

APPLIED ERGONOMICS AND ITS ROLE IN IMPROVING SAFETY AND SYSTEM PERFORMANCE

Alli Jiang*

Department of Applied Ergonomics, The First People's Hospital of Foshan, Foshan, China

Correspondence: Alli Jiang, Department of Applied Ergonomics, The First People's Hospital of Foshan, Foshan, China; E-mail: jia.al@gmail.com

Citation: Jiang A (2025) Applied Ergonomics and Its Role in Improving Safety and System Performance. J Appl Ergon Res 3(1):1-5.

Received date: June 09, 2025; **Accepted date:** June 11, 2025; **Published date:** July 13, 2025

Abstract

Applied ergonomics is the practical application of ergonomic and human factors principles to the design of work systems, products, environments and services. Its primary objective is to improve human well-being, safety and performance while simultaneously enhancing system efficiency and effectiveness. Unlike theoretical ergonomics, applied ergonomics focuses on solving real-world problems across diverse domains such as healthcare, industry, transportation, offices and consumer product design. Applied ergonomics focuses on implementing human-centred design principles to improve safety, efficiency and usability in real work environments. By integrating physical, cognitive and organizational considerations, it reduces injury risk, minimizes errors and enhances system performance across diverse industries and service sectors.

Keywords: Applied ergonomics; Human factors engineering; Workplace design; Musculoskeletal disorders; System performance

Introduction

Physical Applied ergonomics is a multidisciplinary field concerned with appropriate work systems to the capabilities and limitations of people. As modern work environments become increasingly complex, the mismatch between human abilities and system demands frequently results in injuries, errors, inefficiency and reduced quality of work. Applied ergonomics addresses these issues by translating ergonomic theory into practical solutions that improve both human well-being and organizational performance.

The growing emphasis on occupational health, safety and productivity has positioned applied ergonomics as an essential component of system design and management. From reducing musculoskeletal disorders in industrial settings to

improving patient safety in healthcare and enhancing usability in digital systems, applied ergonomics plays a significant role in creating human-centred environments.

Foundations of applied ergonomics

Ergonomics Applied ergonomics is grounded in ergonomics and human factors science, which draws knowledge from anatomy, physiology, biomechanics, psychology, engineering and design. The field recognizes that humans are integral components of systems and that system performance depends heavily on how well tasks, tools and environments are aligned with human characteristics.

The fundamental premise of applied ergonomics is that systems should be designed around people

rather than forcing people to adapt to poorly designed systems. This human-centred method emphasizes safety, comfort, usability and efficiency while considering physical, cognitive and organizational aspects of work.

Principles of applied ergonomics

Several key principles guide the application of ergonomics in real-world settings.

One central principle is adaptability. Work systems should accommodate individual differences in body size, strength, skills and experience. Adjustability in workstations, seating and tools is essential for inclusive design.

Another principle is simplicity and usability. Tasks, controls and interfaces should be intuitive and easy to understand, minimizing the probability of errors and reducing mental workload. Reducing unnecessary complexity improves performance and safety.

The principle of prevention is also essential. Applied ergonomics focuses on identifying and addressing risks early, rather than reacting to injuries or failures after they occur. Proactive ergonomic design helps prevent musculoskeletal disorders, fatigue, and human error.

Material and Methods

Methods and tools in applied ergonomics

Applied ergonomics employs a wide range of qualitative and quantitative methods to assess and improve work systems.

Observational techniques, such as task analysis and posture assessment, are commonly used to identify ergonomic risks in real work environments. Checklists and screening tools help prioritize problem areas.

Measurement-based methods include biomechanical analysis, anthropometric evaluation and workload assessment. These methods provide objective data on physical demands, reach distances, force requirements and postural loads.

Participatory ergonomics is another important method, involving workers directly in identifying problems and developing solutions. This method

enhances acceptance and sustainability of ergonomic interventions.

Applications of applied ergonomics

Applied ergonomics is used across a wide range of sectors, reflecting its versatility and practical relevance.

Industrial and manufacturing settings: In manufacturing, applied ergonomics focuses on reducing physical strain from manual material handling, repetitive assembly tasks and prolonged standing. Ergonomic redesign of workstations, tool modification and automation reduce injury risk and improve productivity.

Office and computer-based work: Office ergonomics addresses issues related to prolonged sitting, screen use and repetitive input tasks. Applied ergonomic solutions include adjustable furniture, optimized monitor placement and improved input device design to reduce neck, back and upper limb disorders.

Healthcare and service sectors: In healthcare, applied ergonomics improves patient handling, equipment usability and workflow design. Mechanical lifting aids, ergonomic medical devices and improved layout of care units enhance worker safety and patient outcomes.

Transportation and public systems: Applied ergonomics plays an essential role in transportation by improving vehicle design, control layouts, signage and operator workstations. These interventions reduce driver fatigue, enhance comfort and improve safety for both operators and users [Table 1].

Applied ergonomics and musculoskeletal disorder prevention

One of the most significant contributions of applied ergonomics is the prevention of work-related musculoskeletal disorders. By addressing risk factors such as awkward postures, excessive force, repetition and static loading, ergonomic interventions reduce the physical stress placed on the body. Applied ergonomics develops task variation, mechanical assistance, proper tool design and optimized work heights. These methods not only reduce injury risk but also improve endurance and long-term work capacity.

Table 1: Application Areas and Outcomes of Applied Ergonomics.

Application Area	Ergonomic Focus	Common Intervention	Key Outcome
Manufacturing	Physical workload	Workstation redesign	Reduced musculoskeletal disorders
Offices	Posture and screen use	Adjustable furniture	Improved comfort and productivity
Healthcare	Patient handling	Mechanical aids	Reduced injury risk
Transportation	Operator controls	Ergonomic layout	Enhanced safety and alertness
Service sector	Task organization	Workflow optimization	Improved efficiency and quality

Cognitive and organizational dimensions

Although frequently associated with physical aspects, applied ergonomics also addresses cognitive and organizational factors. Cognitive ergonomics focuses on mental workload, decision-making and information processing. In applied settings, this involves improving interface design, alarm systems, and information presentation.

Organizational ergonomics examines how work schedules, communication, teamwork and management practices influence performance and well-being. Applied ergonomic interventions may include redesigning shift schedules, improve teamwork structures and foster a positive safety culture.

Benefits of applied ergonomics

The benefits of applied ergonomics are extensive and measurable. Workers experience reduced discomfort, fatigue and injury risk, leading to improved health and job satisfaction. Organizations benefit from lower absenteeism, reduced compensation costs, fewer errors and increased productivity.

Applied ergonomics also enhances quality, reliability and user satisfaction in products and services. By prioritizing human needs,

organizations achieve more sustainable and competitive systems.

Challenges in implementing applied ergonomics

Despite its proven value, implementing applied ergonomics can be challenging. Common barriers include limited financial resources, lack of awareness, resistance to change and insufficient management commitment. In some cases, ergonomic benefits are long-term and not immediately visible, making it difficult to justify investment. Overcoming these challenges requires education, leadership support and integration of ergonomics into organizational policies and design processes. Demonstrating the cost-benefit relationship of ergonomic interventions can further support adoption.

Applied ergonomics in modern work systems

Applied ergonomics focuses on the practical use of ergonomic knowledge to improve how people interact with their work environments. Rather than remaining theoretical, it translates human factors research into real solutions that enhance safety, comfort and efficiency. In today's dynamic workplaces, applied ergonomics is essential for balancing human well-being with organizational performance.

Results and Discussion

Managing physical workload

Physical Many occupations involve physical demands such as lifting, pushing, repetitive actions or prolonged postures. Applied ergonomics addresses these challenges by modifying work methods and equipment to reduce physical strain. Adjusting work heights, improving tool design and introducing mechanical aids help lower the risk of musculoskeletal injuries. These interventions not only protect workers' health but also improve endurance and productivity.

Supporting mental and cognitive performance

Applied ergonomics also considers mental workload and cognitive performance. Workers frequently process large amounts of information, make decisions under time pressure and interact with complex technologies. Poorly designed interfaces or unclear procedures can increase mental stress and lead to mistakes. By simplifying information presentation, improving control layouts and designing intuitive systems, applied ergonomics supports accurate decision-making and reduces cognitive overload.

Role of worker participation

An important feature of applied ergonomics is the involvement of workers in the design and improvement process. Employees possess valuable knowledge about their tasks and challenges. Participatory approaches encourage workers to identify risks and suggest practical solutions. This collaboration increases acceptance of ergonomic changes and ensures that interventions are realistic and sustainable in daily operations.

Organizational integration

Applied ergonomics extends beyond individual workstations to influence organizational practices. Work schedules, job rotation, staffing levels and communication structures all affect human performance.

Ergonomic interventions may include redesigning shift patterns to reduce fatigue, improving teamwork processes or establishing ergonomic

policies within organizations. Integrating ergonomics into management systems ensure long-term effectiveness rather than isolated improvements.

Technology and innovation

Advances in technology have expanded the scope of applied ergonomics. Wearable devices can monitor posture and movement, while data analytics help identify high-risk tasks. Automation and digital tools reduce physical workload but must be carefully designed to avoid introducing new ergonomic problems. Applied ergonomics ensures that technology enhances human performance rather than creating additional strain.

Emerging trends and future directions

The future of applied ergonomics is closely associated to technological innovation and system complexity. Wearable technologies and sensors allow real-time monitoring of posture, movement and workload. Data analytics and artificial intelligence support predictive risk assessment and personalized ergonomic solutions.

Human-centred design, participatory techniques and sustainability considerations are increasingly shaping applied ergonomics practice. As work systems evolve, applied ergonomics will continue to play a crucial role in ensuring that technology serves human needs rather than creating new risks.

Conclusion

Applied ergonomics is an essential study that transforms ergonomic theory into practical, real-world solutions. By aligning work systems, tools and environments with human capabilities, applied ergonomics enhances safety, comfort and performance across diverse domains.

Its contributions to injury prevention, error reduction, productivity improvement and system sustainability make it a significant component of modern design and management practices. As workplaces and technologies continue to evolve, the role of applied ergonomics will become increasingly important in creating healthy, efficient and human-centred systems.

References

1. Dunkel Schetter C, Tanner L. Anxiety, depression and stress in pregnancy: Implications for mothers, children, research and practice. *Curr Opin Psychiatr.* 2012;25:141-148. [Crossref] [Google Scholar] [PubMed]
2. Milani GP, Porro A, Agostoni C, Gianni ML. Breastfeeding during a Pandemic. *Ann Nutr Metab.* 2022;78:17-25. [Crossref] [Google Scholar] [PubMed]
3. Sayil M, Gure A, Ucanok Z. First time mothers' anxiety and depressive symptoms across the transition to motherhood: Associations with maternal and environmental characteristics. *Women Health.* 2007;44:61-77. [Crossref] [Google Scholar] [PubMed]
4. Lee SA. Coronavirus anxiety scale: A brief mental health screener for COVID-19 related anxiety. *Death Stud.* 2020;44:393-401. [Crossref] [Google Scholar] [PubMed]
5. Mahram B. Validation of Eshpil berger anxiety test in Mashhad. 1994. [Google Scholar]
6. Mappa I, Distefano FA, Rizzo G. Effects of coronavirus 19 pandemic on maternal anxiety during pregnancy: A prospective observational study. *J Perinat Med.* 2020;48:545-550. [Crossref] [Google Scholar] [PubMed]
7. Berthelot N, Lemieux R, Garon-Bissonnette J, Drouin-Maziade C, Martel E. Uptrend in distress and psychiatric symptomatology in pregnant women during the coronavirus disease 2019 pandemic. *Acta Obstet Gynecol Scand.* 2020;99:848-855. [Crossref] [Google Scholar] [PubMed]
8. Yassa M, Birol P, Yirmibes C, Usta C, Haydar A. Nearterm pregnant women's attitude toward, concern about and knowledge of the COVID-19 pandemic. *J Matern Fetal Neonatal Med.* 2020;33:3827-3834. [Crossref] [Google Scholar] [PubMed]
9. Sharmin N, Lubna Z, Hiramoni FA, Sharker T, Ahmed Zahir. Mental health status of pregnant women and breastfeeding mothers during COVID-19 outbreak in Bangladesh. 2021. [Google Scholar]
10. Sun Y, Wang D, Han Z, Gao J, Zhu S. Disease prevention knowledge, anxiety and professional identity during COVID-19 pandemic in nursing students in Zhengzhou, China. *J Korean Acad Nurs.* 2020;50:533-540. [Crossref] [Google Scholar] [PubMed]