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Ergonomics in Educational Technology: Enhancing Engagement and Well-Being Through Strategies and Insights

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Abstract

The rapid expansion of educational technology (EdTech) has transformed learning environments, yet its integration often occurs without adequate consideration of ergonomics—the physical, cognitive, and environmental conditions that shape learner engagement and well-being. This paper examines ergonomics as both a conceptual and practical imperative in technology-mediated education, arguing that human-centered design is essential for realizing the pedagogical potential of digital tools. Drawing on contemporary research, the paper identifies emerging ergonomic challenges, including physical strain, cognitive overload, environmental distractions, and equity gaps. It further outlines practical strategies for ergonomic EdTech integration, emphasizing digital interface design, optimal learning space configuration, inclusive practices, and the promotion of digital well-being. Finally, the paper presents policy recommendations for institutions and educators, highlighting the need for ergonomic guidelines, teacher professional development, and iterative evaluation mechanisms. Overall, the paper advocates a holistic approach that aligns technological innovation with learner health, cognitive efficiency, accessibility, and meaningful engagement.

Keywords: Ergonomics in EdTech; Human-centered design; Cognitive load management; Digital well-being; Inclusive learning environments

INTRODUCTION

Educational technology (EdTech) has become an integral component of contemporary pedagogy, reshaping instructional delivery and expanding opportunities for personalized, collaborative, and flexible learning (Selwyn, 2023; Bates, 2022). Digital platforms, adaptive systems, and interactive media now form the backbone of classroom instruction in many educational systems worldwide. However, the rapid adoption of EdTech has often prioritized technological capability over human-centered design. This imbalance has raised important questions about how physical comfort, cognitive load, environmental conditions, and accessibility

influence students' ability to engage meaningfully with digital tools (Carvajal-Morales et al., 2024; Saha et al., 2024).

Ergonomics, concerned with optimizing human interaction with systems, provides a critical framework for examining these issues. In learning environments, ergonomic principles highlight how posture, device placement, lighting, classroom layout, cognitive clarity, and interface usability collectively affect learners' comfort, attention, and performance (Norman, 2013; Sweller et al., 2019). As a conceptual orientation, ergonomics underscores the interconnectedness of physical, cognitive, and environmental factors in shaping learning outcomes. As a practical imperative, it offers actionable strategies for reducing musculoskeletal strain, managing cognitive workload, and fostering inclusive and supportive learning spaces.

Despite its importance, ergonomics remains underemphasized in EdTech implementation. Emerging research shows that poor ergonomic alignment can lead to fatigue, distraction, discomfort, and disengagement, ultimately limiting the pedagogical value of technology-enhanced instruction (Ait Ouares, 2024; Uche & Okata, 2015). Furthermore, inequities in access to ergonomic furniture, devices, and environments disproportionately affect marginalized learners, deepening existing educational disparities (Selwyn, 2023). Recognizing these emerging challenges provides the foundation for a holistic approach that integrates ergonomics into EdTech adoption, ensuring that innovation supports, not undermines, learner well-being and engagement.

This paper therefore explores the emerging ergonomic issues associated with EdTech integration, analyzes their implications for learning, and presents a framework for practical and policy-oriented ergonomic improvements. The paper advocates a human-centered, equitable, and sustainable approach, aligning technological innovation with learner health, cognitive efficiency, and meaningful engagement.

ERGONOMICS IN EDUCATIONAL SETTINGS.

Ergonomics, defined broadly as the study and design of tools, spaces, and tasks to fit human physical and cognitive characteristics, offers a vital lens for assessing and optimizing educational environments (Uche & Okata, 2015; Saha et al., 2024). In the context of education, ergonomic considerations involve more than just the selection of furniture; they extend to the layout of classrooms or study spaces, the design and positioning of devices, environmental factors (lighting, acoustics, ventilation), and the structure of digital interfaces.

Empirical studies underscore the negative consequences of mismatched classroom environments. Furniture whose dimensions do not correspond to students' anthropometric measurements has been linked to discomfort, posture problems, and reduced learning efficiency (Saha et al., 2024). In digital learning contexts, ergonomically optimized workstations and adjustable furniture have been shown to reduce physical strain, support better posture, and contribute to improved focus and learning outcomes (Saha et al., 2024).

Moreover, ergonomic designs that consider environmental comfort—such as good lighting, acoustic control, adequate ventilation, and flexible layout—further support cognitive performance, mood, and overall well-being (Barrett et al., 2015; Rashid & Zimring, 2008). Classroom and laboratory settings that neglect these factors risk undermining student health, participation, and academic engagement, especially in technology-intensive contexts.

STUDENT ENGAGEMENT AND WELL-BEING

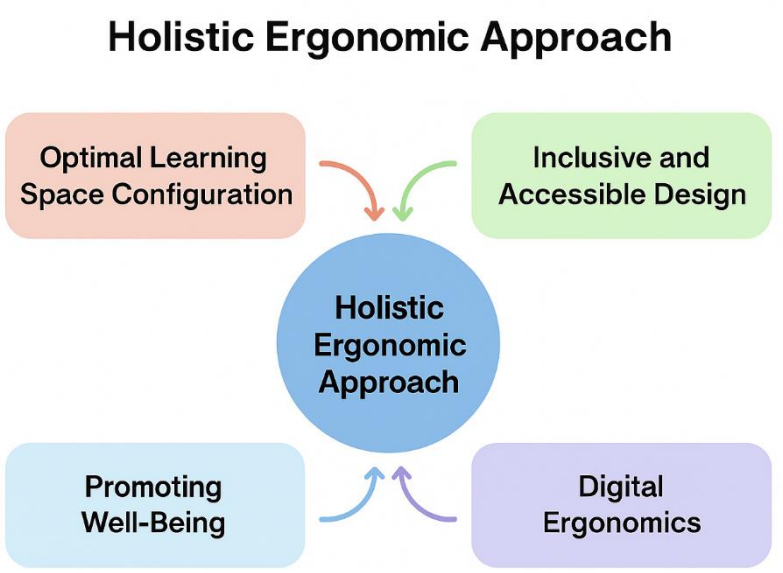
Student engagement and well-being are critical outcomes of effective learning. Engagement encompasses behavioral, cognitive, and emotional involvement in educational activities, while well-being refers to the holistic physical, mental, and social health of learners (Fredricks et al., 2004; Shankland & Roskam, 2017). Evidence suggests that poorly designed learning environments, whether physical or digital, can impede attention, reduce motivation, and exacerbate stress, thereby undermining both engagement and well-being (Eom et al., 2020). Conversely, environments that consider human factors and ergonomic principles can support sustained engagement, cognitive efficiency, and positive learning experiences.

ERGONOMIC FRAMEWORK FOR TECHNOLOGY-MEDIATED LEARNING ENVIRONMENTS

A holistic ergonomic approach recognizes that optimal learning emerges from the interplay between physical space design, digital tool usability, inclusive practices, and the psychosocial well-being of learners. This framework underscores the need for institutions, policymakers, and educators to integrate ergonomic principles into planning, instructional design, and technology deployment. It promotes learning environments where students can engage meaningfully without experiencing avoidable physical strain, cognitive overload, or exclusion due to poorly designed tools or spaces.

By situating ergonomics at the core of educational technology integration, stakeholders can create learning ecosystems that promote equity, sustain engagement, and optimize cognitive performance in both face-to-face and digital modalities.

Diagram 1: Ergonomic Approach for Technology-Mediated Learning



ERGONOMICS AND ITS RELEVANCE IN LEARNING CONTEXTS

Ergonomics, the science of designing environments and tools to align with human capabilities and limitations, is increasingly recognized as essential in education (Ait Ouares, 2024; García-Tudela et al., 2020). In learning contexts, ergonomics addresses physical (furniture, posture), cognitive (information presentation, mental workload), and environmental (lighting, acoustics) dimensions. Although much research on ergonomics has focused on workplace settings, its principles are highly applicable to educational environments, particularly as EdTech becomes pervasive. When ergonomic principles are neglected, students may experience discomfort, cognitive overload, and reduced engagement (Uche & Okata, 2015; Liu & Zhou, 2025).

ERGONOMICS AND LEARNING

Ergonomics provides a lens through which educational technology can be evaluated and optimized to support learner engagement and well-being. In the context of learning, ergonomics encompasses **three interrelated dimensions**: physical, cognitive, and environmental (Dul et al., 2012; Ait Ouares, 2024). Each dimension interacts with technological tools and pedagogical practices to shape the quality of the learning experience.

Physical Ergonomics

Physical ergonomics concerns the design of learning spaces, furniture, and devices to accommodate the human body's capabilities and limitations. In educational contexts, considerations include appropriate seating, desk height, device positioning, and posture support. While research in workplaces highlights the impact of ergonomic mismatches on musculoskeletal health, similar concerns apply to classrooms and digital learning environments (García-Tudela et al., 2020; Uche & Okata, 2015). For instance, prolonged use of laptops or tablets in poorly designed settings may cause discomfort, fatigue, and reduced concentration, ultimately undermining engagement. Integrating ergonomic furniture and adjustable workstations into classrooms and study areas can mitigate these issues, promoting comfort and sustained participation.

Cognitive Ergonomics

Cognitive ergonomics addresses mental processes such as attention, memory, problem-solving, and decision-making. In EdTech-enhanced learning, cognitive ergonomics involves designing user interfaces, instructional materials, and interaction sequences that reduce unnecessary cognitive load while promoting active engagement (Norman, 2013; Sweller et al., 2019). For example, poorly organized digital platforms or excessive information density can overwhelm learners, causing frustration and disengagement. Conversely, interfaces and content structured according to principles of clarity, feedback, and progressive complexity support meaningful knowledge construction and enhance learner motivation.

Environmental Ergonomics

Environmental ergonomics refers to the broader physical and social context in which learning occurs, including lighting, acoustics, temperature, spatial layout, and social interactions. Research suggests that poorly lit or noisy classrooms, crowded seating, or poorly ventilated spaces can impair concentration and cognitive performance (Barrett et al., 2015; Rashid & Zimring, 2008). Similarly, online learning environments that neglect usability, accessibility, or collaborative features may hinder participation and engagement. By integrating environmental considerations such as flexible seating arrangements, optimal lighting, and accessible digital design educators can create spaces conducive to both learning and well-being.

Integrative Perspective

Positioning ergonomics within educational technology requires recognizing the interdependence of physical, cognitive, and environmental factors. A physically comfortable learning space supports cognitive processing; a cognitively clear interface enhances engagement; and a supportive environment fosters social and emotional well-being. Thus, ergonomic design should not be treated as a peripheral concern but as a central principle guiding the integration of technology in education (Ait Ouares, 2024; Dul et al., 2012).

By adopting this conceptual framework, educators, instructional designers, and policymakers can anticipate potential challenges, implement evidence-informed strategies, and create technology-enhanced learning environments that maximize engagement, efficiency, and learner well-being.

EMERGING ISSUES IN ERGONOMIC EDUCATIONAL TECHNOLOGY INTEGRATION

Physical Strain and Posture-Related Challenges

One of the most prominent ergonomic concerns in technology-mediated learning involves the risk of musculoskeletal strain. Prolonged use of laptops, tablets, and smartphones often encourages suboptimal postures, including forward head tilt, rounded shoulders, and wrist deviation, which can contribute to neck pain, back discomfort, visual strain, and fatigue (Uche & Okata, 2015; Liu & Zhou, 2025). In many cases, school furniture remains mismatched to students' anthropometric characteristics, exacerbating physiological stress and reducing attentional capacity (García-Tudela et al., 2020). These posture-related issues diminish engagement, contribute to discomfort, and undermine the pedagogical benefits that EdTech aims to provide.

Cognitive Load and Information Processing Challenges

Cognitive ergonomics has become increasingly important as digital learning environments proliferate. Poorly designed educational platforms—characterized by excessive multimedia stimuli, unintuitive navigation, and insufficient scaffolding—can overload working memory and impede meaningful knowledge construction (Sweller et al., 2019). Interface complexity, inconsistent layouts, and poorly sequenced content increase extraneous cognitive load, leading to frustration, disorientation, and disengagement (Norman, 2013). Instead of facilitating deeper learning, improperly designed digital tools may introduce barriers that limit comprehension, hinder transfer, and reduce students' intrinsic motivation.

Environmental and Accessibility Barriers

Environmental factors significantly influence how students interact with EdTech tools. In physical classrooms, inadequate lighting, poor ventilation, uncomfortable seating arrangements, and disruptive noise levels negatively affect concentration and persistence (Barrett et al., 2015; Rashid & Zimring, 2008). Digital learning contexts present additional challenges, such as device incompatibility, limited accessibility features, and design elements that fail to accommodate learners with disabilities (Burgstahler, 2015). When ergonomic considerations are absent, both physical and digital environments may exacerbate stress, limit participation, and reinforce inequities in learning outcomes.

Equity and Inclusivity Concerns

Ergonomic inadequacies disproportionately affect learners from marginalized or resource-constrained

backgrounds. Students without access to proper seating, adjustable devices, or ergonomically optimized home learning environments may experience higher levels of discomfort and reduced engagement (Selwyn, 2023). Similarly, inaccessible digital interfaces or insufficient inclusive design principles can marginalize students with sensory, motor, or cognitive differences. Therefore, ergonomics becomes not merely a matter of comfort but a fundamental issue of equity, inclusion, and educational justice.

PRACTICAL IMPLICATIONS OF INTEGRATING ERGONOMICS INTO EDUCATIONAL TECHNOLOGY

Recognizing the importance of ergonomics in digital learning environments has significant implications for teaching, learning, institutional planning, and student well-being. Integrating ergonomic principles into Educational Technology design and implementation enhances comfort, cognitive efficiency, and long-term health, while optimizing learning performance (Fiorella, 2023; García-Tudela et al., 2020).

Enhancing Physical Comfort and Minimizing Musculoskeletal Strain

A primary implication of ergonomic integration is the reduction of physical discomfort associated with prolonged technology use. Research highlights the value of aligning classroom furniture with anthropometric data, promoting healthy postures, and implementing adjustable workstations to reduce discomfort and fatigue (Uche & Okata, 2015). Practical strategies include:

- Height-adjustable desks and chairs that reflect diverse student body sizes
- Device stands to maintain neutral neck and wrist postures
- Optimal screen placement to minimize visual strain
- Scheduled movement breaks to prevent repetitive strain injuries

These measures support sustained attention and help learners remain physically comfortable as they engage with digital content.

Improving Cognitive Efficiency Through Digital Ergonomics

Digital ergonomics is essential for supporting deep cognitive engagement in technology-rich environments. Clear interface structure, predictable navigation, and reduction of extraneous stimuli significantly enhance cognitive processing (Carvajal-Morales et al., 2024).

Practical ergonomic design practices include:

- Readable font styles and appropriate spacing
- Low-glare backgrounds and balanced color contrast
- Chunked multimedia elements aligned with cognitive load theory
- Logical and consistent interface pathways

Such features enable learners to focus on content meaningfully rather than wrestling with usability challenges, thereby improving comprehension and knowledge retention (Sweller et al., 2019; Fiorella, 2023).

Strengthening Student Engagement

Ergonomically optimized environments promote behavioral, emotional, and cognitive engagement. Comfortable seating, well-regulated lighting, and minimized distractions help students sustain attention and

participate actively (Fredricks, Blumenfeld & Paris, 2004). Digital ergonomics further supports engagement by reducing frustration and enhancing usability. When discomfort and cognitive overload are reduced, students are more likely to display interest, motivation, and persistence.

Promoting Student Well-Being and Healthy Digital Habits

EdTech integration should be accompanied by ergonomic guidelines that promote student health. Digital well-being practices—including structured breaks, proper screen-distance management, and visual rest techniques—help reduce fatigue, stress, and other negative outcomes associated with intense device use (Shankland & Roskam, 2017). Schools and institutions can embed these practices into policy frameworks and instructional routines, fostering long-term healthy behavior.

Optimizing Learning Space Design

Ergonomic principles significantly influence the design and usability of learning environments. Flexible, well-ventilated, and acoustically balanced spaces improve comfort and support diverse pedagogical approaches (Barrett et al., 2015). Practical implications include:

- Modular layouts that accommodate collaborative and individual work
- Natural lighting and glare-reducing architectural features
- Improved ventilation systems to support alertness
- Noise-reducing materials that enhance concentration

Such environments maximize the potential of digital tools and contribute to more effective teaching and learning.

Strengthening Institutional Policy and Resource Allocation

Institutional commitment to ergonomics is essential for sustainable EdTech implementation. Schools must adopt procurement policies that prioritize ergonomic standards for furniture and devices (Burgstahler, 2015). Additional actions include providing teacher training on ergonomic best practices, designing ergonomic guidelines for classroom technology use, and allocating budgets for environmental improvements.

Advancing Inclusion and Accessibility

Ergonomic integration aligns closely with Universal Design for Learning (UDL) principles by reducing physical and cognitive barriers. Adjustable desks, accessible interfaces, high-contrast modes, and auditory-friendly environments support learners with diverse needs (Burgstahler, 2015). Ergonomics therefore plays a vital role in promoting equitable participation and academic success among all learners.

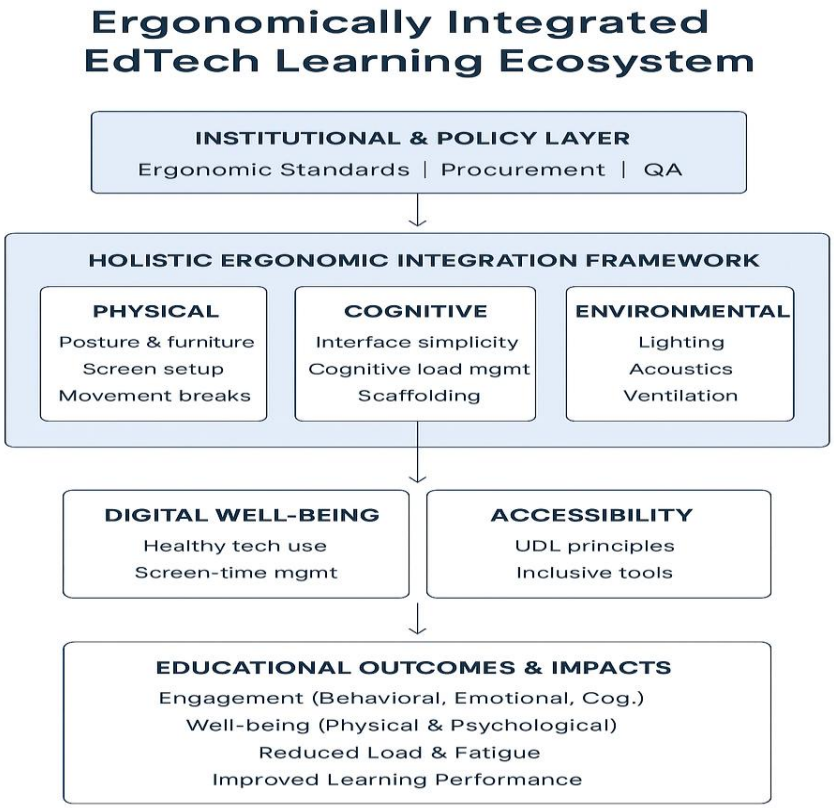
Enhancing Teacher Well-Being and Instructional Effectiveness

Teachers, like students, benefit from ergonomically supportive environments. Appropriate workstations, reduced platform complexity, and flexible teaching tools minimize physical and cognitive workload, enabling more effective lesson delivery (Ait Ouares, 2024). Ergonomically responsive classrooms reduce occupational strain and support long-term teacher well-being.

Increasing Return on Educational Technology Investment

Ergonomics ensures that EdTech investments yield meaningful educational benefits. Without ergonomic alignment, technology may be underutilized or contribute to discomfort and frustration, reducing its instructional value (Norman, 2013). When ergonomics is incorporated in procurement, training, and classroom design, institutions maximize the pedagogical impact and cost-effectiveness of digital innovations.

Diagram 1. Conceptual Model: Ergonomically Integrated EdTech Learning Ecosystem



The conceptual model illustrates the dynamic relationships among the key components shaping ergonomically aligned Educational Technology environments.

STRATEGIES FOR ENHANCING ENGAGEMENT AND WELL-BEING

Addressing the ergonomic challenges in educational technology requires deliberate strategies that integrate **physical, cognitive, and environmental considerations**. By adopting human-centered design principles, educators and instructional designers can create learning environments that promote engagement, well-being, and effective knowledge construction (Dul et al., 2012; Ait Ouares, 2024).

1. Physical Ergonomic Strategies

Physical ergonomics can be addressed through the design and adaptation of learning spaces, furniture, and devices:

- **Adjustable furniture and flexible layouts:** Providing chairs, desks, and workstations that can be adjusted for height and posture encourages comfort and reduces musculoskeletal strain (García-Tudela et al., 2020; Uche & Okata, 2015). Flexible seating arrangements support movement, collaboration, and engagement.
- **Device positioning and usability:** Ensuring laptops, tablets, and monitors are positioned to reduce neck, shoulder, and eye strain enhances both comfort and sustained attention (Liu & Zhou, 2025).
- **Active breaks and micro-movement:** Encouraging students to take short physical breaks during prolonged digital learning sessions can mitigate fatigue and improve focus (Dudek & Dubowski, 2017).

2. Cognitive Ergonomic Strategies

Cognitive ergonomics focuses on designing content, interfaces, and tasks that align with learners' mental processes:

- **Clear interface design and navigation:** Intuitive, consistent, and accessible digital interfaces reduce cognitive load and facilitate seamless interaction (Norman, 2013).
- **Scaffolded learning experiences:** Breaking complex tasks into manageable steps, providing prompts, and offering adaptive feedback supports meaningful knowledge construction (Sweller et al., 2019; Fiorella & Mayer, 2016).
- **Active learning and generative strategies:** Incorporating opportunities for learners to summarize, organize, and elaborate on information enhances engagement and long-term retention (Fiorella, 2023; Pi et al., 2023).

3. Environmental Ergonomic Strategies

Environmental ergonomics involves shaping the physical and virtual context to support comfort and attention:

- **Optimized classroom lighting, acoustics, and temperature:** Adequate lighting, noise reduction, and thermal comfort improve concentration and overall learning experience (Barrett et al., 2015; Rashid & Zimring, 2008).
- **Accessible digital environments:** Ensuring that online learning platforms are compatible with assistive technologies and adhere to accessibility standards promotes inclusivity and engagement (Burgstahler, 2015).
- **Collaborative and socially supportive spaces:** Both physical and virtual environments should enable interaction, peer learning, and social presence, which positively influence motivation and well-being (Fredricks et al., 2004).

4. Training and Awareness

Implementation of ergonomic strategies requires **educator and learner awareness**:

- **Professional development for teachers:** Training on ergonomic principles and best practices in EdTech integration ensures that educators can design and manage learning environments effectively (Ait Ouares, 2024).
- **Learner education on self-regulation:** Teaching students to adjust posture, manage screen time, and optimize their study environment empowers them to sustain engagement and well-being (Uche & Okata, 2015).

PRACTICAL INSIGHTS AND CASE EXAMPLES

While the integration of ergonomic principles into educational technology is a relatively recent focus, several illustrative examples demonstrate how human-centered design enhances engagement and well-being in diverse learning contexts. These cases provide actionable insights for educators, instructional designers, and policymakers.

1. Primary and Post-Primary Applications

In primary and secondary schools, ergonomic interventions often focus on **furniture design, classroom layout, and digital device use**. For instance, García-Tudela et al. (2020) highlighted the benefits of adjustable desks and chairs tailored to students' anthropometric dimensions. Such adaptations reduced physical discomfort and supported sustained attention during technology-mediated lessons. Additionally, the introduction of flexible classroom layouts, including standing desks and collaborative learning stations, promoted movement and peer interaction, which positively influenced engagement and motivation (Barrett et al., 2015).

2. Higher Education and University Settings

At the tertiary level, ergonomic strategies have been implemented to address **both physical and cognitive challenges** associated with prolonged device use and complex digital content. Liu and Zhou (2025) documented the impact of ergonomically optimized computer labs and study spaces, noting improvements in student comfort, concentration, and task completion rates. Similarly, universities integrating **adaptive learning platforms** have benefited from interfaces designed to reduce cognitive load, provide scaffolding, and guide learners through complex material in structured steps (Sweller et al., 2019; Fiorella, 2023). These interventions demonstrate how ergonomic and cognitive design principles can be combined to enhance engagement in higher education contexts.

3. Online and Blended Learning Environments

The rise of fully online and blended learning models has brought attention to **digital ergonomics**. Accessible and user-friendly platforms, structured course layouts, and interactive features that encourage reflection and collaboration have been shown to support learner engagement and well-being (Burgstahler, 2015; Pi et al., 2023). For example, platforms incorporating **active learning prompts, progress indicators, and collaborative discussion spaces** foster a sense of agency and social presence, mitigating the isolation often reported in online courses (Fredricks et al., 2004).

4. Lessons Learned and Best Practices

From these cases, several key insights emerge:

- Ergonomic interventions must address **physical, cognitive, and environmental dimensions** simultaneously to maximize effectiveness.
- **Flexibility and adaptability** are critical; learning spaces and digital platforms should accommodate diverse student needs and preferences.
- **Training and awareness** for both educators and learners are essential for effective implementation.
- Integrating ergonomics into EdTech requires a **holistic perspective**, recognizing that comfort, cognitive ease, and environmental factors collectively influence engagement and well-being.

IMPLICATIONS FOR POLICY AND PRACTICE

The integration of ergonomic principles into educational technology carries significant consequences for policy, institutional planning, instructional design, and classroom implementation. The paper perspective stresses the need for proactive, evidence-informed approaches that support engagement, well-being, and equity in digitally mediated education (Ait Ouares, 2024; Dul et al., 2012).

1. Institutional Policy and Guidelines

Institutions should establish formal ergonomic standards for both digital and physical learning environments:

- **Learning space design:** Policies must articulate criteria for ergonomic furniture, lighting, ventilation, temperature, and classroom layout to support comfort, posture, and accessibility (García-Tudela et al., 2020; Barrett et al., 2015).
- **Technology procurement:** Devices and platforms should be selected based on ergonomic features—adjustable screens, intuitive interfaces, accessibility functions, and minimal cognitive friction (Burgstahler, 2015).
- **Equity and inclusivity:** Policies must ensure that all students, regardless of socio-economic or physical differences, can access ergonomically supportive environments and tools (Selwyn, 2023).

2. Instructional Design and Teaching Practices

Educators and instructional designers play a central role in operationalizing ergonomic principles:

- **Human-centered learning design:** Digital materials should minimize cognitive load, segment information, and provide clear navigation cues (Sweller et al., 2019; Fiorella, 2023).
- **Movement-oriented and collaborative pedagogy:** Structured movement, interactive discussions, and flexible use of physical space enhance engagement and well-being (Fredricks et al., 2004; Pi et al., 2023).
- **Professional development:** Teachers require training on ergonomic risks, digital well-being, and human-centered EdTech integration to ensure safe and effective implementation (Ait Ouares, 2024).

3. Sustainable Implementation and Continuous Evaluation

Ergonomic alignment requires ongoing monitoring and iterative improvement:

- **Monitoring and feedback systems:** Regular evaluations of furniture, device use, and digital platform usability can help reduce ergonomic risks (Uche & Okata, 2015).

- **Learner involvement:** Student feedback on comfort, usability, and accessibility enhances responsiveness and fosters inclusive design (Dul et al., 2012).
- **Iterative design:** Policies and practices must adapt to technological changes and emerging ergonomic evidence, leveraging continuous improvement (Norman, 2013).

SUMMARY OF POLICY AND PRACTICE IMPLICATIONS

Embedding ergonomics within institutional policy, instructional design, and ongoing evaluation ensures that EdTech adoption is human-centered, equitable, and sustainable. This approach maximizes learning outcomes by reducing discomfort, preventing cognitive overload, and supporting student engagement and well-being. It also advances inclusivity by ensuring that all students, including those with disabilities and those from under-resourced backgrounds, can benefit from ergonomically optimized learning environments.

CONCLUSION

This paper demonstrates that ergonomics is both a conceptual framework and a practical necessity for effective EdTech integration. Emerging challenges including physical strain, cognitive overload, environmental barriers, and inequities highlight the risks of adopting technology without human-centered design. When ergonomic principles are applied, however, educational technology becomes more usable, accessible, and engaging, supporting deeper learning and promoting student well-being.

A holistic, ergonomically informed approach aligns technological innovation with the fundamental human needs of comfort, cognitive clarity, and emotional stability. It ensures that learning environments are designed not merely to accommodate tools but to support the learners who use them. By prioritizing ergonomics in policy, instructional design, teacher training, and institutional planning, educational systems can create sustainable, equitable, and developmentally responsive environments that enhance the full value of educational technology. Ultimately, integrating ergonomics into EdTech adoption is essential for building future-ready learning ecosystems that promote learner health, cognitive efficiency, and meaningful engagement.

Declaration of Conflicting Interests

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