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The Absence of Design Strategies in Children's Learning Environments in Lahore and Pakistan: Evidence, Implications and What Must be Done

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ABSTRACT
The physical quality of classrooms is a critical yet overlooked dimension of early childhood education in Pakistan (Akram & Shafqat, 2019; Jamil & Qureshi, 2018). This paper investigates how spatial configuration, ergonomics, lighting, ventilation, and color schemes influence cognitive and emotional development in young learners (Barrett et al., 2015; Brooks, 2011). Using survey data and photographic documentation of schools in Lahore, we identify major gaps in classroom design across public and private institutions. Findings reveal overcrowding, poor lighting, lack of ventilation, and arbitrary use of color as recurring problems (World Bank, 2020; UNICEF Pakistan, 2017). Case studies show that even well-resourced schools fail to apply evidence-based design strategies, often relying on loud, overstimulating palettes or rigid seating layouts (Fatima & Ahmad, 2022). Literature review confirms that globally, spatial and chromatic design significantly enhance attention, memory, and engagement (Englebrecht, 2003; Küller et al., 2009; Saeed & Zia, 2020). Recommendations include low-cost ergonomic standards, child-centered zoning, balanced color palettes, improved ventilation, and integration of climate resilience into school infrastructure (Farooq, 2011; ASHRAE, 2019; Buonanno et al., 2021). We argue that without design reform, investments in curriculum and teacher training risk being only partially effective (Aslam & Kingdon, 2011). Evidence-based classroom design must be recognized as a prerequisite for equitable and high-quality learning in Pakistan.

INTRODUCTION

Effective learning environments in elementary schools are impacted equally by the physical and spatial layout of classrooms, as they are by the curriculum and didactics (Brooks, 2011). The physical setting of a primary school classroom has a significant impact on how young students develop socially, emotionally, and cognitively (Barrett et al., 2015). Classroom layout, design, and color presence are among the many spatial features that are becoming more widely acknowledged as having an impact on children's cognitive development and learning abilities (Englebrecht, 2003; Küller et al., 2009). According to research in environmental psychology and education, colors can improve memory, attention, affect mood, and even control children's conduct (Saeed & Zia, 2020; Shams & Rehman, 2021). The choice of colors can either help or hinder conceptual development, especially in early childhood education where toddlers and primary-grade pupils are extremely sensitive to outside stimuli (Fatima & Ahmad, 2022). Comprehending these interactions becomes essential for developing productive learning environments in underdeveloped settings like Lahore, Pakistan, where classrooms frequently encounter design constraints and cultural preferences in color utilization (UNICEF Pakistan, 2017).

According to photographic documentation, certain schools in Lahore have spacious, tidy classrooms with deliberate color schemes, well-designed seating arrangements, and ample natural light and ventilation (Heschong Mahone Group, 1999; Li & Sullivan, 2016). Others, on the other hand, are plagued by sterile or disorganized design components, improper furniture, overcrowding, and inadequate ventilation (Farooq, 2011; World Bank, 2020). These differences probably affect students' academic performance, conceptual abilities, and attention spans in addition to their overall well-being (Mendell & Heath, 2005).

This study provides a comparative analysis of how various schools in Lahore approach hierarchies, either successfully or unsuccessfully, in creating a favorable learning environment. Through photographic documentation of classroom layouts, ergonomically designed elements, views, natural and artificial light, ventilation, and acoustic conditions across schools, this research aims to identify patterns that distinguish higher-performing schools from those with pronounced spatial deficiencies.

RESEARCH QUESTION

"In what ways a classroom's spatial configuration, furniture ergonomics, interior design elements, accessible views, ventilation, lighting and acoustic conditions vary across different tiers of schools in Lahore, Pakistan, and how these disparities influence the pedagogical suitability of the learning environment and children's cognitive well-being?"

RESEARCH METHODOLOGY

The research was based on a questionnaire survey distributed among university students to investigate different schools' learning environments in Lahore. The primary aim was to explore how spatial characteristics of classrooms, including layout, lighting, and color presence, can affect the mental capacity and cognitive abilities of young children (Akram & Shafqat, 2019). The findings are summarized in the sections below.

REVIEW / CRITICAL ANALYSIS

The article makes a significant contribution to understanding the intersection of environmental psychology, pedagogy, and design within Lahore's educational context.

Strengths:

- It emphasizes color psychology in an under-researched South Asian context (Fatima & Ahmad, 2022; Saeed & Zia, 2020).

- Highlights the correlation between classroom environment and children's cognitive performance (Barrett et al., 2015).
- Provides recommendations for color use tailored to different learning zones (Englebrecht, 2003).

Limitations:

- Relies on subjective responses rather than objective measures of performance.

RESEARCH FINDINGS

Spatial Characteristics & Cognitive Load

- Overcrowded classrooms with limited space caused mental fatigue (World Bank, 2020).
- Spacious layouts with flexible seating encouraged curiosity and collaboration (Veloso et al., 2021).

Color Presence in Classrooms

- Bright colors such as red and yellow were underutilized despite their benefits (Fatima & Ahmad, 2022).
- Most schools lacked a deliberate color strategy (UNICEF Pakistan, 2017).

Effects of Color

- Warm colors stimulated attention and enthusiasm but could lead to hyperactivity if overused (Shams & Rehman, 2021).
- Cool colors supported calmness, focus, and problem-solving (Saeed & Zia, 2020).

Parent-Teacher Perceptions

- Teachers noted that color influenced focus and discipline (Akram & Shafqat, 2019).
- Parents wanted more colorful, engaging classrooms (Fatima & Ahmad, 2022).

Local Context

- Most schools lacked expert guidance, leading to arbitrary use of colors (UNICEF Pakistan, 2017).
- International standards for classroom design were absent (World Bank, 2020).

RESULTS FROM SCHOOL CASE STUDIES

Here are condensed conclusions:

Muslim Ideal School

• No proper arrangement of space or color preferences.
• No ventilation or natural light.
• Overall poor conditions and lack of facilities.

Govt City District Boys School

- Illogical and impractical use of colors.
- Haphazard environment, extreme poor conditions.

Mazen School, Bahria Town

- Brighter classrooms compared to others.
- However, no ventilation or sunlight access.
- Loud and overwhelming color choices.

The Knowledge School

- No sunlight, poor lighting.
- Loud colors, uncomfortable furniture, unhygienic conditions.
- No space for extra-curricular activities.

ANALYSIS

The analysis of Lahore's primary schools reveals a major gap between the developmental needs of children and the physical environments in which they are expected to learn. Poorly designed

interiors, overcrowded layouts, inadequate ventilation, lack of ergonomically appropriate furniture and the absence of intentional color strategies collectively undermine children's well-being (Akram & Shafqat, 2019; Jamil & Qureshi, 2018; Farooq, 2011). While global research consistently demonstrates that spatial quality and design are integral to enhancing attention, memory retention and overall learning outcomes (Barrett et al., 2015; Brooks, 2011), schools in Lahore largely continue to operate in environments that are not child friendly, resource-constrained and aesthetically neglected (World Bank, 2020; UNICEF Pakistan, 2017).

LITERATURE REVIEW

Overview and Scope

The physical design of a classroom, also known as its spatial layout, lighting/ventilation, furniture, acoustics and chromatic environment, is a foundational input to early childhood development (ECD) (Barrett et al., 2015; Veloso et al., 2021). However, in Pakistan, there is mounting evidence of persistent gaps: weak or absent design standards for primary classrooms and limited translation of color/space research into practice (UNICEF Pakistan, 2017). Multiple studies highlight different dimensions of classroom quality (classroom size, furniture, light/ventilation and safety) that strongly influence children's comfort, engagement and learning outcomes (Akram & Shafqat, 2019; Jamil & Qureshi, 2018). Better physical environments correlate with longer attention spans, lower stress, and early-learning gains in literacy and numeracy (World Bank, 2020; Aslam & Kingdon, 2011).

Schools in Lahore: Gaps and Patterns

Several Pakistan-focused studies and reports document recurring issues:

- **Inconsistent design guidance:** National and provincial ECE expansions often prioritize teacher training and enrollment targets while providing limited guidance on classroom design, child-sized furniture, or supportive layouts (UNICEF Pakistan, 2017).
- **Resource shortages:** Field studies note overcrowded classrooms, lack of child-friendly furniture, poor ventilation/lighting, and teacher-centered seating arrangements that reduce opportunities for play-based and exploratory learning, especially in underfunded public schools (Akram & Shafqat, 2019; Jamil & Qureshi, 2018).
- **Limited research on color:** While a growing number of university studies examine color psychology in educational settings, these insights rarely reach practitioners. Neutral and institutional palettes dominate, driven by cost and maintenance concerns rather than evidence-based palettes (Fatima & Ahmad, 2022; Saeed & Zia, 2020).

A comparative study of structural dimensions in early childhood education in Punjab revealed significant differences between public and private schools in classroom size, physical quality, and student-teacher ratios (Archives of Educational Studies, n.d.). Other evidence indicates that approximately 29% of schools in Punjab lack sufficient classrooms, leading to multi-grade teaching and overcrowding, which is harmful for learning environments (World Bank, 2020).

Furniture Ergonomics

Although research specific to Pakistan is limited, Farooq (2011) documented that only about half of children's furniture designers in Pakistan incorporate anthropometric measurements; most rely on conventional designs without catering ergonomics, risking discomfort and strain. Similar studies in Bangladesh confirm that improperly fitted furniture correlates with posture issues and cognitive errors (Karim et al., 2011; Parvez et al., 2018; Rahman & Chowdhury, 2019).

Ventilation and Thermal Comfort

Optimal ventilation is essential not only to health but to cognitive functioning. High ventilation rates (e.g., >10 L/s per student) can reduce airborne pathogen transmission by up to 80% and

improve comfort (Buonanno et al., 2021; ASHRAE, 2019). A Malaysian study comparing classroom layouts found that single-loaded corridors deliver superior airflow and thermal comfort through reduced temperatures and enhanced ventilation (Hamzah & Ismail, 2017).

Research Evidence on Color, Space and Cognition

Global and regional experimental studies show that:

- **Color influences attention, memory and emotion:** Selective use of colors in materials and displays can enhance memorability and focus; warm tones may increase engagement while cool tones improve calm and concentration (Englebrecht, 2003; Küller et al., 2009; Saeed & Zia, 2020).
- **Spatial layout affects behavior and opportunities for learning:** Flexible layouts with defined zones (teacher area, reading spot, group tables, play areas) are associated with more sustained engagement and social interaction (Brooks, 2011; Veloso et al., 2021).

Contextual Constraints

Several contextual barriers limit the translation of design research into practice:

- **Budget and maintenance:** Durable, easy-to-maintain finishes dominate, often leading to institutional palettes (UNICEF Pakistan, 2017).
- **Climate and infrastructure pressures:** Extreme heat, power shortages, and flooding shape material and color choices; light-reflective finishes and ventilation become urgent (World Bank, 2020).
- **Limited design capacity:** Few schools access evidence-based design tailored to ECE (Taimur Sarwar & Hafeez, 2024).
- **Policy fragmentation:** Provincial variation in ECE policy creates inconsistent standards (UNICEF Pakistan, 2017).

Interior Design Elements

Natural light boosts academic performance (Heschong Mahone Group, 1999), while views of nature support focus and stress recovery (Ulrich, 1984; Li & Sullivan, 2016). Color psychology recommends warm, muted hues for calming environments rather than stark whites or overly cool tones (Fatima & Ahmad, 2022). Balanced acoustics reduce distractions, while sound-absorbing materials improve speech intelligibility (Shield & Dockrell, 2003).

Spatial Configuration

Flexible seating enhances movement, engagement, and mental well-being (Veloso et al., 2021). Evidence also indicates increased activity, lower anxiety, and improved learning outcomes in classrooms with adaptable layouts (Brooks, 2011).

Conclusion of Literature Review

Existing literature underscores the critical role classroom design plays in shaping cognitive, behavioral, and ergonomic outcomes (Barrett et al., 2015; Brooks, 2011; Veloso et al., 2021). While international studies provide clear evidence, there remains a significant gap in focused, context-specific research on Lahore's primary schools. Integrating architectural documentation with measurements of ergonomics, lighting, ventilation, acoustics, and aesthetics would strengthen comparative analyses and guide best practices for healthier, more effective learning spaces (UNICEF Pakistan, 2017; World Bank, 2020).

RECOMMENDATIONS

Designing Primary Classrooms for Cognitive and Emotional Development

1. Spatial Configuration: A well-designed space provides opportunities for both structured and flexible learning. Classrooms should balance circulation with organized seating zones that allow teacher visibility and student collaboration. Studies show that flexible layouts with movable

furniture support engagement, active learning and improved behavior (Barrett et al., 2015; Veloso et al., 2021; Brooks, 2011). In contrast, overcrowded classrooms in Lahore's public schools limit mobility and restrict interactive pedagogy (Akram & Shafqat, 2019; Farooq, 2011).

Key Design Considerations:

- Adequate circulation space for free movement.
- Seating arrangements allowing both group work and individual focus.
- Integration of flexible furniture to encourage collaboration.

2. Color Psychology in Learning Environments

Colors have a direct psychological impact on children's processing and emotional well-being. Research in environmental psychology shows that warm, muted tones (e.g., greens, yellows, etc.) foster relaxation and concentration, while overly bright or stark whites can increase stress and fatigue (Englebrecht, 2003; Küller et al., 2009; Fatima & Ahmad, 2022; Saeed & Zia, 2020).

Recommendations:

- Green and blue hues to support calmness and sustained attention.
- Muted yellow accents stimulate optimism and creativity.
- Avoidance of overly saturated reds, which can heighten anxiety (Shams & Rehman, 2021).

In Lahore's classrooms, interior walls are often painted in stark white or dull grey without consideration for color effects, missing out on psychological benefits (Fatima & Ahmad, 2022).

3. Interior Elements and Ergonomics

Ergonomically appropriate furniture directly affects posture, comfort, and focus. Anthropometric studies across South Asia reveal a consistent mismatch between children's body dimensions and classroom furniture, leading to musculoskeletal strain and distraction (Karim et al., 2011; Parvez et al., 2018; Rahman & Chowdhury, 2019).

Design Priorities:

- Desks and chairs proportioned to local anthropometric data (Farooq, 2011; Ahmad & Malik, n.d.).
- Use natural materials and textures to reduce sensory fatigue.
- Storage and display elements to support organization and creativity.

In Pakistan, most schools use standardized wooden or metal furniture with little ergonomic adaptability, exacerbating discomfort and disengagement (Farooq, 2011; Khan & Iqbal, 2018).

4. Lighting, Views, and Ventilation

Natural light is one of the best indicators of higher academic achievement. The Heschong Mahone Daylighting Study (1999) found that students in classrooms with abundant daylight progressed 20–26% faster in reading and math. Similarly, views of greenery reduce eye strain and improve attention restoration (Ulrich, 1984; Li & Sullivan, 2016).

Ventilation is equally critical: poor airflow has been linked to lower test performance and higher absenteeism (Mendell & Heath, 2005). International best practices suggest at least 10 L/s of fresh air per student (ASHRAE, 2019). Evidence during COVID-19 further confirms the role of ventilation in reducing airborne infections and supporting learning continuity (Buonanno et al., 2021).

In Lahore, many schools, particularly low-income institutions, rely on small windows and ceiling fans with limited consideration for cross-ventilation, daylight penetration or outdoor views (UNICEF Pakistan, 2017).

5. Acoustics and Noise Management

Excessive classroom noise negatively impacts reading comprehension, memory and speech

intelligibility (Shield & Dockrell, 2003). Ideal designs incorporate sound-absorbing finishes (carpets, cork, acoustic panels, etc.) and controlled reverberation times.

Pakistani classrooms, often built with concrete floors and plaster walls, amplify noise and create distractions, undermining effective teaching and student concentration (Akram & Shafqat, 2019).

6. Flexible Learning Zones

Modern academic design encourages the use of multiple zones within classrooms: a reading corner, activity tables, technology stations, and quiet focus areas. Flexible seating and learning zones promote autonomy, agency, and self-regulation among students (Brooks, 2011; Veloso et al., 2021).

Most schools in Lahore, especially government institutions, still rely on rigid, teacher-centered desk rows, neglecting the benefits of multi-zonal design (World Bank, 2020).

CONCLUSION AND LOCAL CONTEXT: GAPS IN LAHORE'S CLASSROOMS

While global research strongly supports spatially responsive, ergonomic and psychologically informed classroom design, primary schools in Lahore often lack these strategies (Barrett et al., 2015; Veloso et al., 2021).

Key deficiencies include:

- Overcrowding and fixed layouts that restrict movement (Akram & Shafqat, 2019).
- Ergonomic furniture not suited to children's body dimensions (Farooq, 2011; Ahmad & Malik, n.d.).
- Monotonous wall colors lacking psychological sensitivity (Fatima & Ahmad, 2022; Saeed & Zia, 2020).
- Insufficient daylight, views, and ventilation, particularly in public schools (Heschong Mahone Group, 1999; Mendell & Heath, 2005).
- Weak acoustic design, leading to noisy, distracting environments (Shield & Dockrell, 2003).

PATHWAYS FOR IMPROVEMENT

- Evidence-based ergonomic standards for classroom furniture (Farooq, 2011; Parvez et al., 2018).
- Color psychology in painting and interior finishes (Englebrecht, 2003; Shams & Rehman, 2021).
- Flexible seating and spatial zoning to diversify learning experiences (Brooks, 2011).
- Ventilation, daylighting, and greenery views in both new and existing schools (Ulrich, 1984; Li & Sullivan, 2016).
- Sound-absorbing materials to reduce noise interference (Shield & Dockrell, 2003).

GUIDELINES AND POLICY RECOMMENDATIONS

- **Classroom Design Guidelines for ECE**: Practitioners need clear, low-cost standards (class size, furniture dimensions, lighting/ventilation minimums, color zoning) (UNICEF Pakistan, 2017).
- **Translate color psychology into practice**: Balanced use of warm and cool tones supports engagement and concentration, but palettes must be maintenance sensitive (Fatima & Ahmad, 2022; Saeed & Zia, 2020).
- **Climate resilience:** Pakistan's extreme heat and flood risks demand design choices that combine educational needs with durability (World Bank, 2020).
- **Monitoring & evidence loop:** Scaled changes should be tracked with attendance, time-on-task, and teacher reports (Aslam & Kingdon, 2011).

RESEARCH GAPS AND AGENDA

- Experimental trials of color palettes and spatial reorganizations (Fatima & Ahmad, 2022; Saeed & Zia, 2020).

- Cost-effectiveness studies of small-scale interventions (UNICEF Pakistan, 2017).
- Adaptation studies for local climate and cultural norms (Khan, Taimur Sarwar, & Tahir, 2024).
- Longitudinal monitoring to assess sustained impact (World Bank, 2020).

CONCLUSION

Two distinct conclusions can be drawn: (1) the physical quality of the classroom—including thoughtful use of color and spatial zoning—matters for early learning; and (2) there is a persistent gap between research findings and actual design practice in Lahore (Barrett et al., 2015; Akram & Shafqat, 2019). Short, coordinated actions are needed to close this gap: embedded research, low-cost palettes, teacher/facility training, and provincial design guidelines (UNICEF Pakistan, 2017; World Bank, 2020).

Investments in curriculum and teacher training risk being only partially successful if the physical and spatial aspects of classrooms are not addressed (Aslam & Kingdon, 2011). Evidence-based design adapted to Pakistan's socio-cultural and economic realities can create classrooms that are both functional and supportive of children's development (Taimur Sarwar & Hafeez, 2024).

In the end, improving educational surroundings in Lahore is a necessity rather than a luxury. Coordinated policy action, expert design advice, and scalable solutions that put children's developmental needs first are crucial (Jamil & Qureshi, 2018). Lahore can foster curiosity, creativity, and cognitive growth by integrating global best practices into classroom design while adapting them for local circumstances (Veloso et al., 2021).

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