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*Future-Ready Construction and Facility Management:
Driving Research and Innovation for a Smart Built Environment*

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THE IMPACT OF BIOPHILIC DESIGN ON STUDENT ENGAGEMENT IN CLASSROOM SETTINGS

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Abstract

This study investigates the impact of biophilic design on student engagement within classroom environments, highlighting the role of natural elements in enhancing cognitive, emotional, and behavioral dimensions of learning. Traditional classroom designs often lack connections to nature, relying heavily on artificial lighting and materials, which can hinder focus and elevate stress levels. Biophilic design, which integrates elements such as natural light, indoor plants, views of nature, and organic materials, offers a compelling alternative for creating healthier, more stimulating educational spaces. The research adopts a mixed-methods approach, combining quantitative surveys and qualitative open-ended questionnaires, to assess students' perceptions of biophilic versus conventional classroom environments. The study was conducted at Universiti Teknologi MARA (UiTM) and Universiti Teknologi PETRONAS (UTP), where students evaluated classroom comfort, motivation, stress, and concentration in settings with varying degrees of biophilic integration. Findings demonstrate that classrooms incorporating biophilic elements significantly enhance students' emotional well-being, attention, and sense of engagement. Natural light, green views, and the presence of plants were especially influential in reducing stress and fostering a more inviting atmosphere for learning. However, the study also recognizes that external factors—such as academic pressures and personal preferences—can mediate these effects. Additionally, practical considerations like budget constraints, space limitations, and maintenance requirements pose challenges to full-scale adoption, although small-scale implementations were shown to deliver measurable benefits. Overall, this research reinforces the value of biophilic design in shaping supportive, restorative, and engaging educational environments. The study advocates for broader incorporation of biophilic principles into classroom design, and recommends future research to explore their long-term impacts on academic performance and student well-being.

Keywords: (biophilic, student engagement, classroom settings)

1. INTRODUCTION

This research investigates the impact of biophilic design on student engagement in educational settings, particularly within university classrooms. Biophilic design integrates natural elements—such as daylight, indoor vegetation, views of nature, and organic materials—into built environments to foster human connection to nature, promote well-being, and improve cognitive and emotional performance (Kellert, 2018). Despite its recognized benefits in healthcare and workplace environments, its application in educational spaces remains underexplored. The study addresses a significant problem: conventional classroom designs often neglect natural connections, relying on artificial light, closed environments, and synthetic materials. Such spaces can increase student stress and reduce attention and motivation (Barrett et al., 2015). While prior research highlights nature's restorative effects on health and mood (Ulrich, 1984; Rogers, 2010), there is limited evidence detailing how biophilic elements influence student engagement, especially across cognitive, emotional, and behavioral

dimensions. This research aims to fill that gap by examining how biophilic design features affect students' experiences and learning engagement. The study's core objectives are to:

1. Determine the extent to which biophilic elements influence student engagement in the classroom
2. Understand students' perceptions of biophilic classroom design and its effects on learning
3. Compare engagement levels between biophilic and conventional classroom environments

Guided by these objectives, the study employed a mixed-methods approach, combining quantitative surveys and qualitative open-ended questionnaires to collect both measurable data and personal insights from students. The research was conducted at Universiti Teknologi MARA (UiTM) and Universiti Teknologi PETRONAS (UTP), which offered contrasting classroom designs for analysis.

The findings suggest that natural light, plants, and outdoor views have a positive influence on student engagement, motivation, and emotional well-being. The study concludes by advocating for wider adoption of biophilic principles in educational design to create healthier, more engaging, and supportive learning environments.

2. LITERATURE REVIEW

The literature review highlights the growing importance of biophilic design in enhancing learning environments by integrating natural elements such as light, views of nature, indoor plants, and organic materials into classroom spaces. Studies suggest that exposure to nature reduces stress and mental fatigue while promoting cognitive function and emotional well-being (Browning et al., 2014; Determan et al., 2019). Research also emphasizes the role of natural light in enhancing mood, attention, and academic performance (Choi et al., 2014), and demonstrates that views of nature can help restore focus (Kaplan, 1995). However, while the reviewed studies confirm the general benefits of nature in built environments, they reveal a significant research gap in assessing how biophilic design specifically influences student engagement across cognitive, emotional, and behavioral dimensions. Most existing research tends to focus on short-term well-being or environmental psychology, neglecting comprehensive, education-specific outcomes (Anderson et al., 2020; Chung et al., 2022). This study addresses these gaps by combining empirical student feedback with structured comparisons between biophilic and traditional classrooms, thus contributing both theoretical depth and practical insights. It also suggests future research should explore long-term academic impacts and culturally responsive biophilic design, an area still underexplored in educational architecture (Kellert, 2018).

3. METHODOLOGY

This study employed a mixed-methods research design, combining quantitative surveys and qualitative open-ended questionnaires to explore the impact of biophilic design on student engagement. Data were collected from students at Universiti Teknologi MARA (UiTM) and Universiti Teknologi PETRONAS (UTP) using structured Likert-scale surveys and written responses. Purposive sampling targeted classrooms

with and without biophilic features. Descriptive statistical analysis was applied to survey data, while thematic analysis interpreted qualitative responses. Ethical considerations included informed consent, anonymity, and voluntary participation. The dual-method approach ensured both measurable trends and deep personal insights into students' learning experiences.

4. FINDING AND DISCUSSION

The findings of the study suggest that classroom environments, both traditional and biophilic in design, can affect student engagement, mood, and overall well-being. Twenty-one to twenty-six-year-old students, with a majority being female, represent various levels of academic advancement, ranging from second-year students to those at the fifth year and above, one of the greatest perspectives offered for further exploration. Main findings reveal how critical aspects such as natural light affect mood and alertness whereby most of the students suggested that exposure to sunlight had a positive effect on their emotional state and cognitive skills. Besides, they claimed that classrooms with good natural light, plants, and open designs led to better concentration and a favorable ambience for learning. Greenery was cherished for its calming and focus-enhancing effects. A classroom's comfort was another prime factor for the students. They acknowledged that though some of the design features such as biophilic aspects made them comfortable, some designs with manifestations like low air quality and uncomfortable furniture deterred the overall learning experience. They preferred natural air quality and ventilation and the use of natural materials like wood and stone because they would contribute to more relaxation and engagement within the environment. The data further discussed how biophilic design had varying effects. Half the participants found it to be motivational and stress-reducing; the other half still experienced moderate stress, which suggests a role for influences beyond the physical environment, such as academic pressures. The need for open layouts enhancing collaboration with some space for individual focus, was similarly substantiated. Overall, the survey pointed to biophilic design as the way to go in terms of addressing student engagement, concentration, and well-being. Some improvements that came as suggestions from the respondents are increased natural light, improved ventilation, more nature, and the use of natural materials to create a comfortable, sustainable, and inspiring classroom. It gives a suggestion appropriate to the principles of biophilic design, establishing a healthy, motivating, and productive learning ambience.

5. CONCLUSION

This study concludes that biophilic design positively influences student engagement by enhancing focus, emotional well-being, and classroom comfort. Natural light, plants, and views of nature were key contributors to creating restorative learning environments. The research advances both theory and practice by highlighting how design directly affects learning outcomes, encouraging educational institutions to integrate nature-inspired elements. Practical recommendations include incorporating plants, maximizing natural light, and using natural materials, even in budget-limited settings. Limitations include a small sample size and short-term analysis. Future research should explore long-term effects and cultural contexts to optimize biophilic design in education.

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