

The Importance of the Study and Work Environment Ergonomics for Today's and Future Managers and Logistics Specialists

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Abstract: Ergonomics in the work environment represents an important area since the non-compliance with it negatively affects people's health. To create sustainable working conditions for employees in the future, today's students – future managers, logistics specialists, and entrepreneurs need to be approached. The paper presents pilot research oriented towards the awareness of ergonomics and its merit in relation to health and productivity while studying and performing sitting work tasks. The meaning of this was raised by the Covid-19 pandemic impacts and an increase in the home office and distant studying. Also, the paper combines arguments from secondary data sources with obtained primary data. The main goal was to gather evidence justifying active engagement of logistics managers in ergonomics, as well as setting logistics processes respecting ergonomics requirements. The main findings underline the need for logistics specialists and employees themselves to be aware of ergonomics principles so that human well-being can be sustainably achieved.

Keywords: Ergonomics, logistics processes, human resources, decision-making

1. Introduction

Ergonomics includes the arrangement of a workplace to meet the needs of the people using it. It is a scientific discipline aiming to ensure work performance, comfort, and minimize the risks of people's health issues [1]. Managers, experts, and employees should cooperate in creating an appropriate ergonomics system [2,3]. Ergonomics is characterized by interdisciplinarity [4]. It is important to ensure that the work environment is adapted to the employee, not vice versa. To create appropriate arrangements, suitable strategy is required [5]. When setting the workplace, it is important to determine who will use it and what the scope of their work will be. The decision-

making process needs to include a number of factors such as age, gender, and body position [6]. The importance of ergonomics approaches at work is growing rapidly [7]. Reducing the burden on a person at work brings an improvement in the physical and mental conditions and increases performance. People spend half their life at work being exposed to various factors [8]. The connection between ergonomics and logistics is supported by a notion that it can provide long-term competitiveness via efficient human work [9]. This connection is often undeliberate. While looking for lean solutions, the most ergonomic ones lead to the elimination of bottlenecks in the logistics processes [10].

The main goal of this research included examination of the perceived importance of ergonomics among university students of management and informatics in Slovakia. These students will become employees, logistics specialists, and/or managers, and their adhering to the ergonomics principles is crucial. The research gathers arguments for logistics managers to actively engage in ergonomics. If logistics processes respect these requirements, their overall efficiency will be enhanced. This is achieved via the elimination of wasting human work and time. The connection between ergonomics and logistics is multi-fold, following the fact that people are an important resource. They can also represent the object of logistics operations. Setting work environments along with ergonomics principles for logistics specialists can be approached as a motivational tool [11]. Such a work environment enables these people to fully utilize their creativity to design innovations for logistics operations [12]. When focusing on people as the object of logistics, the ergonomics requirements need to be incorporated in relation to the perceived value of the travelling time [13]. All these areas are closely connected to new technologies to analyze available data, using business intelligence systems [14] or discrete computer simulations [15]. These types of data can be used for the decision-making support in logistics companies focusing on particular operations [16]. The importance of ergonomics principles is underlined by the fact that their violation increases the costs of logistics operations [17], affecting whole economies [18] in the long term [19,20].

2. Literature Review

A summary of similar research outlines the context for new findings. Ergonomics is a wide field since workplaces have specific conditions. This research focuses on knowledge work and studying.

Franssila et al. [21] studied ergonomics and workload management in information-intensive tasks, presenting a method evaluating information ergonomics. This concept includes specific dimensions such as: multitasking, interruptions, management of information load, and work productivity. One of several indicators that can be monitored is the number of tasks that are fragmented, being monitored daily. Another phenomenon of the current work environment in the same industry was described by Okkonen et al. [22] as a ubiquitous work. The authors emphasize

the role of information ergonomics, crucial for the workers constantly working digitally. Castillo-Martinez et al. [23] focus on the hybridization in combination with the communication technologies. This led to a point where work can be performed at any physical place, leading to changes in ergonomics. The authors identify the need to include new elements so that ergonomics can analyze modern work.

Certain connections between ergonomics of work and the musculoskeletal disorders were studied by Shang et al. [24]. The authors stress the importance of the workers themselves being aware of the risk their work poses on their health. This leads to the workplace ergonomics evaluation. The authors warn that there is a multitude of evaluation tools, and only the selection of appropriate ones help managers identify the job risk(s). The study carried out in Korea aimed at measuring an awareness level of adjustable office chairs' functions. The results showed that employees did not know even half of these functions. Specifically, 55% of workers thought their chair had sufficient adjustable functions, whereas 73% used only two or fewer functions, and 10% of respondents did not use any functions at all [25]. A different study conducted by the University of Cincinnati looked into particular ergonomic issues related to working from home during the pandemic. The study involved 843 participants and focused on discomfort, health problems, and the respondents' stress level or their fatigue. Regarding the study, 85% of employees reported using a laptop and 55% of employees also used its monitor. Less than 45% of employees reported using adjustable armrests, whilst more than 40% of the participants reported severe lower back pain, moderate neck, head, and eye issues, and mild back and shoulder problems [26].

A study performed by the West Texas A&M University focused on the effects of sit-stand workstations. The results concluded that these workstations had positive effects as employees felt improvements in their health, physical activity, and productivity [27]. A study published by the University of Newcastle was concerned with the prevalence of musculoskeletal discomfort and workstation configuration, work position, and ergonomics training. Here, the sample included 301 academic staff members. More than 90% of them claimed that they had experienced musculoskeletal discomfort in the past. The most frequent health problems comprised the neck, shoulders, the lower and the upper back [28]. From the managerial perspective, ergonomics must be appropriately set according to specific requirements of a particular company, its employees, or their job position. Designing effectively working ergonomics can be understood as a decision-making process [29]. An ideal state is when a given company selects an alternative leading to the maximal utility at minimal costs [30].

3. Data and Methods

The methodological approach begins with a research goal definition, which is followed by a description of the research methods. While analyzing the connection between ergonomics and logistics, the research goal was to gather evidence for logistics managers to actively engage in an ergonomic setting of logistics processes. Then, it was to examine the perceived importance of ergonomics among university students in Slovakia (studying management and informatics), and also to present recommendations for improving ergonomics of computer work tasks.

Furthermore, related research questions were stated as follows: a) What are the main arguments of current and future managers, logistics specialists and employees in their drawing close attention to ergonomics issues? b) Has the perception of ergonomics changed due to the Covid-19 pandemic? Moreover, used methods included analysis, synthesis, induction, and deduction. Sociological questioning via the questionnaire technique was employed to collect primary data. Analysis was applied in several cases to find out information about ergonomics, more narrowly focusing on ergonomics in the study and office environment. Synthesis was used to combine information in relation to comprehensive conclusions. Induction led to making recommendations for improving the workplace ergonomics. Deduction was applied to the identified health issues occurring due to incorrect workplace ergonomics.

The questionnaire technique was used to determine the awareness of respondents about ergonomics in connection with the fact that the respondents were experiencing distance learning. It was carried out online from October 2021 to March 2021. To determine the perceived importance level of ergonomics, the Likert scale was applied. The overall number of questions was ten, with 92 responses being collected. Since the number of students participating in the research amounted to 1,595, the actual sample size shifted the margin of error to 9.92%. It was a pilot survey to map the given situation and confirm the importance of the topic studied, thus the sample is considered acceptable. The statistically testable hypothesis was stated as follows: respondents who are aware of the principles of ergonomics are more attentive to identifying them in their surroundings. It was tested using the z-score. This followed from the fact that the data collected were categorical, and after coding the positive answers to one of the questions analyzed, the number of categories related to variables was two.

4. Results

The results section consists of two main parts. The first part is a presentation of the collected secondary sources, which is an analysis of health problems caused by non-compliance with the ergonomics principles and the link between such problems and the increased costs. The second part is a summary of the original pilot survey.

4.1 Health Problems Caused by Non-Compliance with Ergonomics and Their Implications

Specific research demonstrating a link between health problems and the non-compliance with ergonomics principles was conducted by Wilmot et al. [31]. The authors searched scientific databases for terms related to sedentary work. More than 794,577 participants were involved in the studies analyzed leading to the finding that sedentary work is closely related to increased risks of diabetes and cardiovascular disease. Statistics revealed that the average adult spends 50 to 70% of the day sitting at work. Nastasia and Gaspard [32] analyzed the state some workers were in after they had developed musculoskeletal disorders due to their work. In this case, rehabilitation programs must be provided for them so that they can return to work. Still, ergonomic modifications are needed to support the whole process.

Other statistics showed that up to 35.7% of all adults in the United States are obese and that the nation's poor health is causing a significant increase in health care costs. Studies have shown that up to one third of all corporate injury and disease costs in the United States are musculoskeletal disorders. Based on the facts listed above, sedentary work in offices poses health risks for workers [33].

Within the managerial approach to ergonomics, proactivity instead of reactivity is promoted by Fernandes et al. [34]. The anticipation of ergonomics issues and their occurrence is not possible without identifying particular risks. An appropriate procedure then includes combining a technical perspective and medical perspective. A key role is played by targeted training courses because they can disseminate the ergonomics values among employees. Sarbat and Tasan [35] connected ergonomics with performance management. Their solution for companies to incorporate ergonomics properly into their operations is a combination of sustainability and ergonomics indicators.

4.2 Results of Pilot Ergonomics Survey among Students at a Slovak University

Details of the pilot survey were given in the methodology section. Results of several questions from the questionnaire show the students' opinions on ergonomics. Changes due to the Covid-19 pandemic were examined. Their effects on the perceived importance of a properly set environment for studying and working with a computer are related to distance learning.

The following values describe the obtained sample: 57.61% females, 42.39% males. When asked about the perception and awareness of an ergonomics setting of the study environment at the faculty they study at, 64.13% of the respondents marked a positive answer. The impact of the Covid-19 pandemic in the form of long-term distance learning was assessed by comparing the answers to two specific questions in the questionnaire. (For both of them, a scale from 1 to 5 was

used, where 1 = very important, 5 = not important). The results of the comparison are shown in Fig. 1.

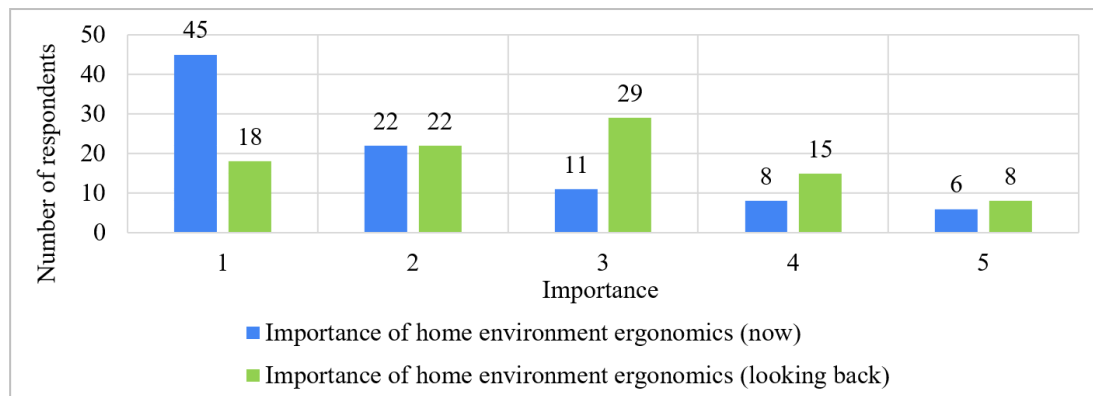


Fig. 1 Comparison of the perceived importance of home environment ergonomics (studying/home office PC activities). Source: authors

The results suggest an increasing trend in the perceived importance of ergonomics of the home environment for studying due to the Covid-19 pandemic. It is assumed that the importance of this element will be more perceived in the future and reflected in the work environment settings.

In addition to summarizing the answers, an analysis of statistically significant relationships was applied, even though it is still a pilot survey. The aim was to indicate possible significant relationships and contexts to guide the next research phases. Specifically, it was the application of a test of independence between the answers to two questions in the questionnaire. The perceived importance of setting home environment ergonomics for work and studying was confronted with the knowledge of basic ergonomics principles. When asked whether they know the principles of an ergonomically correct studying environment, the respondents were given three options – yes, no, partially. However, the hypothesis that respondents who are aware of the principles of ergonomics are more attentive to identifying them in their surroundings has not been confirmed. It was tested using the z-score with the following results: z-score = 0.036; critical value = 1.96; p-value = 0.971; significance level of 0.05.

Based on the results stated in subchapter 4.1, the answer to the research question a) is that these arguments include the employees' health problems caused by inappropriate ergonomics conditions of their workplaces, decreased productivity as well as negative effects on their well-being. Based on the results stated in subchapter 4.2, the answer to the research question b) is positive, thus the pandemic has actually changed the perception of ergonomics.

Following from the answers to the research questions, ergonomic recommendations reflect the pilot survey findings emphasizing the growing importance of knowledge about the correct setting of a person's own work environment for office activities and for studying (Fig. 2).

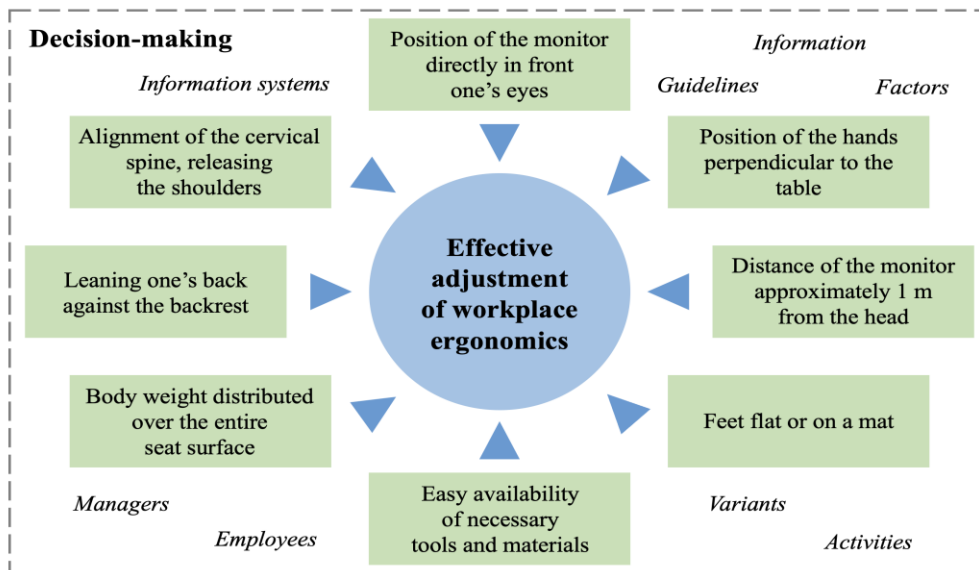


Fig. 2 Recommended elements of appropriate ergonomics in work/study environment. Source: authors

5. Discussion

The research focused on work environment ergonomics of knowledge work and studying. It examined the connections between inappropriate conditions and people's health. For future changes, managers and employees need to acknowledge the role of ergonomics. They also need certain tools to assess the risks of individual processes and recommendations to adjust or alter their environments.

A similar issue was studied by Smith [36] who examined how ergonomic studying conditions can affect students' performance. Capri et al. [37] studied these issues selecting university libraries. Physical conditions and the users' perceptions were included. The results showed that the level of noise and lighting were considered unsatisfactory. Study environment was also researched by Rudolf and Griffiths [38]. Their study focused on tables installed for a laptop program. In this case, the ergonomic analysis led to the implementation of positive changes expressed as enhanced students' comfort and productivity. All these studies support the need to include ergonomics into designing study environments. Knowledge of ergonomics principles can be transformed into better working conditions in the future.

In relation to the recommendations presented below, Chim [39] presents the concept of 6 Ws of ergonomics. If ergonomics is approached in such a complex way, employees' comfort can be achieved. Lowe et al. [40] studied the direction of the ergonomics methods development. Specialized apps are still at an early stage of their adoption among ergonomists. More development and adaptation of modern tools to be used to gather information on work ergonomics is yet to come. However, this area attracts researchers' attention. Feyen et al. [41] studied the computer-aided ergonomics so that these issues can be assessed at the very early stages of their designing, and Shi

et al. [42] emphasize the role of human body models. These models need to work with current data representing the changes in the height, weight, and other parameters of today's population as it was concluded by several authors [43, 44]. Emerging technologies are constantly changing working conditions. Hybridization of work makes it ubiquitous for the knowledge-intensive jobs. However, these technologies can also be used to improve the conditions in which people work. Sensors can be applied to gather data on working conditions in real time or to detect violation of ergonomics principles. Numerous other cases when new technologies push the efficiency of logistics further include the supply chain management supported by the Big Data analysis or the design of smart logistics operations via controlling [45]. As described by Siemieniuch et al. [46], and in relation to future work arrangements, humans will still be in the center, and only a systematic approach will bring fully effective workplace ergonomics including more efficient logistics processes redesigned to create smoother workflows [47].

6. Conclusion

The research examined the perceived importance of ergonomics among university students of management and informatics in Slovakia. Based on the synthesis of individual findings, the authors compiled recommendations for setting up a suitable work environment, both for studying and office work. When performing work in a home or work environment, it is necessary for a student/an employee to take care of their health despite higher prices of individual ergonomic aids.

Based on the analysis of available solutions, these include adjustable chairs adaptable to a person's height, figure, or other physical parameters. An important element of the work/study environment involves lighting with sufficient intensity to prevent eye strain. Monitors should be placed on an adjustable stand so that their height, distance, and angle can be altered. The more accessible ergonomic aids include hand pads when working with a computer mouse or foot pads placed under desks.

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