers and 80.7% used smartphones. In accordance with the literature, our students mostly used these two tools in distance education processes (8).

In our study, participants declared that they attended the lesson mostly from their study desks at home. In Altin and Ulker's study, the participants stated that they mostly attended classes in their bedrooms or living rooms and used a desk. Studying lessons at the desk is a choice that increases concentration (9).

Half of our participants declared that they attended classes at the correct screen-eye distance. It has been reported that watching the screen for a long time during distance education causes vision-related problems. In a study investigating the effects of digital devices and online learning on computer vision syndrome in students during the COVID-19 period, computer vision syndrome caused by watching a screen for a long time was detected in 70% of students (10). In studies conducted in China (11) and Trinidad-Tobago (12), it was reported that screen time and previous history of myopia astigmatism negatively affect vision during online education.

Height-adjustable chairs and contact of the feet with the ground during the study are ergonomically important issues. The fact that the feet do not touch the ground causes increased kyphosis and forward-leaning head posture (13). In our study, both neck and back pain were observed, and lower back pain was observed less frequently in these patients. Musculoskeletal pain was frequently observed during distance education. Researchers (14, 15) report that incorrect posture, repetitive movements, and immobility in non-ergonomic ways during study caused joint pain.

Conclusion

Distance has been included in education since the COVID-19 period and has been determined as a method that can be used in natural disasters and events that require students ro be away from the physical school or university. Maintaining and improving the ergonomic standards of students while using the distance education method positively affects student learning. There are no ready-made tools or furniture that are suitable for every students. Understanding and learning ergonomics are very important for students' academic success. Academics, parents, and students should be trained in the basics of office ergonomics necessary for studying, and ergonomics should be included in the curriculum orientation courses.

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