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Enhancing student well-being through wellness design: Evaluating the impact of Biophilic and recreational spaces in high school environments

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Abstract

This study explores the role of wellness design in educational interiors, examining how design elements reduce stress and enhance mental well-being among students. The purpose of this research is to identify specific design strategies - such as biophilic design, user-centered layouts, and the integration of natural light - that contribute to supportive learning environments. Using a mixed-methods approach, the study includes case analysis of schools employing wellness-focused designs, supplemented by surveys that gauge students' and educators' experiences within these spaces. Quantitative data focuses on factors like daylighting levels and spatial arrangement, while qualitative responses capture perceptions of comfort and engagement. Results indicate that elements such as natural light, green features, and adaptable spaces contribute significantly to reducing anxiety and fostering a positive mental state. Schools designed with these principles report higher levels of student satisfaction and focus, and feedback suggests that biophilic and user-cantered designs make classrooms feel more inviting and calming. Conclusively, wellness design in schools is shown to play a vital role in supporting mental well-being and stress reduction, offering a practical framework for designers to enhance learning environments effectively.

Keywords: Educational interiors, biophilic design, mental well-being, user-centered design, daylighting

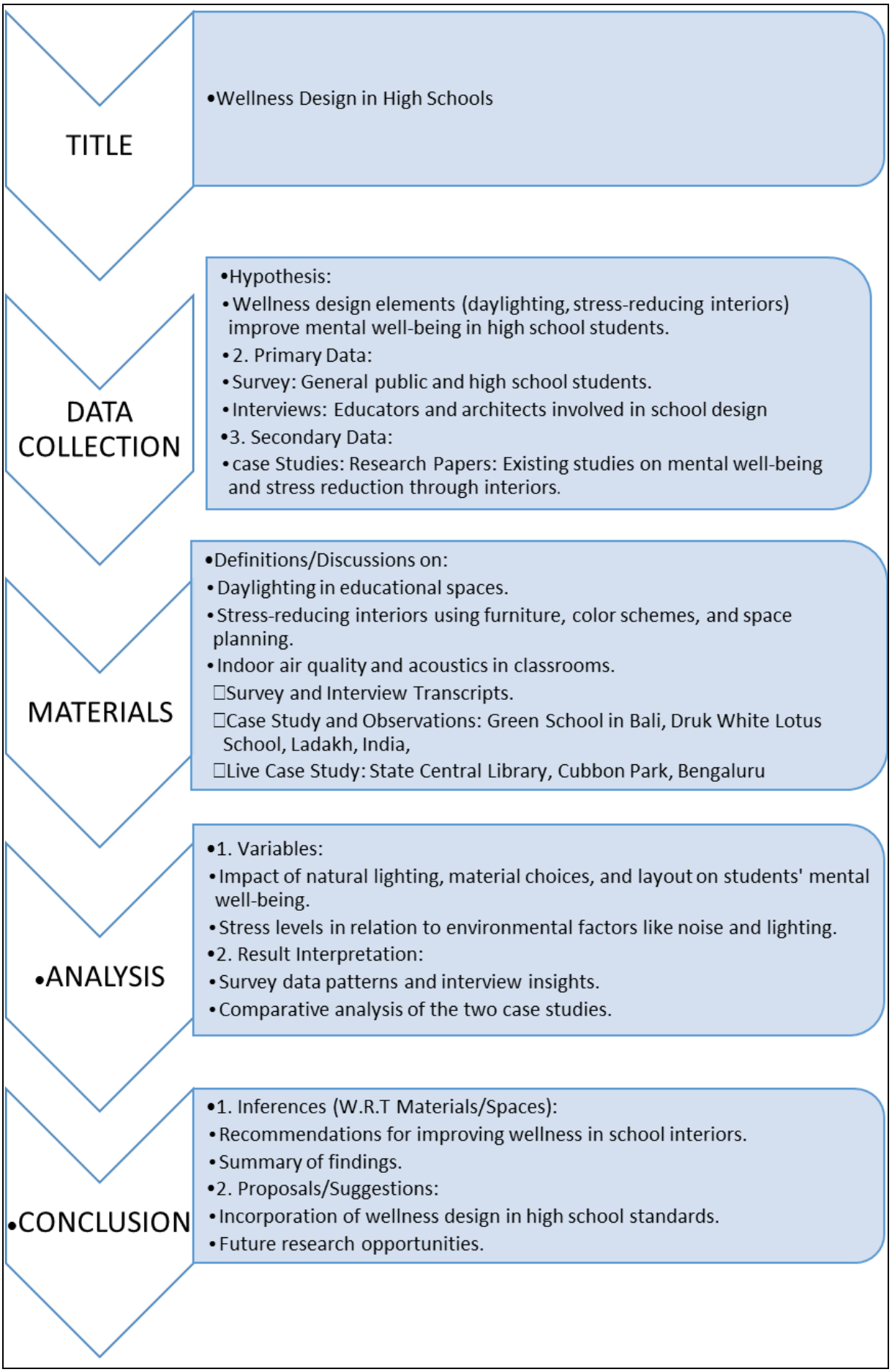
Introduction

High school environments profoundly influence students' mental and emotional well-being. Wellness design, encompassing biophilic elements and recreational spaces, offers a transformative approach to fostering supportive educational environments. Biophilic design integrates natural elements like greenery, daylight, and natural ventilation, while recreational spaces provide students with areas for physical activity and relaxation. Together, these elements contribute to stress reduction, enhanced cognitive function, and better academic performance. This study explores these aspects through a multi-method approach, aiming to establish the significance of wellness-focused design in high schools.

Materials and Methods

Literature Review: The growing emphasis on wellness design in educational settings reflects an understanding of how thoughtfully designed spaces can positively impact student well-being and academic outcomes. As research highlights, the integration of natural lighting, biophilic elements, and flexible spaces within schools can reduce stress, enhance mental well-being, and support cognitive performance. These resources offer insights into best practices in wellness-focused school design and its potential benefits for educational spaces.

Research Methodology


TITLE
•Wellness Design in High Schools
DATA COLLECTION
•Hypothesis:
• Wellness design elements (daylighting, stress-reducing interiors) improve mental well-being in high school students.
• 2. Primary Data:
• Survey: General public and high school students.
• Interviews: Educators and architects involved in school design
•3. Secondary Data:
• case Studies: Research Papers: Existing studies on mental well-being and stress reduction through interiors.
MATERIALS
•Definitions/Discussions on:
• Daylighting in educational spaces.
• Stress-reducing interiors using furniture, color schemes, and space planning.
• Indoor air quality and acoustics in classrooms.
Survey and Interview Transcripts.
Case Study and Observations: Green School in Bali, Druk White Lotus School, Ladakh, India,
Live Case Study: State Central Library, Cubbon Park, Bengaluru
•ANALYSIS
•1. Variables:
• Impact of natural lighting, material choices, and layout on students' mental well-being.
• Stress levels in relation to environmental factors like noise and lighting.
•2. Result Interpretation:
• Survey data patterns and interview insights.
• Comparative analysis of the two case studies.
•CONCLUSION
•1. Inferences (W.R.T Materials/Spaces):
• Recommendations for improving wellness in school interiors.
• Summary of findings.
•2. Proposals/Suggestions:
• Incorporation of wellness design in high school standards.
• Future research opportunities.

Online Case Studies

a. Case Study 1: Green School in Bali

Architectural Vision: The Green School, designed by PT Bamboo Pure under the leadership of John Hardy, embodies a sustainable, holistic approach to education. Its architecture integrates natural materials, predominantly bamboo, to create a unique relationship between built forms and the surrounding environment.

Design Elements

1. **Sustainable Materials:** Bamboo is the primary material, used innovatively to create walls, roofing, and structural frames. The school also utilizes recycled materials like tires and bottles.
2. **Spatial Planning:** The classrooms are open-air, allowing natural ventilation and reducing dependency on artificial cooling. This approach fosters a connection between students and nature.
3. **Energy Efficiency:** Renewable energy systems, such as micro-hydro power and solar panels, make the school nearly self-sufficient. Skylights and strategic openings maximize natural daylighting.
4. **Community Integration:** Spaces are designed to facilitate collaborative learning, such as amphitheatres and shared gardens.

Green School demonstrates how sustainable architecture can seamlessly integrate functionality, aesthetics, and environmental responsibility, setting a benchmark for eco-friendly educational spaces.
Source: Google scholar.

Fig 1: Section_Google images

Fig 2: Section_Google images

b. Case Study 2: Druk White Lotus School, Ladakh, India
The Druk White Lotus School, designed by Arup Associats, is a perfect example of architecture blending with extreme environmental conditions while respecting local culture.

Design Challenges

1. **Climate Adaptation:** Situated in a high-altitude desert, the design counters harsh temperatures and seismic activity.
2. **Materiality:** Locally sourced rammed earth and stone are the primary materials, ensuring thermal insulation and reduced transportation footprint. Traditional mud bricks are reinforced for earthquake resistance.

Design Solutions

1. **Passive Design:** Thick walls provide thermal mass, maintaining indoor temperatures in the extreme cold. South-facing windows maximize solar gain during the winter months.
2. **Water Conservation:** Innovative water management systems, such as greywater recycling and efficient irrigation, combat the region's water scarcity.
3. **Cultural Integration:** Traditional Ladakhi architectural motifs are incorporated, ensuring the building harmonizes with its cultural context.

This project highlights the importance of designing for extreme climates and showcases how vernacular techniques can be reinterpreted in modern architecture.
Source: Google scholar.

Fig 3: Section_Google images

Fig 4: Section_Google images

Research Papers Summaries

a. Research Paper 1: "Biophilic Design in Educational Spaces for Enhancing Well-being"

- **Authors and Source:** Published in the Journal of Environmental Psychology.

- **Summary:** This paper examines how incorporating biophilic design elements (like green walls, natural light, and outdoor learning areas) in schools positively impacts students' mental well-being.
- The study found that students in biophilic environments showed improved attention spans, reduced anxiety, and higher levels of engagement.
- **Key Findings:** Daylighting, greenery, and natural materials significantly contribute to stress reduction and mental well-being. This study underscores the importance of integrating natural elements in educational settings.

b. Research Paper 2: "The Impact of Classroom Design on Student Learning and Well-being"

- **Authors and Source:** Published in Building and Environment journal.
- **Summary:** This research focuses on how physical classroom environments (such as lighting, acoustics, and ventilation) affect student learning outcomes and psychological well-being.
- The paper highlights that classrooms with proper lighting and acoustics reduce cognitive load and stress, enhancing overall academic performance.
- **Key Findings:** Attention to ergonomic design, natural light, and effective acoustics is essential for minimizing stress in learning environments. These elements form a foundational approach to wellness design in schools.

Government Portal/Organization

- **Role:** NCERT is responsible for curriculum and educational research in India, including health and wellness initiatives in schools.
- **Relevant Initiatives:** NCERT promotes wellness through programs focused on health, mental well-being, and stress reduction.
- They provide resources on mental health awareness and healthy practices in schools.
- **Inference:** Through NCERT's frameworks, India acknowledges the importance of mental health and wellness in educational spaces, advocating for supportive environments that foster holistic student development.
- **Source:** Google

Inferences

- Biophilic design elements like natural lighting, greenery, and outdoor spaces significantly reduce stress, enhance mental well-being, and improve cognitive focus in students.
- Schools such as Green School in Bali and Druk White Lotus in Ladakh highlight how wellness design adapts to specific cultural and environmental contexts, promoting both sustainability and student well-being.
- Research confirms that incorporating ergonomic designs, proper lighting, and effective acoustics in classrooms improves attention spans, reduces anxiety, and enhances academic performance.
- Government frameworks like NCERT emphasize the importance of mental health and stress-free environments in schools, supporting holistic student development.
- Integrating biophilic and recreational spaces fosters emotional, physical, and academic growth, creating nurturing and sustainable learning environments.

Live Case Study: State Central Library, Cubbon Park, Bengaluru

Fig 5: Section_Author: the ariel view of the main library

Fig 6: Section_Author the main entrance

Fig 7: Section_Author the rustic book racks

Fig 8: Section_Author the view from outside

Observations Relevant to High School Wellness Design

The State Central Library, also known as the Seshadri Memorial Hall, was constructed in 1915. It stands as a tribute to Sir K. Seshadri Iyer, a visionary administrator and Dewan of Mysore, who was instrumental in modernizing the city. Although the specific architect's identity remains unclear, the library reflects a British colonial design approach, likely influenced by European-trained architects or engineers working in the Mysore state during that period.

Architectural Details

1. **Style and Influences**
- The building draws from Classical European styles, characterized by symmetry, balance, and decorative grandeur.
- Features such as Corinthian columns and a portico are hallmarks of Greek revival architecture, adapted for a tropical climate.

2. **Materials and Construction**
- Built primarily using brick and lime mortar, typical of early 20th-century colonial buildings in South India.
- The "Pompeian red" facade is both aesthetic and symbolic, as the bold colour was chosen to make the building visually stand out within the lush greenery of Cubbon Park.

3. **Layout**
- The central hall, a prominent feature, is flanked by smaller reading rooms and archival spaces.
- The grand staircase serves as the centrepiece of the interior, providing access to the upper floors.

4. **Design Adaptations for Climate**
- High ceilings allow natural ventilation, keeping the interiors cool.
- Large windows provide abundant natural light, reducing reliance on artificial lighting.

Library's Role and Evolution

1. **Cultural Significance**
- The library holds 2.65 lakh books in multiple languages, including rare manuscripts in Kannada, Sanskrit, and English.
- It serves as an educational and cultural hub, with specific sections dedicated to children's literature and Kannada research.

2. **Technological Upgrades**
- Over time, it has integrated digitization projects, cataloguing rare texts for preservation and easy access.
- Introduction of modern systems like HVAC for climate control ensures the protection of delicate manuscripts.

Insights for Interior Designers and Architects

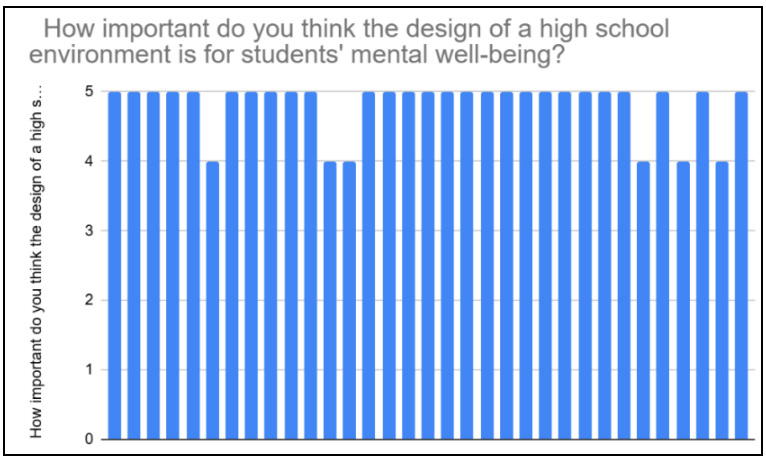
1. **Adaptive Reuse**
- Balancing modernization (e.g., LED lighting and digital catalogues) with heritage preservation is critical. Incorporating contemporary elements while respecting the building's historic integrity is a delicate yet essential task.

2. **Enhancing Functionality**
- Revitalizing underutilized spaces into vibrant areas for interactive learning or events could enhance community engagement.

3. **Conservation Strategies**
- Regular maintenance of the unique "Pompeian red" facade and structural reinforcements for seismic stability ensure longevity.

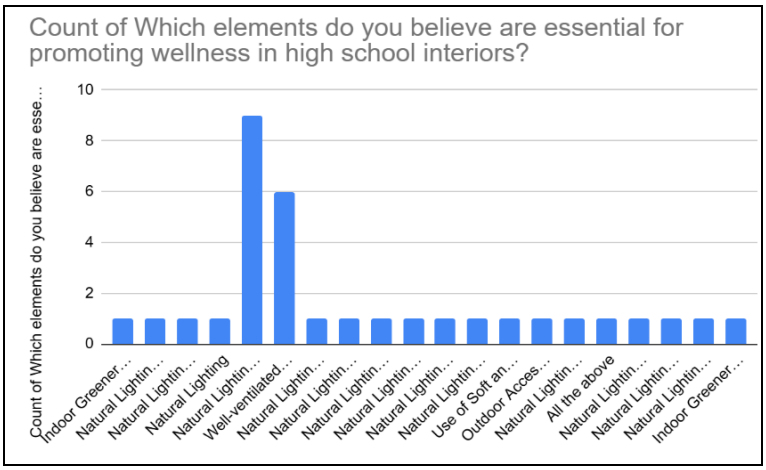
Survey: Graphs and interpretation

A survey was conducted among high school students, teachers, and administrators to gather insights into Preferences for biophilic elements (e.g., plants, natural lighting), The perceived benefits of recreational spaces on stress reduction and well-being.



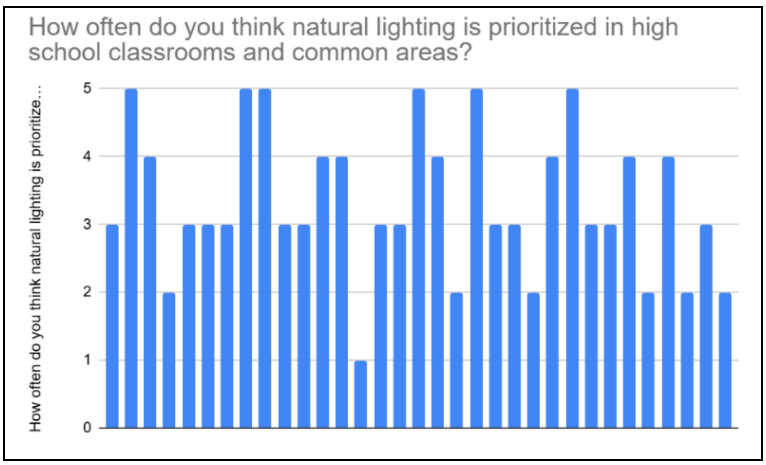
Note: This question assesses how critical participants consider school design in influencing mental health. Higher ratings indicate widespread acknowledgment of its significance in reducing stress and fostering well-being.

Fig 9: Survey 1



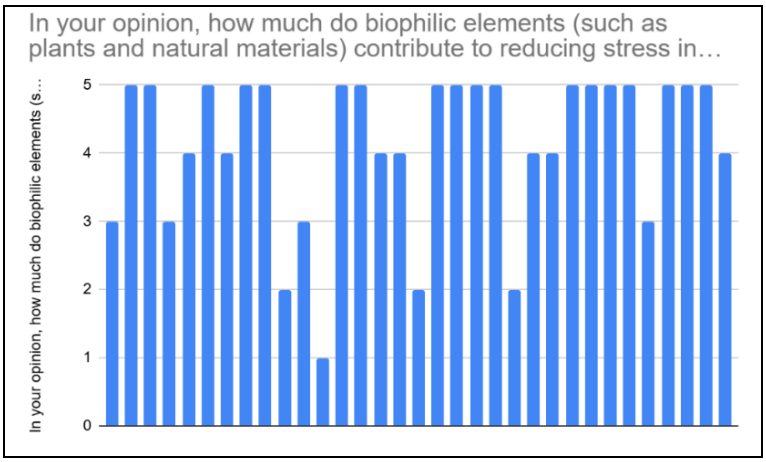
Note: The data highlights which features, like natural lighting or quiet spaces, are deemed most valuable for mental and emotional health. Popular responses suggest strong preferences for biophilic and ergonomic aspects.

Fig 10: Survey 2



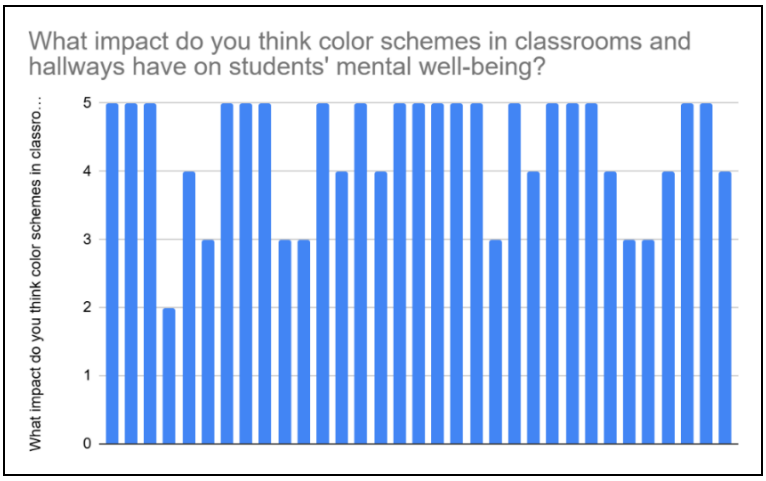
Note: Responses reveal how often participants believe natural light is a focus in school design. Frequent prioritization reflects better mental clarity and mood improvement linked to adequate daylighting

Fig 11: Survey 3



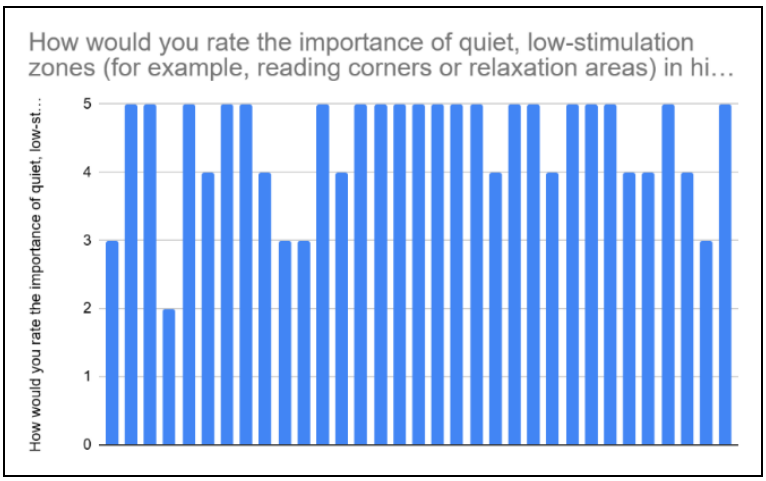
Note: This explores the effectiveness of greenery and natural materials in lowering stress. Higher ratings suggest strong support for incorporating plants and biophilic materials in school environments.

Fig 12: Survey 4



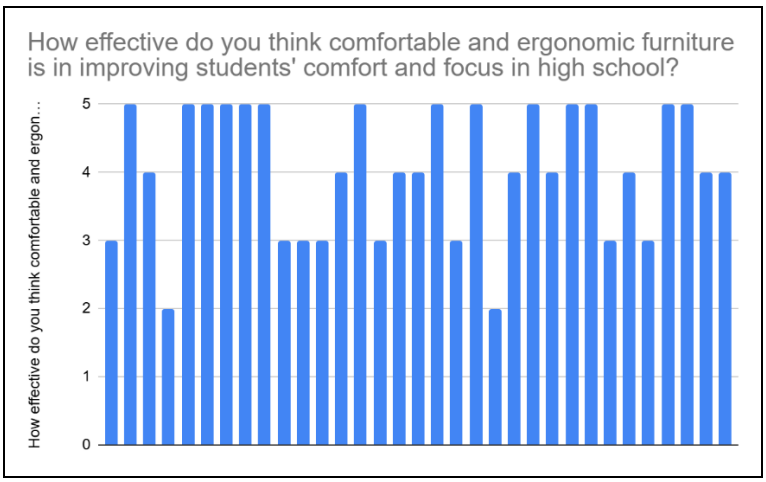
Note: The responses measure the influence of colours on emotions. Strong impacts align with theories that soft, calming hues enhance focus and relaxation.

Fig 13: Survey 5



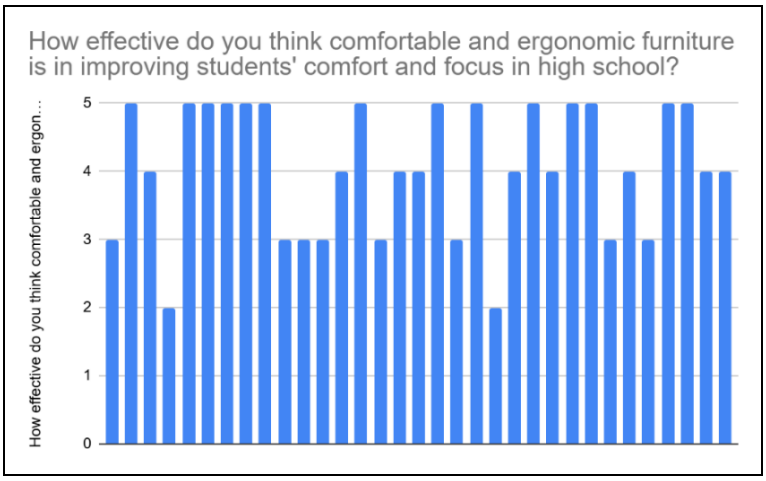
Note: Data shows the value participants place on low-stimulation areas for reflection. Higher ratings emphasize the need for reading corners and relaxation zones.

Fig 14: Survey 6



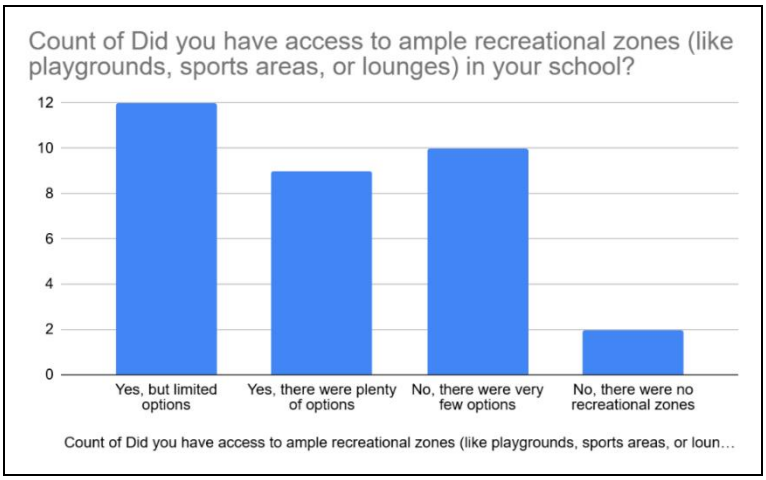
Note: This assesses how ergonomic design aids focus and comfort. Positive feedback underscores its necessity in reducing physical discomfort and increasing attention.

Fig 15: Survey 7



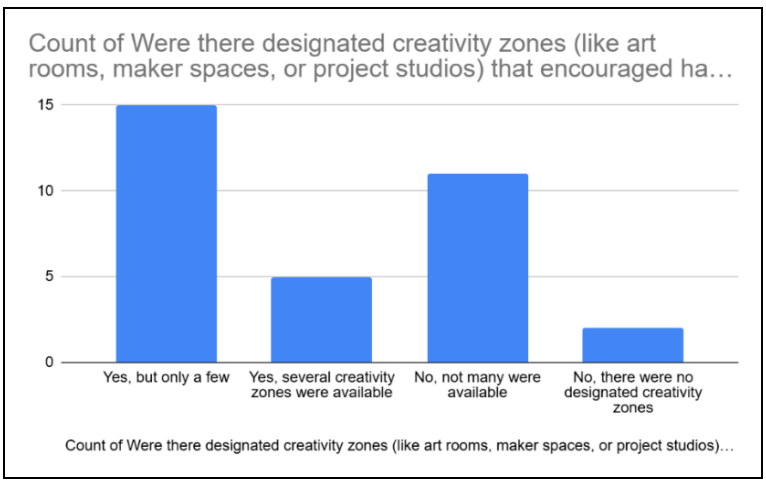
Note: Responses highlight which additional elements (e.g., improved air quality or noise control) participants prioritize, helping focus future design efforts.

Fig 16: Survey 8



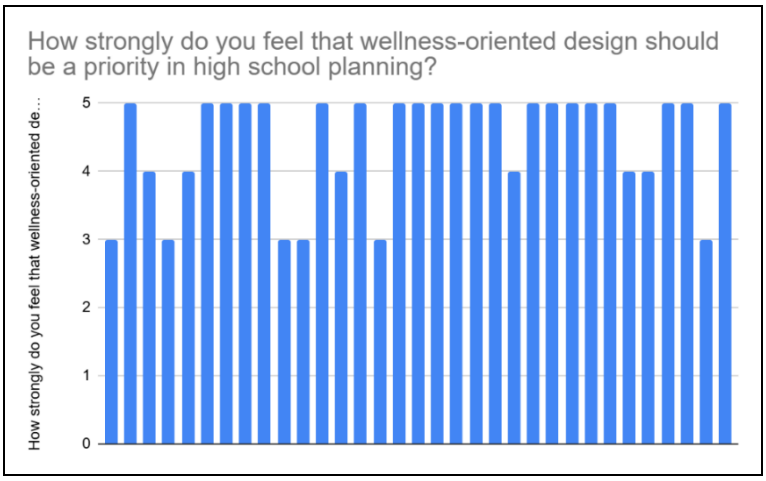
Note: Participants reflect on the availability of playgrounds or lounges in their schools. Limited options may suggest a need for more physical activity and relaxation spaces.

Fig 17: Survey 9



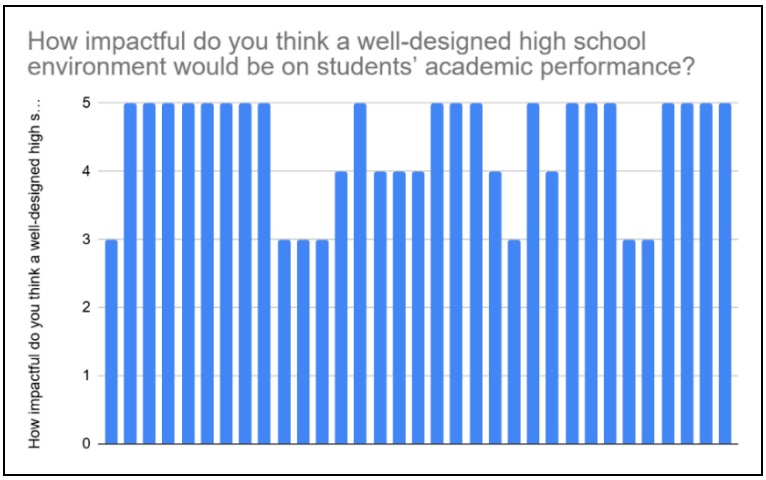
Note: Responses gauge the prevalence of art and maker spaces. A lack suggests potential enhancements in fostering creativity.

Fig 18: Survey 10



Note: This assesses how strongly participants feel wellness should guide high school planning. Higher scores indicate a consensus for prioritizing such initiatives.

Fig 19: Survey 11



Note: This explores how much participants believe design influences academic success. High ratings suggest that well-designed spaces significantly support learning outcomes.

Fig 20: Survey 12

Results and Discussion

Key Findings from Surveys

1. **Biophilic Elements**
   - Over 80% of participants emphasized the importance of natural lighting and indoor greenery, highlighting their role in reducing stress and enhancing focus.
   - Biophilic elements, such as plants and natural materials, were rated as highly effective in creating calming and supportive environments.
2. **Colour and Spatial Design**
   - Soft, calming colour schemes in classrooms and hallways were identified as having a strong positive impact on students' mental well-being.
   - Quiet, low-stimulation zones like reading corners and relaxation areas were considered vital for emotional and mental recovery, with high ratings for importance.
3. **Ergonomics and Comfort**
   - Comfortable, flexible, and ergonomic furniture was seen as crucial for improving students' physical comfort and focus, with a majority rating it as very effective.
4. **Recreational and Creativity Zones**
   - Limited access to recreational spaces (e.g., sports areas or lounges) was noted by a significant number of participants, indicating a need for more physical activity zones in high schools.
   - Creativity zones, such as maker spaces or art rooms, were often reported as insufficient, emphasizing a gap in areas fostering hands-on learning and innovation.
5. **Integration of Wellness-oriented Design**
   - The majority of respondents strongly supported wellness-oriented design as a priority in high school planning, indicating broad awareness of its benefits.
   - A well-designed school environment was rated as highly impactful on students' academic performance, affirming the connection between physical space and cognitive outcomes.
6. **Key Recommendations for Design Features**
   - Participants most frequently desired more natural lighting, improved air quality, noise reduction solutions, and additional spaces for relaxation and

reflection in high school environments.

Discussion

Impact of Wellness Design: Incorporating natural lighting, greenery, and calming colour schemes significantly enhances students' mental well-being, focus, and stress reduction. These elements create a more welcoming and supportive learning environment.

Recreational and Quiet Spaces: Recreational zones provide opportunities for relaxation and physical activity, crucial for emotional balance and mental health. Quiet, low-stimulation zones foster reflection and offer a sanctuary from overstimulation in school settings.

Academic Benefits: Ergonomic and comfortable furniture improves focus and reduces physical discomfort, directly supporting academic performance. Schools that integrate wellness-focused designs report higher student satisfaction and engagement.

Challenges

Budgetary Constraints: Implementing biophilic and wellness-focused elements, such as natural lighting systems or recreational areas, often requires significant investment, limiting widespread adoption.

Awareness and Training: Lack of awareness among stakeholders (administrators, policymakers) about the benefits of wellness design hampers its integration into school planning.

Space Limitations: Existing high schools may face difficulties in retrofitting wellness-oriented features due to limited space or architectural constraints.

Recommendations

Cost-effective Solutions: Introduce modular green walls or portable indoor plants to incorporate biophilic elements at a lower cost.

Utilize natural materials and energy-efficient systems like skylights for daylighting in new and existing structures.

Prioritize Multifunctional Spaces: Create adaptable areas that can serve as recreational, reflective, or collaborative spaces to maximize utility.

Stakeholder Collaboration: Increase awareness among educators, administrators, and designers about the long-term benefits of wellness design through workshops and case studies.

Policy Support: Advocate for government guidelines mandating wellness-focused elements in school designs to promote holistic student development.

Conclusion

The study demonstrates that wellness design is a transformative approach to enhancing high school environments. Key elements, including natural light, biophilic features, calming colours, and ergonomic furniture, significantly reduce stress and improve academic outcomes. Recreational and quiet zones further support emotional well-being and foster creativity. Despite challenges like budget limitations and space constraints, cost-effective solutions and policy advocacy can make wellness design more accessible. Integrating these strategies into high school planning ensures a nurturing and productive environment, prioritizing mental health and academic excellence.

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