IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Biophilic Learning Spaces: Enhancing Spatial Experience through Biophilic Strategies and Interventions - A Case of NIF Global, Nagpur, Maharashtra

[1]Anjali Patel, [2]Ar. Aparna Bhattacharyya (Mukherjee)

[1] 2nd YearStudent,M.Des –Interior Design,[2]Professor –M.Des–Interior Design,

Parul Institute of Architecture and Research
Vadodara, Gujarat , India

Abstract: The research examines the potential impact of adopting biophilic design concepts in creating spatial experiences in the setting of educational learning spaces, with a specific focus on design institutes. Contemporary learning spaces have been noted to lack natural aspects in their designs, resulting in uncomfortable environments, increased stress among learners, and low productivity.

Through the use of a systematic methodology involving an extensive literature review, analysis of case studies, assessment of user experience, and evaluation of NIF Global Nagpur premises, it was established that certain environmental elements such as lighting, ventilation, and vegetation are instrumental in improving user experiences and comfort.

The study then provides interpretations of the results to develop suggestions for spatial improvements in context. Findings from the study suggest that even small interventions that consider the aspects of biophilic design principles may have a positive effect on user experiences by increasing comfort and fostering creativity.

Index Terms **- BiophilicDesign,Studio-BasedLearning,SpatialQuality,GreenIntegration,Ventilation,UserExperience.**

I. INTRODUCTION

Thespatial environment plays a considerable role in determining the outcomes for the users, such as productivity and creativity. Given that the design institutes involve a lot of activity in the studio space, the quality of the spatial environment becomes essential forensuring success and wellbeing in this sphere. Many contemporary educational buildings have artificial lighting, poor ventilation, andlack of exposure to natural elements. These aspects might result in discomfort for students and lower productivity.

A design institute is a creative learning environment where students study interior and fashion design. Unlike traditional learning settings, these environments are intended to be creative workspaces where students will create ideas, experiment, develop projects

and interact for hours on end. It becomes important not only to ensure productivity in terms of learning but also encourage creativity and effective collaboration.

But other studios are created purely based on function, thus creating a denser environment where artificial inputs must be created. The absence of natural elements, such as ample sunlight, ventilation, greenery, as well as the natural stimulus that is needed by the human brain, may be a significant cause why people using the place feel discomfort in addition to the condition of their minds. Incorporating biophilia and biophilic designs in architecture would serve as a perfect response to the issue. Daylighting, ventilation, greenery, and a view of nature included in educational institutions would be greatly helpful.

Biophilia and biophilic designs incorporating natural elements in architecture offer an appropriate way of addressing such concerns. Including elements of daylighting, ventilation, greenery, and natural stimuli in learning institutions would significantly help people in these settings.

II. AIM

To study the impact of biophilic design strategies on spatial experience in educational learning spaces and explore interior-level interventions to enhance environmental quality, user comfort, creativity, and the overall learning experience.

III. NEED OF STUDY

- To understand how spatial condition influence user comfort, productivity, and learning experience in design institutes.
- To studying the impact of natural components like sunlight, ventilation, and greenery on spatial quality within studio-based learning environments.
- To identify gaps in existing learning spaces that rely on artificial systems and function-driven planning.
- To explore how biophilic design strategies can enhance spatial experience through interior-level interventions.
- This study is needed because research clearly shows that spatial conditions directly affect learning, but their application in design institutes and real studio spaces is still not properly explored.

IV. RESEARCH GAP

- The current literature mostly focuses on general educational environments, where there is less discussion about design institute and studio-based learning spaces.
- Insufficient research addressing the specific spatial requirements of studio environments.
- Lack of direct correlation between environmental factors (daylight, ventilation, and connection to nature) and user experience.
- Majority of studies remain theoretical, with limited real-space analysis and application.
- Minimal exploration of the relationship between user behavior and spatial conditions.
- Lack of discussion about interior level solutions that can be applied.

V. OVERVIEW OF BIOPHILIC DESIGN

5.1 CONCEPT OF BIOPHILIA

Biophilic design is an approach whereby humans are connected with nature in a designed environment. Biophilia stems from the word “bio,” which means life (all forms of life ranging from plants, humans, to other systems) and “philia,” meaning love/affinity/connection. Biophilic design includes the use of elements such as daylight, natural ventilation, greenery, water features, organic forms, and natural materials, among others, to enhance the space quality for better well-being.

In terms of education, especially in design institutions, biophilic design plays an important role in improving concentration, relieving stress, and promoting creativity.

5.2 BIOPHILIC DESIGN PRINCIPLES

The basis of biophilic design is the incorporation of elements and processes from nature in artificial buildings, ensuring well-being for people. The theories put forward by scholars such as Stephen R. Kellert and Judith Heerwagen shed light on the effective incorporation of nature within the architecture and interiors. The underlying principle comprises of three basic categories: direct connection with nature, indirect connections through materials, and naturalistic settings.

In educational interiors, these principles help create spaces that improve focus, relaxation, and creativity, supporting a better learning experience.

Key Principles:

- VisualConnection with Nature – Views to greenery or outdoor elements.
- Non-Visual Connection – Sound, smell, and touch (water, plants, textures)
- NaturalLight – Daylight variation throughout the day.
- Airflow& Ventilation – Fresh air movement for comfort.
- NaturalMaterials – Use of wood, stone, earthy textures.
- Biomorphic Forms – Patterns and shapes inspired by nature.
- Prospect& Refuge – Open views with comfortable enclosed spaces.

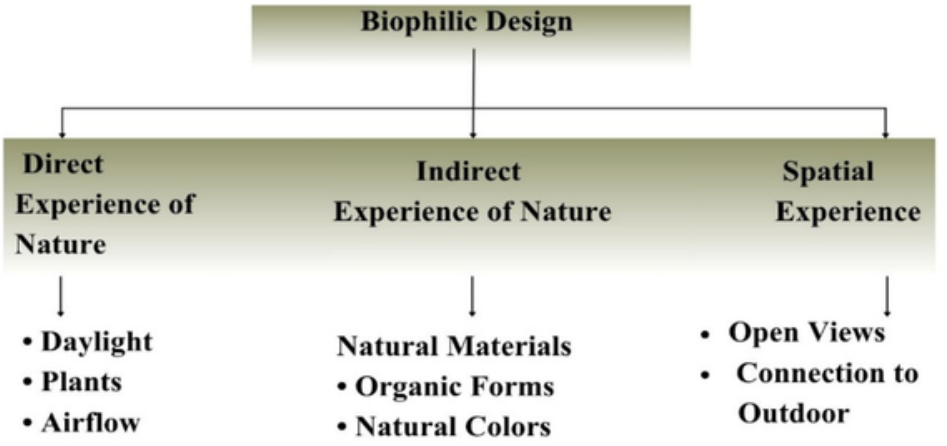

Fig. 1: Classification of Biophilic Design into Direct, Indirect, and Spatial Experiences

5.3 PATTERNS OF BIOPHILIC DESIGN

The application of biophilic design can be achieved through certain patterns that incorporate the presence of natural components in interiors. Common patterns include visual connection with nature, access to daylight, natural ventilation, greenery, and organic material, resulting in comfortable and psychologically beneficial interiors. For educational spaces like design studios, such patterns allow for improved creativity, reduced cognitive exhaustion, and interaction between users.

14 PATTERNS OF BIOPHILIC DESIGN

The 14 Patterns of Biophilic Design represent a guide that seeks to bring about the incorporation of nature within built spaces in such a way that comfort, health, and productivity are enhanced. Biophilia is a term that originated from the work of **Edward O. Wilson** , and further refined as part of design concepts by other scientists like **Stephen R. Kellert, Bill Browning, and Catherine Ryan.**

These14 Patterns can be grouped into three groups, which include **Nature in the Space, Natural Analogues, and Nature of the Space.**

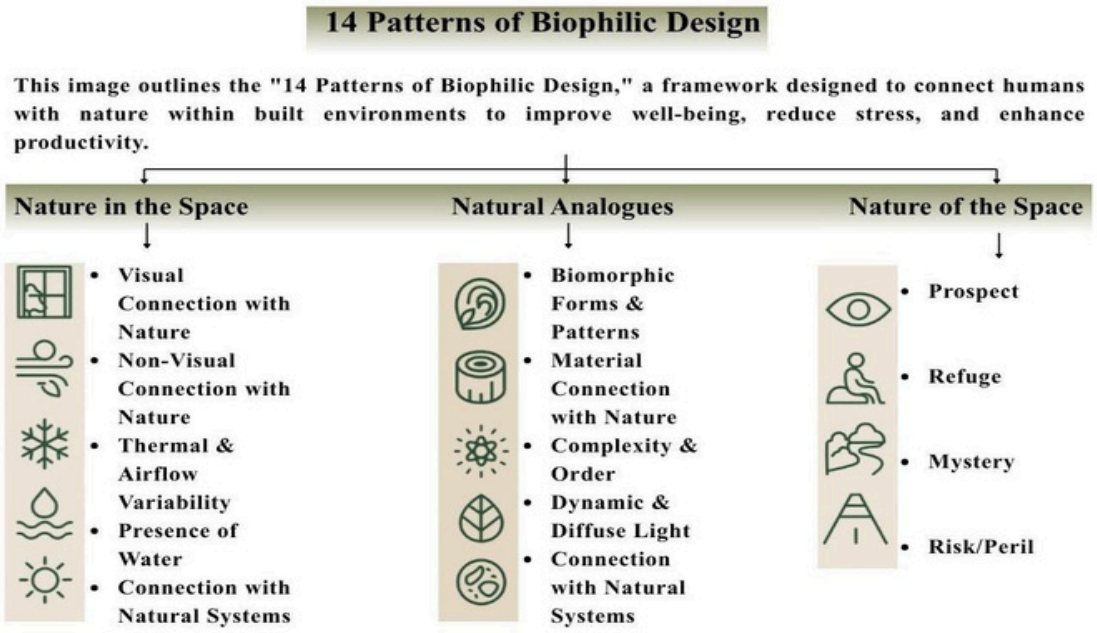

Fig. 2: The 14 Patterns of Biophilic Design Framework

5.4 IMPORTANCE OF BIOPHILIC DESIGN IN EDUCATIONAL FACILITIES

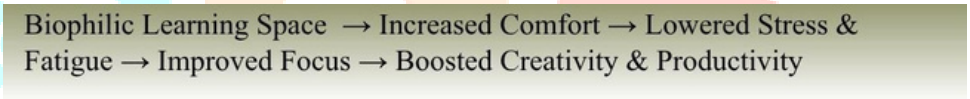

Fig. 3: Effect of Biophilic Design on Learning Process in Studio Spaces

Learning environments, especially design studios, rely on studio learning, where learners spend extended periods creating. Such learning environments require high levels of **concentration, interaction, and creativity**, making the quality of space an important aspect of the learning experience.

Variables like **natural lighting, fresh air, vegetation, and flexibility** in space layout greatly influence comfort and experience.

Natural light improves concentration and reduces exhaustion, while the associationwith nature bringsaboutasense of relaxation andengagement.Biophilicdesign principlesimplementedin studio spacescan improve **comfort, reduce stress, and promote creativity,** whichleads toenhanced learningexperiences .

5.5 IMPORTANCE OF DAYLIGHT, VENTILATION, AND VEGETATION IN ENHANCING STUDIO SPACES

The quality of studio settings can be impacted greatly by daylight, ventilation, and other elements of nature. Good levels of daylight make for better visual comfort and lower reliance on artificial light sources, as well as aiding activities that require more attention to detail like drafting and using digital technologies. Good ventilation ensures proper air flow, as well as thermal comfort an essential element of any studio setting due to its high occupancy rate. Moreover, introducing vegetation into the space through either indoor plants or viewing of landscapes can help achieve sensory comfort.

Fig. 4: Role of Daylight, Ventilation, and Greenery in Enhancing Studio Environment

VI. CASE STUDY

- **Oasis I Studio Saransh**
- **Ahmedabad Gujarat, India,**
- **Area-455 square meters**
- **Completion year-2023**
- **Design by- Studio Saransh**

The total area of the interior project makes up 455 square meters and it has been implemented by the architect Malay Doshi and his design team with Vishal Gohel among them. Studio Saransh is a minimalist design which allows flexibility in use along with comfortable user experience. The design provides an open flow between areas used for work, circulation, and interactions.The combination of neutral materials, natural light, and natural air helps to make the space peaceful. Adding nature inside the space makes it even more comfortable.

It emphasizes simplicity, function, and space experience with biophilia incorporated subtly.

Key Features

- Open-plan layout promoting interaction
- Strong daylight integration
- Raw/Natural material palette
- Cross ventilation and airflow
- Minimal and clutter-free design
- Visual connection to greenery

Biophilic Relevance

- The studioisan illustration of how fundamental spatial organization such as natural light, air circulation, and material compositioncan be utilized to create a comfortable atmosphere through proper planning.

Fig. 5: Oasis Studio/Studio Saransh

6.1 ENVIRONMENTAL AND SPATIAL ANALYSIS

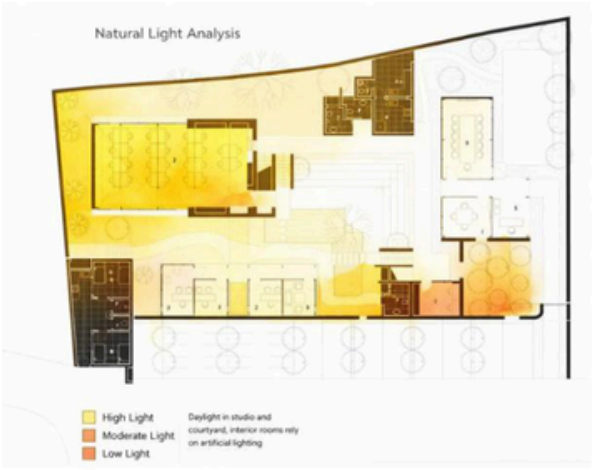

Fig. 6: Natural light Analysis

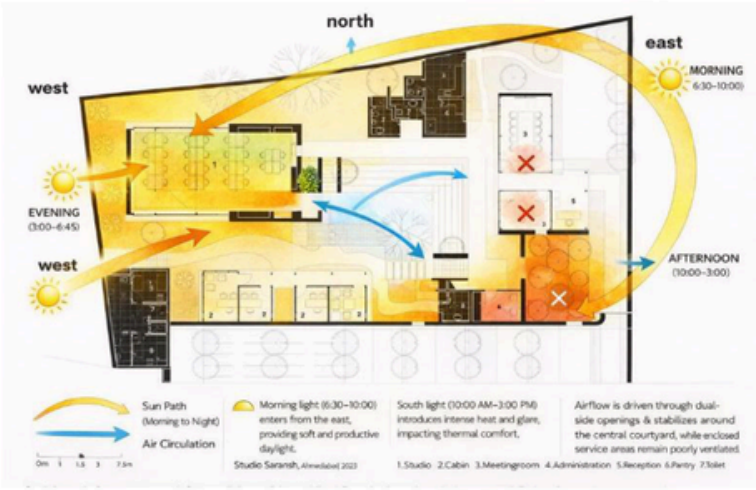

Fig. 7: Sun Path Analysis

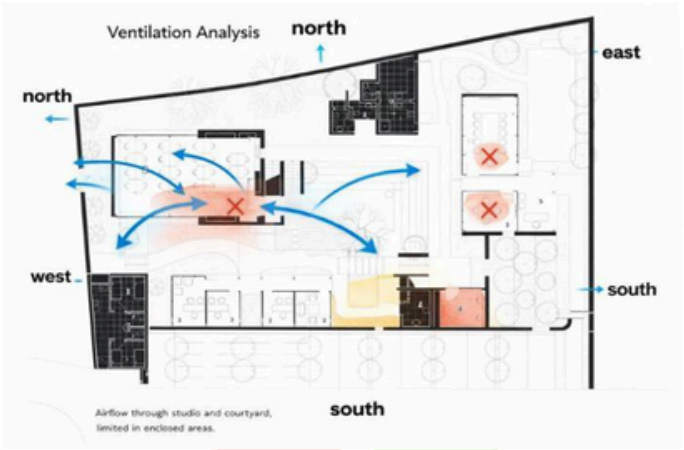

Fig. 8: Ventilation Analysis

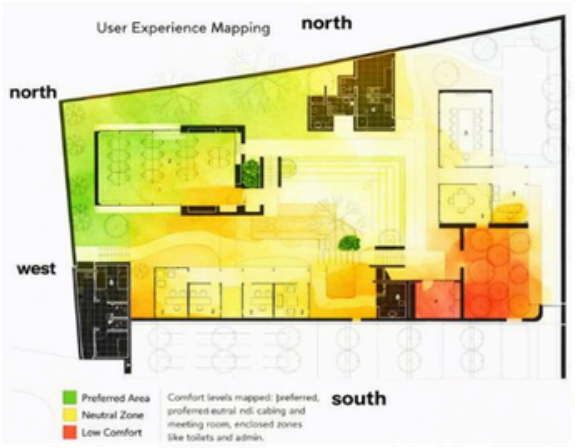

Fig. 9: User Experience Mapping

VII. USER EXPERIENCE DOCUMENTATION

In order to determine the users' spatial preference and comfortability in addition to measuring their overall experience within the educational institution, a user experience survey was carried out on NIF Global students enrolled in interior design, fashion design, and other fields of study. This was expected to give information on the users' usage of the space, their degree of comfort, natural light provision, air circulation, their connection with nature, and stress, among others. In order to maintain a balanced view of the data collection process, both designers and non-designers participated in this survey.

7.1 SURVEY AMONG STUDENTS FROM INTERIOR DESIGN, FASHION DESIGN, AND OTHER DISCIPLINES

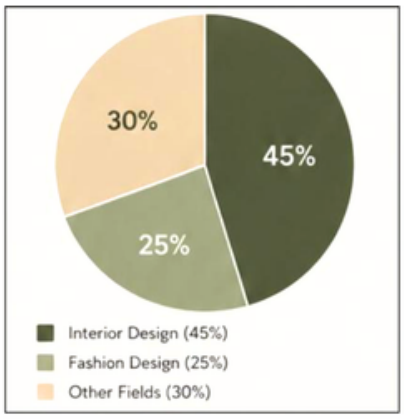

Fig. 10: Department Distribution

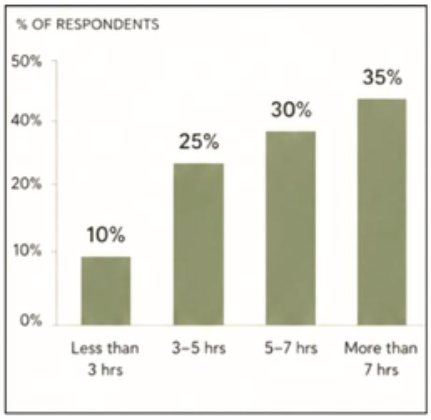

Fig. 11: Time Spent by Students in Institute Daily

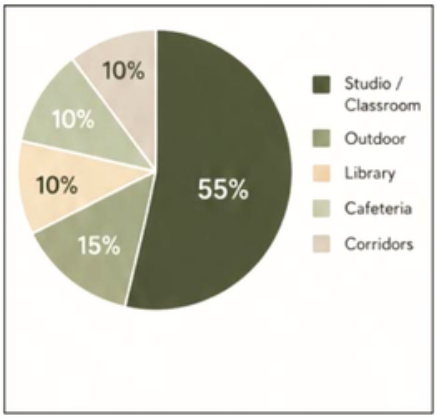

Fig. 12: Frequently Used Spaces by Students

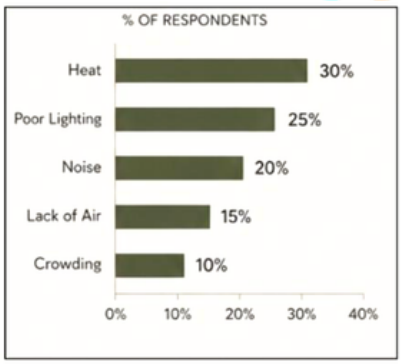

Fig. 13: Factors Affecting Comfort

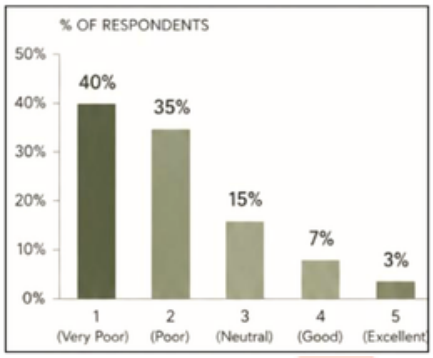

Fig. 14: User Rating of Natural Lighting (1-5)

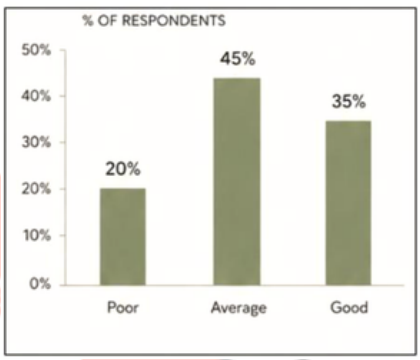

Fig. 15: User Perception of Ventilation

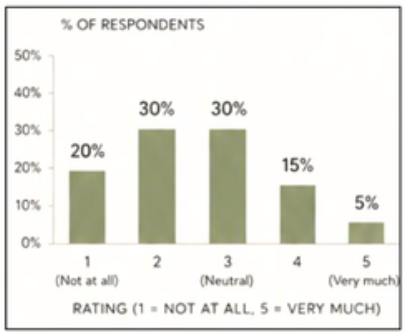

Fig. 16: User connection to nature (1-5

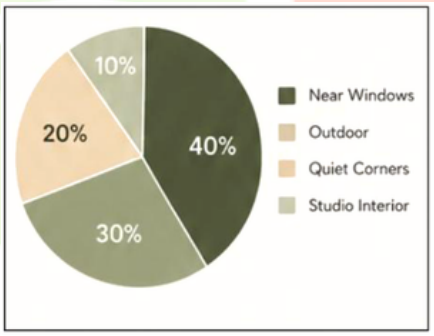

Fig. 17: Preferred working Areas

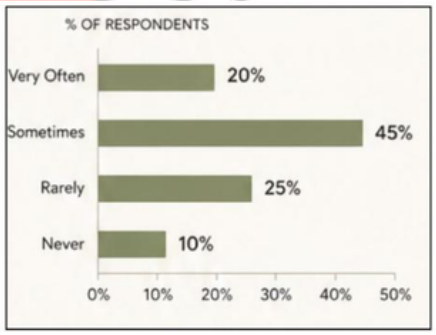

Fig. 18: Stress Level in Studio Spaces

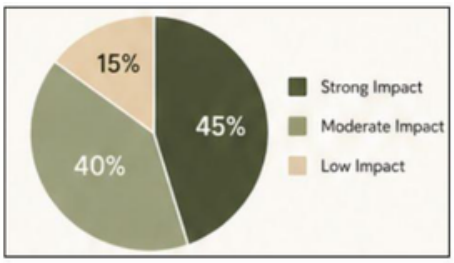

Fig. 19: Impact of natural elements on Productivity

7.2 INFERENCE

The survey indicates that **natural lighting, ventilation, and connection to nature are inadequate, leading to discomfort, stress, and reduced productivity.** Users show a clear preference for spaces with natural elements, highlighting the need for **biophilic strategies** to enhance learning environments.

VIII. DESIGN APPLICATION IN NIF GLOBAL (BASED ON BIOPHILIC STRATEGIES)

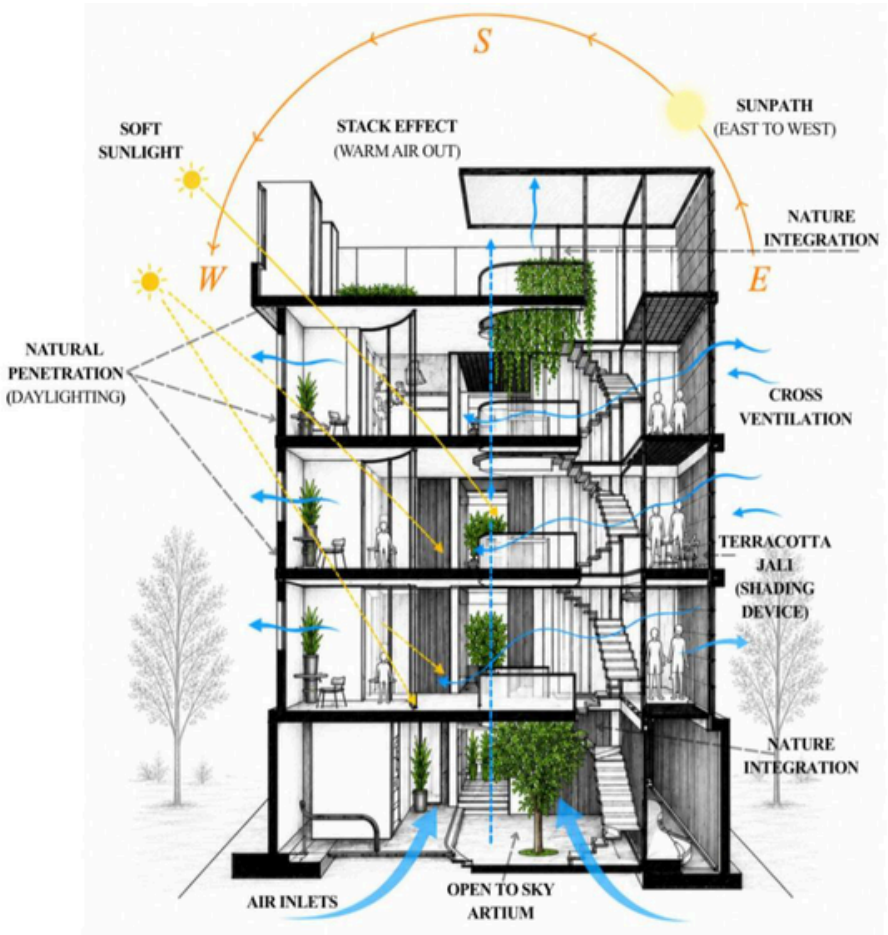

Fig. 20: Conceptual Section Illustrating Biophilic Interventions (NIF Global)

Fig. 21: Existing Site Conditions

The section demonstrates biophilia through the use of an atrium that facilitates stack effect and better air circulation. There is cross-ventilation and penetration of sunlight inside, providing for a more conducive environment. The greenery inside makes one connect more with nature, and the terracotta screens control heat and lighting inside.

Keywords: **Stack Effect, Cross Ventilation, Daylight Penetration, Central Atrium, Indoor Greenery**

8.1 INFERENCE FROM EXISTING CONDITIONS

- Limited natural ventilation
- Uneven daylight distribution
- Weak connection to nature
- Lack of spatial openness

8.2 PROPOSED BIOPHILIC DESIGN INTERVENTION - 3D VISUALIZATION

The proposed 3D visualizations show the implementation of biophilic design principles in the current studio environments. The design intervention concentrates on enhancing natural light, air flow, and nature connections using minimum spatial changes.

Fig. 22: Proposed 3D Views Showing Application of Biophilic Design Strategies in Studio Spaces

8.3 DESIGN INTERVENTION OUTCOME

The proposed intervention enhances spatial quality by adding natural lighting, better ventilation, and indoor plants inside the studio. The design intervention creates an interactive and breath-friendly space due to open layouts and visual connections. Natural materials and managed greenery also improve the users' comfort and lower their levels of stress.

IX. LIMITATIONS OF THE STUDY

- This study is focused only on one instance (NIF Global).
- This study uses qualitative data, with an element of user survey, but no numerical data for light, ventilation, and thermal efficiency.
- The application is conceptual, and there are no specific technical drawings to guide construction.
- There is an element of subjectivity in users' answers.
- Time constraints limited the scope of in-depth comparative case studies and long-term performance evaluation.

X. SUMMARY OF FINDINGS

- Natural lighting and ventilation in existing spaces are inadequate.
- Users prefer spaces with better daylight and openness.
- Lack of greenery affects comfort and increases stress.
- Biophilic strategies improve spatial quality and user experience.
- Simple design interventions can enhance productivity and creativity.

XI. SYNTHESIS OF FINDINGS

The current research emphasizes the importance of applying biophilic design principles in education learning spaces, especially those involving studios. Based on the results of case studies and user surveys, it was concluded that certain aspects like daylight, ventilation, and nature connection have an important role in contributing to user comfort, happiness, and productivity.

From the results of the interventions, it can be seen that even simple and strategic spatial adjustments can have a major impact in improving learning environments.

XII. REFERENCES

1. Wilson, E.O., 1986. Biophilia. Cambridge: Harvard University Press.

Available at: https://books.google.com/books/about/Biophilia.html?id=9xgkAQAAMAAJ

2. Kellert, S.R. and Wilson, E.O., 1995. The biophilia hypothesis. Washington, DC: Island Press.

Available at: https://islandpress.org/books/biophilia-hypothesis

3.Kellert, S.R., Heerwagen, J. and Mador, M., 2008. Biophilic design: The theory, science and practice of bringing buildings to life. Hoboken: John Wiley & Sons.

Available at: https://www.wiley.com/en-us/Biophilic+Design-p-9780470163344

4.Kellert, S.R., 2018. Nature by design: The practice of biophilic design. New Haven: Yale University Press.

Available at: https://yalebooks.yale.edu/book/9780300235432/nature-by-design/

5.Kellert, S.R., 2008. Dimensions, elements, and attributes of biophilic design. In: S.R. Kellert, J. Heerwagen and M. Mador, eds. Biophilic design: The theory, science and practice of bringing buildings to life. Hoboken: John Wiley & Sons.

Available at: https://www.researchgate.net/publication/284608721

6.Kellert, S.R. and Calabrese, E., 2015. The practice of biophilic design.

Available at: https://www.biophilic-design.com/

7.Xue, F., Gou, Z. and Lau, S.S.Y., 2019. Biophilic design in urban environments and its impact on well-being. Journal of Cleaner Production.

Available at: https://www.sciencedirect.com/science/article/pii/S0959652619301234

8.Aye, L., Tucker, R. and Singh, R., 2019. Biophilic design in urban settings: Practice and outcomes. Sustainability.

Available at: https://www.mdpi.com/2071-1050/11/12/3456

9.Biophilic design in architecture and its contributions to health, well-being, and sustainability, 2021. Sustainable Cities and Society.

Available at: https://www.sciencedirect.com/science/article/pii/S2210670721000479

10. Terrapin Bright Green, 2014. 14 patterns of biophilic design.

Available at: https://www.terrapinbrightgreen.com/reports/14-patterns/

11. Wikipedia contributors, 2024. Biophilic design. [online]

Available at: https://en.wikipedia.org/wiki/Biophilic_design

.