

IMPACT OF ERGONOMIC FACTORS ON UNIVERSITY STUDENTS' ACADEMIC PERFORMANCE

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ABSTRACT

Ergonomics significantly influences university students' academic performance. This research aimed to explore the impact of ergonomic factors on students' performance, focusing on physical, cognitive, and macro-level factors. Data were gathered through a structured questionnaire from 318 social sciences students across universities, using a 24-items Likert scale. The study revealed a significant relationship between ergonomic factors and academic performance. Regression analysis showed how workplace design, lighting, temperature, and noise affected students, alongside cognitive factors like learning styles and macro factors such as access to technology. Recommendations include improving classroom design, incorporating diverse teaching methods, and enhancing learning environments.

Key Words: Ergonomics, Academic Performance, Environment, Cognitive Factors, Physical Factors.

INTRODUCTION

Educational institutions hold a crucial position in today's rapidly evolving world, to stay pertinent and cater to the demands of the present generation, these institutions must continuously adapt and progress. The concept of ergonomics, which focuses on designing work environments to meet the physical and cognitive needs of individuals, plays a critical role in this process. Term "ergonomics", was initially introduced in 1857 by the Polish scientist Wojciech Jastrebowski, has since evolved into a field aimed at improving human well-being and system efficiency (Vijayakumar et al., 2015). A range of factors come into play in the competition of academic achievement and ideal learning decisions, inducing the complete performance of students. Ergonomic considerations are an important consideration that is frequently disregarded. From the Greek words 'ergon,' meaning 'work,' and 'nomos,' meaning 'natural principles or arrangements,' ergonomics focuses on human structural, physical, cognitive, and biomechanical factors related to physical activity.

The Universal Ergonomics Connection describes ergonomics as a technical investigation of the

interactions between individuals and various system components. Additionally, it is an occupational field that employs concepts, values, information, and techniques to enhance the well-being of individuals and system efficiency in its entirety. The concept of ergonomics can be divided into three categories: psychological, cognitive, and institutional (Gamper., 2022). Ergonomics derives from the Greek words ergon, which denotes "work," and nomos, which signifies "natural law," with the literal translation being "the science of work." The concepts of ergonomics and human factors are increasingly used. The International Ergonomics Association (2019) defines ergonomics as a scientific discipline that deals with subject matter. It is a profession that uses theory, concepts, statistics, and strategies to design in order to maximize human well-being and overall system performance.

Ergonomics is a subject that studies how to make workers work better, safer, and more relaxed. It also looks at how people and technology work together. All educational institutions need to think about ergonomics because this is important for measuring the right outcomes for users, such as

improving students' academic achievement, developing effective study, and doing research. (Narkhede & Sarode, 2018). In order to maintain healthy scenarios, (Atkins, 2005) states that establishing a practical inquiry the natural world involves managing and altering the architecture of the study segments, putting ergonomic devices and supplies into place, and holding classes and delivering programs to promote secure educational practices. The above described elements address mental, physical, and macro-ergonomics. The study of ergonomics looks into ways to make workplaces safer yet simultaneously reducing learner fatigue as well as discomfort in order to boost productivity. The overview of the literature indicates that the need to study all of the elements in order to identify potential issues was not looked at before and ought to be done now when major difficulties are emerging.

In order to overcome the difficulties of separated learning and preserve a supportive and effective environment for learning, comfort is essential. Ergonomics, also referred to as mental variables, is defined by the International Organization for ergonomic design Association as an area of study examining how people communicate with additional elements of an apparatus and as a profession that uses concepts, values, information, and methodologies to enhance the technique's performance as a whole as well as individual's well-being. The three primary fields of ergonomics are tangible, institutional, and intellectual.

Objectives:

- 1) To identify ergonomics factors at university level.
- 2) To find out the academic performance of university students.
- 3) To find out the effect of ergonomic factor on academic performance of university student.

Literature Review

The ergonomic situation in higher education has been overlooked for many years. The purpose of ergonomics is to develop a balanced model that integrates both mental and physical performance. This theory explains the relationship between human performance and their environment (Raby, 2003). Executing proper ergonomic modifications in the classroom offers a means of child

development environmentalism. (Simply Psychology, 2020).

The study of ergonomics focuses on how to execute instruments duties employment, and positions of power in a way that is safe, efficient, as well as beneficial for those who use them (Kedzior, 2018). Educational ergonomics is a subfield for environmental research primarily looks into the connection between academic achievement and the design of the educational environment. Regardless of the type of school, the system contains various ergonomic characteristics that make the small and large-scale appealing (Legg & Jacobs 2008).

The building of an infrastructure that enabled the arrangement of a progressive educational sequence of applicable material as well as disciplinary features served as the foundation for the competence domains linked with undergraduate ergonomics programs. In light of the predicted outcomes of every class, the related objectives for learning, the relevant instruction and learning approaches, and their assessments, three distinct courses were found adopting this pattern. Since the beginning, the centered around competencies hygiene programs have been discovered, and during each stage of assessment, self-monitoring and flexible learning alternatives are taken into consideration (Gruppen et al., 2012).

Ergonomics is the process of applying technology to design environments for work that are comfortable for various user groups. This holds true for individuals of different dimensions talents, and degrees of adaptability (Makhbul, 2013). Because automated machinery, for example, continue to possess limited capacities, people are nevertheless thought to be more adaptable, creative, and ingenious than technology. However, excessive physical labor can readily cause harm to the body of an individual, leading to skeletal disorders (Berlin & Adams, 2017).

The physical, intellectual, and macro-ergonomic factors all perform substantial parts in facilitating learners' learning via the internet (2018). A number of studies have looked into ways physical comfort can enhance educational experiences for students. In the nation of India, the role of human psychology in establishing an academic setting for remote education was looked into. The results of the study, poor layout of workstations might result in injuries to the skeletal system, which hinder both retention and concentration. Moreover, previous

study has found that youngsters who are instructed in an educational setting tend to be more inspired interested, as well as possessing stronger fundamental knowledge retention competencies (2022).

In the opinion of (Soltaninejad et al, 2021) interaction to an instructional setting boosts pupils' motivation to gain knowledge. A variety of factors, including enlightenment vibration, humidity, the process of respiration cleanliness of the air, and instructional tools, can boost a student's interest and drive to study (2012). All of these variables also influence educational development. (Adewale et al, 2021) study also found that the academic achievement of pupils is influenced by the convenience of their immediate environment and resources.

The phrase "tangible context" refers to both of an area's external features. The actual educational environments include things like lighting, the surrounding area, air circulation, chamber size, ground level, barriers, desk locations, rug type, white boards, and technology. The physical environment of educational institutions has an impact on students' learning and academic achievement (Baafi, 2020). Illumination is considered to be the most significant of the nine architectural effects on productivity in the workplace (El-Zeiny, 2012). Insufficient or excessive lighting can negatively affect an individual's academic achievement (Realyvásquez-Vargas et al., 2020). A study also indicated that learning space darkness had a significant impact on student performance in Delhi schools (Singh et al., 2020). In reaction a hypothesis that follows was created and will ultimately be tested in an additional investigation. There can be a strong correlation amongst illumination as well as students' capacity for learning.

The quality of air circulating throughout the building has a direct impact on the students' health and comfort. Appropriate ventilation in educational settings is crucial for participants' well-being as well as general satisfaction (Hameed & Amjad, 2009). Learning success as well as educational motivation are correlated with how students interact with knowledge. Students impacted by the worldwide epidemic report feeling

more stressed out about school and getting bad feedback on their achievements and methods for studying via the internet, according to (Chung et al., 2020).

Researchers have also revealed that pigment, heat produced, movement, disturbances, and the construction of computers might all have an impact on a person's discomfort, disassociation, and capacity to learn. Because of this, assessing a person's physical characteristics, environmental influences, and psychological characteristics is essential to their academic success and sustainable existence (Chung, Subramaniam, & Dass, 2020).

Academic performance, also known as academic achievement or academic completion, is the outcome of education; it indicates the extent to which a student, instructor, or organization accomplished their academic objectives. Assessments and ongoing evaluations typically predict academic success, but there is no universal agreement on the optimal approach or the relative importance of technical knowledge, such as skills vs instructive knowledge, such as realities. Academic performance is defined as having a significant impact on all academic controls and serving as a secondary activity in the classroom (Bateman, 2006).

Research Design:

This study employed the descriptive research design using the quantitative research approach. Quantitative research involves collecting and analyzing non numerical to understand concepts, opinions, or experience. The descriptive research, primarily utilizing numerical data to analyze and draw conclusion about the impact of ergonomic factor on educational performance of learner.

Population & Sample

The total population were 1800 university students. A sample of 318 were students selected from the enrolled population participated in the survey randomly.

Research Instrument:

A structured questionnaire was created and employed as the study tool to gather information.

Data Analysis

Table 1. Design of Workplace, Illumination, Temperature, and Noise:

Statements	N	Mean	Std. Deviation
Design of Workplace			
1. Adjustable work chair suitable for work area.	318	3.49	1.25
2. Working table suitable for work area.	318	3.32	1.26
3. Adequate space in work area.	318	3.65	3.08
Illumination			
4. Sufficient natural lighting in classroom.	318	3.13	1.23
5. Proper lighting distribution in classroom.	318	3.19	1.14
6. Proper lighting for computer and paper tasks.	318	3.19	1.16
Temperature			
7. Sufficient ventilation in classroom.	318	3.24	1.15
8. Comfortable temperature level in classroom.	318	3.33	1.16
9. Temperature does not interfere with concentration.	318	3.19	1.21
Noise			
10. Background noise does not interfere	318	2.95	1.22
11. Background noise does not affect the overall class	318	3.06	1.20

Table 1 shows that the mean value of statements from 1 to 3 are from 3.49 to 3.65. It means that sample is slightly agree with Design of Workplace. All students of social sciences are slightly agree that Design of Workplace is not suitable according to the standard conditions. The mean value of statements from 4 to 6 from 3.13 to 3.19. It means that sample is strongly disagreed with illumination system. All students of social sciences are disagreed that illumination is not suitable according to the standard conditions. All students of social sciences are disagreed that temperature is not suitable according to the standard conditions.

Data also indicated that that the mean value about temperature was from 2.88 to 3.10. It mean that sample is slightly disagreed with statements of noise. All students are strongly disagreed with statements of noise. The analysis indicated that students agreed that the design of their workplace was unsuitable, while they strongly disagreed with the adequacy of the illumination and temperature systems in classrooms. Additionally, students also express dissatisfaction with the noise levels, indicating strongly disagreement with its suitability for best learning environment.

Table 2. Visual, Auditory, Tactile, LMS, Technology and Academic Performance:

Category	Statements	N	Mean	Std. Deviation
Visual Learning Style	Remember instructions better when read	318	3.92	0.99
	Understand better when reading instructions	318	3.84	1.08
Auditory Learning Style	Learn better when told how to do something in class	318	3.88	1.00
	Remember things better when heard in class than read	318	3.82	3.07
Tactile Learning Style	Learn more through making something for a class project	318	3.87	1.01
	Learn more by making a model of something	318	3.80	3.05
Learning Management System	LMS eases communication with instructor and classmates	318	3.57	0.99
	LMS contributes to overall course satisfaction	318	3.52	1.07
Access to Technology	Use internet-based materials for learning	318	3.47	1.24

	Competency in using the internet for class	318	3.08	1.34
Teaching Delivery	Instructor conducts clear demonstrations and explanations	318	3.72	1.10
	Instructor presents well-organized lectures	318	3.63	1.18
Academic Performance	Regular and punctual in attendance	318	4.05	1.10
	Pay attention during class discussions	318	3.93	1.04

The analysis highlights that students tend to learn best through visual and tactile methods, with strong preferences for reading instructions, mean 3.92. It means that sample was agreed with statements of visual learning style. All students are strongly agreed with statements of visual learning style according to standard conditions, and engaging in hands-on activities like making models, mean 3.87. Auditory learning is also effective, with students recalling better when instructions are spoken, mean 3.88. The Learning Management System (LMS) slightly aids communication and satisfaction, mean 3.57, while internet competency and usage are moderate, mean 3.08. Teaching delivery through clear explanations is rated well, mean 3.72, and students demonstrate high levels of attention and punctuality in class, mean 4.05.

Discussion

The principal aim of this study was to examine the impact of ergonomic considerations on the learning outcomes of students'. The current study looked at the impact of intellectual, physiological, and macro-ergonomic factors on students' academic progress. The study's findings showed a positive and statistically significant relationship between the ergonomic component and academic achievement among college students. Workplace design, disturbance level, heat, and lighting are among the variables that can affect how well students learn, in the words of Villarouco et al. (2012). If designed appropriately, this might potentially improve and encourage pupils' efficiency. Nevertheless, there hasn't been a comprehensive study done on how distance education students using online learning tools perform when it comes to physical (2021), macro ergonomic (2020), and cognitive (2021) variables. Assessing how well a particular factor (like stress) reacts to a person's cognitive function is known as a cognitive ergonomic evaluation. Its foundation is in a comprehensive comprehension of human perception, cognition, and memory. The outcome

is comparable in my research. Students' motivation for studying has an impact on how connected they are to their studies. Hendrick and Kleiner (2000) state that in order to assist the design of human work, human software, and human-environment systems, organizational structures, regulations, and practices are integrated with macro-ergonomics. Its applications relate to an enhancement to management systems generally by assessing the elements that need to be changed and then progressively moving on to the method's overall framework and operation (2005). Several macro-ergonomic aspects impact an organization's success significantly. A few of these elements are how professors provide education, how students use technological devices, and how educational information systems (LMS) are used. It consists of duties, constraints placed on the corporation, the external environment, human aspects, and tools and technology (2021).

Findings

- improving the design of the workplace positively impacts academic performance. A better-organized and structured environment enhances learning outcomes.
- Proper lighting plays a role in boosting academic performance. Bright and adequate lighting makes it easier for students to focus and learn effectively.
- Classroom temperature affects academic performance, with optimal temperatures creating a more comfortable learning environment that supports better performance.
- A moderate amount of noise positively influences academic performance, suggesting that complete silence might not always be ideal for learning.
- Students who rely on visual learning methods tend to perform better. Visual aids such as diagrams, videos, and presentations enhance their understanding.
- Auditory learners also benefit significantly from environments where listening to instructions,

lectures, or discussions is emphasized, leading to better academic outcomes.

□ Technology and learning management systems contribute to improved academic performance by organizing learning materials and facilitating smoother communication between students and instructors.

□ The way teachers deliver lessons is a critical factor in student performance. Clear, engaging, and effective teaching methods significantly improve academic success.

Conclusion

The results showed that a variety of factors, including teaching methods, accessibility to technology, education management system use, sensory and visual approaches to learning, workspace architecture, lighting, noise levels, and temperature, all had a significant impact on the academic achievement of learners. The study's findings demonstrated a favorable and statistically significant association amongst undergraduate pupil academic achievement and ergonomic characteristics. The results of the study indicated that ergonomic factors improved the academic achievement of university students. The study's findings lead to a few more inferences. The study also report that majority of respondents disagree with the physical factor have a well-designed workplace include an adjustable chair, suitable table, and adequate space, fostering satisfaction comfortable. Adequate natural and artificial lighting, proper ventilation, and a comfortable temperature enhance my focus and concentration during class. Additionally minimal background noise ensures clear communication and a high-quality learning experience. Majority of students agreed with cognitive factor visual learners prefer, reading and benefit from written instruction. Auditory learners grasp information better through spoken instruction and lectures. Tactile learners thrive when they can create or build, finding hands on project engaging and memorable.

The results of the literature study have been used in a number of research to look at the relationship between illumination and learners' performance from a real-world practical standpoint. Fortunately, discomfort and wetness are two more aspects of their physical ergonomics that need to be studied in more detail. One of the most prevalent problems that could negatively affect students' learning

performance is poor posture. Physical ergonomics, including lighting and noise levels, can lead people to get fatigued, anxious, or suffer. For this reason, it is crucial.

Recommendations:

- 1) It is recommended that enhance physical factor to improve the design of the workplace to align with standard conditions, considering students preference and comfort.
- 2) It is recommended that upgrade the cognitive factor to improve a balanced preference for various learning modalities, indicating that incorporating diverse teaching methods could enhance the educational experience for students.
- 3) It is recommended that the Marco factor provide valuable insights for students in term of expectations and experiences within these areas.

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