



Paper Type: Original Article

Analyzing the Role of Biophilic Design in Enhancing Employees' Psychological Well-Being and Improving the Quality of Office Environments

Mostafa Najafian* 

Department of Architecture, Tawhid Higher Education Institute, Behshahr, Mazandaran, Iran; mostafanajafian1855@gmail.com.

Citation:

Received: 23 April 2026
Revised: 06 June 2026
Accepted: 16 August 2026

Najafian, M. (2026). Analyzing the role of Biophilic design in enhancing employees' psychological well-being and improving the quality of office environments. *Architectural dimensions and beyond*, 3(3), 243-260.

Abstract

Contemporary office environments extend beyond being settings for work-related activities and play an important role in shaping employees' spatial experiences, comfort, satisfaction, and psychological well-being. In this context, Biophilic design, with its emphasis on establishing a meaningful connection between humans and nature, has emerged as a human-centered approach in architecture and environmental design with considerable potential for improving the quality of workplaces. This study aims to analyze the role of Biophilic design in enhancing employees' psychological well-being and improving the quality of office environments through an integrative literature review and critical analysis of relevant scientific sources. The study examines various Biophilic components, including natural daylight, vegetation, natural materials, water features, natural views, ventilation and environmental comfort, biomorphic patterns, and spatial characteristics associated with the concepts of prospect, refuge, and psychological restoration. The findings indicate that the purposeful integration of Biophilic elements into office environments can contribute to reducing stress and psychological tension, improving mood, enhancing attention restoration, increasing workplace satisfaction, and strengthening employees' concentration and performance. However, the effectiveness of these strategies depends on several factors, including design quality, climatic conditions, users' cultural and perceptual characteristics, and the management and maintenance of natural elements. Furthermore, the literature review indicates that, within the Iranian context, traditional architectural features such as central courtyards, Persian gardens, water features, shading, and the use of indigenous materials can provide valuable local potentials for developing Biophilic approaches in office environments. Accordingly, Biophilic design can be regarded as an effective approach to creating health-oriented, human-centered, and sustainable office environments, in which strengthening the human–nature relationship contributes to improving employees' psychological well-being and the overall quality of their workplace experience.

Keywords: Biophilic design, Psychological well-being, Employees, Office environments, Human-centered architecture, Environmental psychology, Environmental quality.

1 | Introduction

1.1 | Background and Context of the Study

In contemporary architectural literature, the workplace is no longer regarded as a neutral setting for carrying out organizational activities; rather, it functions as a complex spatial–perceptual system in which environmental perception, social relationships, cognitive loads, movement patterns, experiences of privacy,

 Corresponding Author: mostafanajafian1855@gmail.com

 <https://doi.org/10.48314/adb.v3i3.69>



Licensee System Analytics. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0>).

and a sense of belonging are simultaneously shaped. Therefore, the quality of office-space design can directly and indirectly affect employees' mental health and efficiency. Design decisions, including the placement of openings, the quantity and quality of daylight, plan depth, material selection, the presence or absence of natural elements, views and visual quality, acoustic conditions, and access to spaces for pause and rest, go beyond purely aesthetic considerations and become determinants of health, behavior, and performance.

Biophilic design is based on the fundamental assumption that humans possess an innate evolutionary and cultural affinity for nature and living processes. Wilson [1] referred to this tendency as "Biophilia" and defined it as the innate human inclination toward the living world. Kellert et al. [2–4] extended this concept to the fields of architecture and environmental design, emphasizing that sustainability is not limited merely to reducing energy consumption, but also involves creating meaningful experiences of nature and promoting users' physical and psychological well-being. From this perspective, although sustainable buildings may perform successfully in terms of energy efficiency, they cannot fully address the objectives of sustainability if they lack restorative environmental qualities.

This approach is particularly important in office environments because employees spend a significant proportion of their time indoors, under continuous cognitive pressure, complex work-related interactions, and dependence on digital technologies. Under such conditions, disconnection from natural elements such as daylight, vegetation, natural ventilation, and temporal environmental changes may increase mental fatigue, reduce concentration, and diminish job satisfaction. Kaplan's Attention Restoration Theory suggests that natural environments facilitate the restoration of directed attention through the experience of "soft fascination" [5], [6]. Similarly, Ulrich's Stress Recovery Theory proposes that exposure to natural views can reduce physiological and emotional responses associated with stress [7], [8].

In the Iranian context, the relationship between architecture and nature has a rich and meaningful history. Elements such as central courtyards, Persian gardens, iwans, water, shade, windcatchers, local materials, and filtered daylight have functioned not only as physical components but also as systems for climate regulation and enhancing the quality of lived experience. However, many contemporary office spaces in Iran, influenced by global design patterns, have been developed with deep floor plans, uncontrolled glass façades, a predominance of artificial lighting, and diminished spatial identity. This disconnect between the historical capacities of Iranian architecture and the quality of contemporary office environments highlights the need to reinterpret and redefine the Biophilic approach.

1.2 | Problem Statement

The central problem addressed by this research is that contemporary office environments are often designed in ways that marginalize psychological needs and human health. The dominance of functionalist and productivity-oriented approaches in workplace design has resulted in environments that, although considered desirable in terms of spatial organization, density, and functional efficiency, may possess psychologically exhausting qualities from the perspective of users' lived experiences. Open-plan layouts lacking opportunities for individual control, uniform artificial lighting, the absence of views and visual connections with nature, poor acoustic conditions, the extensive use of industrial materials, the lack of natural elements, and limited access to natural outdoor spaces can all contribute to environments that are functionally efficient but psychologically stressful and exhausting. Under such conditions, employees must expend greater psychological energy to maintain concentration, regulate emotions, and cognitively adapt to their surroundings. In the long term, this may result in mental fatigue, reduced cognitive restoration, and decreased job satisfaction.

Despite the growing body of literature on Biophilic design in recent decades, this approach has often been reduced to superficial and symbolic applications in practice. The addition of a few potted plants, green walls, or images of nature is sometimes mistakenly regarded as sufficient to constitute Biophilic design. This reductionist interpretation transforms Biophilia from an evidence-based approach that connects humans and nature into a decorative or marketing-oriented tool in interior design. However, the fundamental issue is not

merely the presence of natural elements, but rather how spatial organization, environmental perception, and users' interaction with natural components are structured within the context of workplace activities. Accordingly, the fundamental question is which elements of Biophilic design, in what combinations and with what spatial qualities, and within which cultural and organizational contexts, can meaningfully contribute to improving employees' mental health. Addressing this question requires moving beyond a descriptive level toward an analytical approach based on psychological, perceptual, and spatial mechanisms.

Another challenge is the heterogeneity and fragmentation of research evidence in this field. International literature includes a range of laboratory studies, field studies, virtual-reality simulations, and systematic reviews, whose findings vary depending on the duration of exposure, type of design intervention, mental-health assessment indicators, and nature of occupational activities [5], [6], [8–14]. This heterogeneity makes it difficult to identify generalizable design patterns. In Iran, although studies have examined mental health and its relationship with healthcare, educational, residential, and office environments, empirical research specifically focused on office spaces remains limited and fragmented [15–20]. Therefore, it is necessary to analyze and integrate international and domestic literature simultaneously in order to establish evidence-based implications and design strategies for office environments.

1.3 | Research Significance

The significance of this study lies in its effort to move Biophilic design beyond mere aesthetics or superficial approaches involving the use of indoor vegetation, and to examine it as an integral component of the health-oriented and sustainable architecture paradigm. Within this framework, physical elements such as natural light, vegetation, materials, the presence of water, view and landscape quality, spatial refuge, and environmental sensory characteristics are regarded not as decorative elements, but as active tools for shaping perception, behavior, emotional regulation, cognitive restoration, and the enhancement of employees' organizational experience. This shift in perspective elevates the role of design from the level of form-making to that of intervention in mental health and quality of working life.

From the perspective of environmental psychology, this study is significant because it considers the office environment as an everyday, repetitive, and persistent setting in which small but continuous effects over time can lead to broader outcomes in terms of mental health, reduction of occupational burnout, and either decline or improvement in organizational performance. In this regard, integrating the theories of Attention Restoration, Stress Recovery, concepts of indoor environmental quality, and indicators of job satisfaction makes it possible to formulate an interdisciplinary analytical framework that can serve as a basis for decision-making in workplace design.

From a local and contextual perspective, the significance of this study is particularly pronounced in the Iranian context. Traditional and historical Iranian architecture encompasses rich patterns of interaction between humans, nature, climate, and environmental elements. However, these patterns have either been overlooked in contemporary office design or reproduced in symbolic and non-functional forms. Reinterpreting these indigenous capacities through the lens of contemporary Biophilic knowledge can contribute to the development of strategies that are both supported by credible scientific evidence and compatible with the cultural, climatic, and behavioral conditions of Iranian society.

1.4 | Research Objectives

The main objective of this article is to evaluate the impact of Biophilic design on the mental health of employees in office environments. This objective is pursued within an analytical and evidence-based framework in order to explain the relationship between environmental qualities and psychological outcomes in contemporary workplaces.

To achieve the main objective, the study pursues five specific objectives: 1) it aims to explain the theoretical foundations of Biophilic design and examine its relationship with contemporary approaches to office architecture in order to establish a conceptual basis for subsequent analyses, 2) it analyzes the physical, spatial,

and sensory elements that influence employees' mental health, with emphasis on factors such as lighting, views, materials, acoustics, and the presence of natural elements, 3) it critically reviews domestic and international literature and research on Biophilia and workplace environmental health in order to identify knowledge gaps and areas of theoretical and empirical convergence, 4) it identifies and categorizes the psychological, cognitive, behavioral, and organizational outcomes associated with exposure to Biophilic and non-Biophilic office environments, and 5) it seeks to derive design implications and strategies for developing sustainable, restorative, and evidence-based office environments capable of contributing effectively to the improvement of employees' mental health.

1.5 | Research Questions

The present study focuses on a set of central questions aimed at explaining the relationship between Biophilic design and mental health in office environments. The first question concerns how Biophilic design affects employees' mental health in office spaces, and through which perceptual, cognitive, and emotional mechanisms these effects occur.

The second question focuses on identifying and analyzing the influential elements of this approach; specifically, which Biophilic components have the strongest associations with stress reduction, attention restoration, increased job satisfaction, and improved employee productivity in workplace environments?

The third question addresses the comparative analysis of domestic and international research literature, examining the areas in which these two bodies of research demonstrate theoretical and empirical overlap and the areas in which they differ, remain heterogeneous, or reveal research gaps.

Finally, the fourth question focuses on the practical dimension of the study and examines how existing fragmented findings can be translated into a set of evidence-based architectural design strategies. These strategies should be applicable to the design and redesign of office environments based on health-oriented and restorative approaches.

2 | Theoretical Framework

2.1 | Biophilic Design Theory

Biophilic design theory emerged from the convergence of biology, environmental psychology, ecology, architecture, and cultural studies. The fundamental premise of this theory is that humans evolved within natural environments and that their perceptual, cognitive, and emotional systems continue to respond positively and meaningfully to natural cues—including daylight, temporal variations, organic textures, vegetation, water, and open views [1–4]. Accordingly, a complete separation of built environments from natural elements may lead to reduced sensory stimulation, lower environmental preference, and diminished psychological restoration capacity.

Within this framework, Kellert introduced Biophilic design as a response to the limitations of purely technical approaches to sustainability [3]. From his perspective, sustainable architecture should not be restricted to optimizing energy consumption and building-system efficiency; it should also restore meaningful human experiences of nature within the built environment. This perspective is particularly important in office environments, where the design of administrative buildings is largely based on economic criteria, spatial efficiency, functional flexibility, and cost control. At the same time, the psychological and perceptual quality experienced by users is often given secondary priority. In contrast, Biophilic design redefines these priorities by positioning mental health and human experience as integral components of architectural performance.

Browning et al. [21] classify Biophilic design patterns into three broad categories: “nature in the space,” “natural analogues,” and “nature of the space.” The first category includes the direct presence of natural elements within the built environment, such as daylight, plants, water, air movement, animals, and natural landscapes. The second refers to the use of materials, colors, patterns, and textures that directly or indirectly evoke nature. The third addresses spatial organizational characteristics such as refuge, prospect and

surveillance, controlled mystery, organized complexity, and spatial diversity [21], [22]. This framework is particularly significant for architecture because it translates abstract psychological concepts into principles that can be applied to spatial design.

However, it is important to emphasize that Biophilic theory should not be reduced to a checklist of isolated and simplified elements. The mere presence of a green wall, the use of wood, or the addition of several natural components does not, by itself, guarantee improved mental health. The actual effectiveness of these elements depends on factors such as scale, quality of implementation, maintenance, climatic compatibility, functional appropriateness, accessibility, and the way users perceive and experience the environment. From this perspective, Biophilic design in office environments should be understood and developed not as a fragmented decorative strategy, but as an integrated system based on relationships among its constituent elements.

2.2 | Evolution of Biophilic Architecture

Pre-modern architecture in many cultures implicitly incorporated Biophilic characteristics because buildings necessarily interacted directly with climate, daylight, wind, shade, water, local materials, and everyday patterns of life. In these architectural traditions, elements such as courtyards, gardens, iwans, arcades, terraces, and operable windows were used not merely as aesthetic devices, but also as means of regulating environmental conditions, organizing social relationships, and enhancing thermal and psychological comfort. This design logic can be observed in diverse forms within the architectural traditions of Iran, the Islamic world, the Mediterranean region, East Asia, and other indigenous cultures.

With the onset of industrialization and the expansion of mechanical technologies, a gradual separation between buildings and their climatic contexts emerged. The development of mechanical ventilation systems, artificial lighting, glass façades, and deep-plan layouts enabled the production of large-scale and standardized office environments. At the same time, however, this transformation reduced users' everyday contact with natural elements. In many twentieth-century office buildings, spatial efficiency, standardization, and cost control became dominant over the quality of sensory and psychological experience. This condition contributed to contemporary critiques of workplace environments and the emergence of Biophilic approaches in architecture.

In the contemporary period, Biophilic architecture has developed in conjunction with approaches such as health-oriented design, restorative design, evidence-based design, ecological architecture, and green building. Its primary distinction, however, lies in its emphasis on reconnecting human lived experience with nature. In office environments, this development has moved beyond symbolic interventions such as simply adding green elements. It has resulted in structural design strategies, including organizing floor plans around daylight, designing plant-filled atriums, creating semi-open and transitional spaces, incorporating green roofs, using natural materials, providing controlled views, developing psychological restoration spaces, employing mixed-mode ventilation, and shaping spatial patterns based on the concepts of refuge and prospect.

The introduction of digital tools and simulation technologies has also accompanied recent developments. The use of virtual reality and interactive modeling in evaluating the effects of Biophilic design has made it possible to control environmental and behavioral variables [6], [9]. Nevertheless, these tools cannot fully replace long-term lived experience within real environments. Therefore, the future of Biophilic research and design requires integration among laboratory studies, post-occupancy evaluations, and context-sensitive architectural design approaches.

2.3 | Environmental Psychology and Workplace Well-Being

Environmental psychology examines the effects of physical environments on human perception, emotion, cognition, behavior, and social interaction. In office environments, these effects are particularly significant because users are continuously and extensively exposed to relatively stable environmental conditions. Variables such as lighting, sound, temperature, spatial density, privacy, perceived personal control, visual

access, and material quality collectively shape a framework of psychological support or stress within the workplace.

Ulrich's Stress Recovery Theory emphasizes the rapid and involuntary human response to natural stimuli. According to this theory, exposure to non-threatening natural landscapes can reduce physiological arousal and regulate negative emotional responses [7], [23]. In office environments, such exposure can be achieved through various elements, including views of green spaces, indoor vegetation, daylight, warm and natural materials, or access to outdoor spaces for short periods. Although workplace environments differ from healthcare settings, the stress-reduction mechanisms associated with experiences of nature can be applied across both contexts.

In contrast, Kaplan's Attention Restoration Theory focuses on the concept of directed-attention fatigue [24], [25]. Office activities frequently require sustained concentration, distraction control, information processing, and continuous decision-making. Under such conditions, natural environments can provide a form of soft fascination, allowing attentional capacity to recover without imposing additional cognitive demands. This mechanism is particularly important for the design of rest areas, internal circulation routes, natural views, and pause spaces within office environments.

Workplace well-being is a multidimensional concept that extends beyond the absence of illness or disorder and includes psychological energy, emotional balance, job satisfaction, perceived meaning, psychological safety, and a sense of environmental support. Through sensory diversity, improved environmental perception, increased contact with nature, and reinforcement of organizational signals of care, Biophilic design can contribute significantly to these dimensions. However, achieving workplace well-being requires the integration of Biophilia with indoor environmental quality factors, including adequate ventilation, favorable acoustic conditions, thermal control, and ergonomic principles [26–28].

2.4 | Human–Nature Relationship in Architectural Design

The relationship between humans and nature in architecture is multidimensional and systematic. At the sensory level, humans directly respond to stimuli such as light, color, sound, smell, air movement, temperature variations, texture, vegetation, and water. At the cognitive level, natural patterns can contribute to the perception of order, spatial legibility, organized complexity, and meaning-making. At the emotional level, exposure to nature can enhance feelings of calmness, vitality, security, motivation, and place attachment. At the cultural level, natural elements carry collective memory, identity, spirituality, and place-based narratives.

Iranian architecture represents a prominent example of this multilayered relationship between humans and nature. The Persian garden, with its geometrically organized spatial structure, water axis, purposeful shading, structured planting, integration of sound and water movement, and careful control of light and views, simultaneously creates a climatic system and a profound psychological–perceptual experience. Similarly, the central courtyard in traditional Iranian houses provides daylight, ventilation, privacy, security, and a controlled connection to the sky, creating a balance between introversion and contact with nature. Iwans and semi-open spaces also function as transitional elements between interior and exterior, shade and light, stillness and movement, and individuality and collectivity.

Applying these principles to contemporary office architecture does not mean formally reproducing historical elements; rather, it requires extracting their spatial and functional logic. Within this framework, the courtyard can be transformed into an atrium or central green core within an office building; the iwan can be reinterpreted as shaded terraces or semi-open workspaces; water can be incorporated through controlled, low-consumption, climate-responsive approaches in acoustic, reflective, or symbolic forms; and local materials can contribute to strengthening a sense of place, reducing perceptual stress, and enhancing the quality of environmental experience.

3 | Literature Review

3.1 | International Studies

International studies related to Biophilia and mental health have developed along several major lines of inquiry. The first line can be traced to classical research on the role of visual exposure to nature in psychological restoration. Ulrich's [29] seminal study demonstrated that even viewing a natural scene through a window can have more positive effects on health indicators and recovery than viewing non-natural surfaces such as a wall. Subsequent studies by Ulrich et al. [7] further emphasized that exposure to natural landscapes, compared with urban scenes, can be more effective in reducing stress and promoting psychological recovery. Although these studies were primarily conducted in healthcare and controlled settings, they provided an important theoretical basis for transferring these concepts to workplace environments.

The second line of research concerns Kaplan and Kaplan [24], [25] Attention Restoration Theory and environmental preference theory. According to this theory, natural environments have a greater capacity to restore attentional resources due to characteristics such as soft fascination, a sense of being away, extent, and compatibility. Subsequent studies examining exposure to images of nature, walking in natural environments, and the use of natural visual stimuli have shown that such experiences can improve attentional performance, mood regulation, and cognitive functioning [30–32]. These findings are particularly relevant to office environments, where employees are frequently exposed to cognitive fatigue resulting from focused and screen-based tasks.

The third line of research focuses on the role of plants and living elements in indoor and office environments. Lohr and colleagues demonstrated that the presence of plants in windowless environments can reduce stress and improve certain performance indicators [33]. Similarly, Nieuwenhuis et al. [8], through a series of field studies, reported that “green” offices, compared with offices lacking natural elements, can improve perceptions of air quality, increase concentration, enhance job satisfaction, and improve employees' perceptual performance. These findings challenge the prevailing assumption that minimalist environments devoid of natural elements are necessarily more efficient.

The fourth line of research concerns indoor environmental quality and its relationship with employee health. Boubekri et al. [34] found that greater access to daylight is associated with better sleep quality and improved well-being indicators in the workplace. Similarly, Allen et al. [27] confirmed associations between indoor air quality, carbon dioxide levels, volatile organic compounds, and employees' cognitive performance. These findings indicate that Biophilic design is most effective when integrated with principles of environmental comfort and building engineering, since an aesthetically pleasing environment with inadequate air quality or excessive glare cannot provide sustained well-being.

In recent years, virtual reality studies and systematic reviews have also contributed to this field. Research by Yin et al. [6], [9] indicates that simulated Biophilic environments can play an effective role in reducing stress and anxiety. Systematic reviews have likewise generally supported the positive effects of natural elements on indicators such as stress, job satisfaction, motivation, and cognitive performance, while emphasizing methodological heterogeneity, differences in assessment instruments, and the need for longitudinal studies [11–13].

Iranian research on Biophilic design has grown considerably in recent years. However, much of it has focused on healthcare, educational, and residential environments, while empirical studies specifically addressing office environments remain limited. In this context, Mousavi et al. [15], in a study of healthcare environments in Mashhad, found that direct experiences of nature in indoor spaces had the greatest impact on the psychological dimension of health, followed by indirect experiences of nature and spatial–environmental qualities. Although this research was conducted in a healthcare context, its modeling of the relationship between environmental components and mental health is also relevant to office environments.

Samavati et al. [16] addressed office–commercial environments more specifically by examining the effects of Biophilic design strategies on improving employees' mental health. Their findings emphasized the role of natural daylight, nature-inspired sounds, color, texture, and organic forms in reducing stress and increasing concentration, although their methodological framework was primarily descriptive–analytical.

In another study, Azimi et al. [17] compared an office designed according to an Iranian garden-oriented approach with a contemporary design studio. They analyzed the effects of Biophilia and spatial quality on employees' mental health and performance. The significance of this study lies in establishing a comparative connection between domestic and international examples and emphasizing the role of spatial experience in improving organizational performance.

Tandro Saleh et al. [18], in a study conducted in Shiraz, also demonstrated that factors such as prospect and refuge, the presence of water, and non-rhythmic sensory stimuli play an important role in reducing stress. Although this study was conducted in a residential context, its findings are applicable to office design, particularly in relation to the Iranian tradition of gardens and courtyards. Arghiani et al. [19], in the context of educational environments, likewise demonstrated that daylight, vegetation, views of nature, and the ecological quality of the environment are key factors in reducing stress.

A comparison of international and Iranian studies indicates that both bodies of research emphasize the significant role of nature in reducing stress, improving mood, and enhancing mental health. Common elements such as daylight, plants, views of nature, water features, natural materials, and spatial quality have been identified as key factors in both bodies of literature. This convergence suggests the existence of certain fundamental and relatively universal needs in human environmental experience.

Nevertheless, significant differences can also be observed. International literature is richer and more systematically structured in terms of methodological diversity, including laboratory studies, field studies, controlled experiments, virtual reality studies, and systematic reviews [5], [6], [8–14]. In contrast, Iranian literature relies predominantly on descriptive studies, conceptual analyses, and case studies with limited scope, particularly in non-office contexts [15–20]. This situation indicates the need to expand empirical research, post-occupancy evaluations, and standardized psychological assessments in Iranian office environments.

At the same time, one of the strengths of Iranian literature is its attention to cultural and climatic context. In this context, nature is not viewed merely as a biological stimulus but is also associated with concepts such as gardens, water, shade, privacy, local materials, collective memory, and spirituality. Therefore, Biophilic design in the Iranian context requires adaptation to climatic constraints, particularly water scarcity, hot-arid or cold climates, patterns of spatial privacy, and maintenance conditions.

3.2 | Research Gaps

A review of the existing literature reveals several major research gaps: 1) there is a lack of longitudinal studies examining the sustained effects of Biophilic design in office environments. Although employees' mental health is shaped by continuous and repeated exposure to the environment, rather than merely by short-term contact, long-term evidence remains limited; 2) uncertainty remains regarding the relationship between the quantity and quality of Biophilic interventions. In other words, it is still unclear what amount and type of natural elements—such as daylight, vegetation, water, and natural materials—are optimal for different types of office activities; 3) the interaction among environmental components has received comparatively limited attention. For example, daylight, in the absence of adequate glare or solar heat-gain control, may shift from being a restorative factor to becoming a source of environmental stress, and 4) empirical research conducted in actual Iranian offices and organizational settings remains very limited. There is therefore a need for mixed-method, data-driven approaches that simultaneously measure environmental conditions and psychological outcomes.

Table 1. Summary of major international and Iranian studies on Biophilic design and mental health.

Study	Context	Method	Biophilic Focus	Key Findings Related to Mental Health
Ulrich et al. [7], [29]	Healthcare and environmental exposure	Comparative study and psychophysiological experiments	Natural views and landscapes	Exposure to natural landscapes facilitated stress recovery, reduced negative emotions, and improved physiological responses.
Kaplan and Kaplan [24], [25]	Environmental psychology	Theoretical framework and empirical evidence	Restorative natural environments	Nature restores directed attention through soft fascination, psychological distance, and perceptual extent.
Lohr et al. [33]	Windowless indoor environment	Controlled experiment	Indoor plants	The presence of plants reduced stress and improved several functional and perceptual indicators.
Nieuwenhuis et al. [8]	Office environments	Three field studies	Green office versus minimalist office	Offices incorporating natural elements improved perceived air quality, concentration, job satisfaction, and productivity.
Boubekri et al. [34]	Office workers	Case-control study	Daylight and windows	Greater exposure to natural light was associated with improved sleep quality and quality of life.
Yin et al. [6], [9]	Simulated office environment	Virtual reality experiment	Indoor Biophilic environments	Reduced stress and anxiety and improvements in some cognitive functions were reported.
Lei et al. [10]	Indoor work environments	Quantitative study	Amount and arrangement of greenery	Greenery had significant effects on physiological, psychological, and functional indicators.
Ríos-Rodríguez et al. [11]	Office environments	Systematic review	Natural elements and stress response	Overall evidence supports the positive effects of nature on stress reduction, although substantial methodological heterogeneity exists.
Mousavi et al. [15]	Healthcare environment (Mashhad)	Survey, factor analysis, and modeling	Direct and indirect experiences of nature	Direct experience of nature showed the strongest association with improvement in the psychological dimension of health.
Samavati et al. [16]	Office-commercial complex	Descriptive-analytical	Light, sound, color, texture, and natural forms	Reduced stress, increased concentration, and improved work performance were reported.
Azimi et al. [17]	Office environment (comparative study)	Comparative-descriptive	Biophilia and spatial vitality	A positive relationship was observed between Biophilic design, mental health, and organizational performance.
Tandro Saleh et al. [18]	Residential environment (Shiraz)	Mixed-method and statistical analysis	Prospect-refuge, water, and sensory stimuli	Prospect-refuge, water, and non-rhythmic sensory stimuli were effective in reducing stress.
Arghiani et al. [19]	Educational environment	Delphi and AHP	Daylight, plants, natural views, and ecosystem	Natural daylight was identified as the most important factor in reducing stress.

4 | Research Methodology

4.1 | Research Design

This article employs an integrative review and critical analysis approach. This methodology is appropriate because the subject of Biophilic design lies at the intersection of several interdisciplinary fields, including architecture, environmental psychology, interior design, building sciences, sustainability, and organizational studies. Accordingly, the aim of the study is not to conduct a statistical meta-analysis, but rather to synthesize, interpret, and critically re-examine the existing evidence and derive design implications for office environments.

Accordingly, various types of sources, including theoretical studies, empirical research, systematic reviews, case studies, Iranian studies, and specialized reports, were examined and analyzed simultaneously. The findings were then categorized and interpreted according to four main dimensions: design elements, psychological mechanisms, workplace outcomes, and contextual variables.

4.2 | Data Collection Method

Data were collected through a systematic review of scientific literature in both Persian and English. English-language sources included reference books, articles published in reputable scientific journals, empirical

studies, systematic reviews, and specialized reports addressing Biophilia, restorative environments, indoor environmental quality, and workplace environments.

Persian-language sources were also collected from reputable academic databases and university journal websites. The keywords used in the search included “Biophilic design,” “Biophilic architecture,” “mental health,” “office space,” “stress reduction,” “environmental psychology,” “natural daylight,” and “indoor plants,” along with their English equivalents.

Studies were included in the review if they met at least one of the following criteria:

- I. Providing theoretical foundations for Biophilic design or restorative environments.
- II. Examining Biophilic elements in office or workplace environments.
- III. Analyzing the relationship between indoor environmental quality and mental health indicators.
- IV. Focusing on outcomes such as stress, attention, job satisfaction, performance, or productivity.
- V. Providing perspectives related to the Iranian cultural context concerning nature and architecture.

In contrast, sources lacking scientific support, unrelated to architecture, or lacking a focus on mental health outcomes were excluded from the review process.

4.3 | Analytical Framework

The analytical framework of this study is based on four main dimensions:

- I. Architectural and environmental elements: including natural light, plants, water, natural materials, views and landscapes, ventilation, spatial quality, refuge, prospect, and sensory diversity.
- II. Psychological processes: including attention restoration, stress reduction, mood regulation, perceived control, place attachment, and environmental preference.
- III. Organizational and occupational outcomes: including mental health, job satisfaction, concentration, performance, productivity, and reduced absenteeism.
- IV. Contextual variables: including culture, climate, maintenance conditions, organizational structure, type of work activity, and user expectations.

4.4 | Reliability and Validity

The reliability of the research was enhanced through comparison and overlap of findings across multiple sources and by examining the reproducibility of observed patterns across different studies. Interpretive validity was also maintained by distinguishing between strong empirical evidence, supportive evidence, and contextual inferences.

The study avoids reductionist interpretations of the findings and emphasizes that no Biophilic component independently and automatically leads to improved mental health. Rather, design quality, integration among elements, and user experience play decisive roles.

5 | Findings and Discussion

5.1 | Biophilic Design Elements in Office Environments

The findings from the literature review indicate that Biophilic design in office environments should be understood as an integrated system of physical, sensory, and perceptual elements, rather than as a collection of isolated components. Natural light, indoor plants, natural views, natural materials, water features, natural or mixed-mode ventilation, biomorphic forms, nature-derived colors, spatial quality, and environmental comfort all contribute to shaping the user experience; however, their effectiveness is maximized when they are coherently integrated into the spatial structure.

Natural light is one of the most fundamental components of Biophilic design in the workplace. Daylight is not merely a source of illumination; it plays an essential role in regulating circadian rhythms, sleep quality, mood, alertness, and the perception of time [34]. In office design, equitable access to natural light should be considered in the organization of the floor plan, as deep-plan layouts and spaces without direct daylight can disrupt users' connection with the natural environmental cycles. However, uncontrolled daylight can also result in glare, increased thermal loads, and visual fatigue. Therefore, the use of shading devices, appropriate building orientation, suitable glazing, controlled spatial depth, and careful placement of workstations is essential.

Indoor plants are another key element of Biophilic design. Research indicates that the presence of plants can improve perceived air quality, job satisfaction, concentration, and mental health indicators [5], [8], [33], [35–37]. However, in office design, plants should not be reduced to merely decorative elements. They can also serve functional purposes, including defining spatial boundaries, moderating acoustic conditions, guiding circulation, creating restorative areas in rest zones, and reinforcing a sense of organizational care. In this regard, species selection, maintenance requirements, lighting conditions, and allergy-related considerations are among the factors determining the success of the design.

Natural materials also play an important role in enhancing the perceived quality of the environment. The use of materials such as wood, brick, stone, earth, natural fibers, and organic textures can reinforce feelings of warmth, calmness, tactile engagement, and place attachment [38–41]. In the context of Iranian architecture, these materials have considerable potential for establishing a connection between Biophilic design and local architectural identity. Water, despite its historical and cultural significance in Iranian architecture, should be incorporated into contemporary office environments through a cautious and sustainable approach. Water scarcity, hygiene considerations, and maintenance requirements necessitate controlled and low-consumption applications, such as atriums, semi-open spaces, or reflective surfaces, so that water contributes primarily to users' perceptual and psychological experience rather than excessive physical consumption.

Table 2. Comparison of Biophilic design elements, architectural applications, and psychological outcomes.

Biophilic Element	Architectural Application in Office Environments	Psychological and Functional Outcomes
Natural light	Optimal plan orientation, atriums, controlled windows, shading devices, light shelves, and daylight-accessible courtyards	Improved mood, circadian rhythm regulation, increased alertness, enhanced visual comfort, greater vitality, and reduced mental fatigue
Indoor plants	Potted plants, green walls, indoor gardens, plant partitions, green resting areas, and atrium planting	Reduced stress, increased job satisfaction, improved concentration, enhanced perceived air quality, and increased environmental preference
Views of nature	Windows overlooking trees, sky, mountains, water, internal courtyards, green roofs, or terraces	Attention restoration, reduced cognitive fatigue, short-term mental escape, and increased environmental satisfaction
Natural materials	Wood, brick, stone, earth, natural fibers, warm textures, and tactile surfaces	Enhanced sense of warmth and place attachment, reduced perception of sterile environments, and decreased perceptual stress
Water	Central pools, reflective surfaces, controlled water features, and visual or auditory access to water	Promotion of relaxation, sensory soft fascination, reduced tension, cultural associations, and restorative effects when appropriately designed and maintained
Ventilation and airflow	Operable windows, mixed-mode ventilation, central courtyards, contemporary windcatchers, and adaptive ventilation strategies	Increased perceived control, environmental freshness, reduced sense of enclosure, improved thermal comfort, and stronger connection with climate
Natural forms and patterns	Curved lines, fractal geometry, organic patterns, natural colors, and non-industrial surfaces	Reduced visual monotony, increased environmental preference, stimulation of soft fascination, and enhanced emotional comfort
Prospect and refuge	Semi-enclosed spaces, focus pods, quiet corners, controlled transparency, and extended visual depth	Increased sense of security, environmental control, support for personal privacy, reduced overstimulation, and improved concentration
Sensory diversity	Filtered light, gentle natural sounds, textural variation, seasonal changes, and non-rhythmic stimuli	Reduced sensory fatigue, increased vitality, short-term restoration, and enriched environmental experience
Integrated environmental comfort	Thermal control, acoustics, air quality, humidity, lighting, and ergonomics integrated with natural elements	Enhanced long-term health, increased job satisfaction, improved productivity, reduced environmental complaints, and increased perception of organizational support.

5.2 | Effects on Stress Reduction

Stress reduction is one of the most consistently emphasized outcomes in the Biophilic design literature. Occupational stress generally arises from the interaction of factors such as workload, time constraints, social interactions, spatial density, noise pollution, lack of environmental control, and poor indoor environmental quality. Although architecture cannot eliminate organizational sources of stress, it can reduce the perceived intensity of these stressors and provide opportunities for psychological restoration.

According to Stress Recovery Theory, exposure to non-threatening natural elements can activate positive emotions, reduce physiological arousal, and redirect attention away from stressful stimuli [7], [29]. In office environments, this process often occurs through small, repeated experiences, such as briefly looking at a natural view, being near plants, hearing the sound of water, touching natural materials, or pausing in semi-green spaces. The benefits of these brief encounters are strengthened when they are readily accessible and integrated into the natural flow of daily activities.

Field studies on office vegetation, including the research conducted by Nieuwenhuis et al. [8], indicate that enriching workplace environments with natural elements can reduce perceptions of environmental stress while increasing satisfaction and concentration. Iranian studies have likewise emphasized the roles of refuge, water, and daylight in reducing stress [16–19]. However, a critical point is that Biophilic benefits do not result merely from adding natural elements. When deficiencies in indoor environmental quality—such as excessive noise, inappropriate temperatures, or high spatial density—are present, these benefits are weakened. Therefore, Biophilic design should be considered simultaneously with improvements in indoor environmental quality and organizational conditions.

5.3 | Effects on Mental Health

Mental health in office environments is a multidimensional concept encompassing emotional calmness, mood stability, vitality, environmental satisfaction, perceived control, psychological safety, and perceptions of organizational support. Biophilic design can contribute to these dimensions through several simultaneous mechanisms: the direct effects of natural elements on mood regulation, opportunities for short-term restoration, reinforcement of place attachment, and the symbolic message that the organization values employees' quality of experience.

In monotonous and entirely artificial office environments, the workplace is often perceived merely as a functional setting for work. In contrast, the presence of daylight, healthy plants, warm materials, opportunities to pause, and sensory diversity can make the work experience more humane and meaningful. This interpretation is consistent with findings from enriched environments, which suggest that spaces characterized by greater sensory diversity and higher environmental quality tend to produce more favorable well-being and performance outcomes than minimalist and impoverished spaces [8], [36].

Nevertheless, mental health also requires the principle of environmental choice. Evidence indicates that individuals respond differently to levels of light, sound, and spatial density. Some users experience anxiety in open and highly stimulating environments, whereas others are sensitive to low-stimulation settings. Therefore, effective Biophilic design should provide a range of environments—including bright and semi-bright areas, open and semi-enclosed spaces, highly vegetated zones, low-stimulation areas, and individual as well as collective settings—allowing users to regulate their environmental experience according to their needs.

5.4 | Effects on Cognitive Performance

Cognitive performance in office environments includes sustained attention, working memory, decision-making, creativity, problem-solving, and the reduction of perceptual errors. Biophilic design influences these functions through three principal pathways: attention restoration, stress reduction, and improvements in indoor environmental quality.

Studies associated with Attention Restoration Theory indicate that exposure to nature can replenish directed attentional capacity [24], [25], [30–32], [42], [43]. It is particularly important in information-intensive workplaces, where sustained cognitive effort rapidly leads to mental fatigue. Elements such as indoor plants and natural views can provide brief but restorative cognitive pauses. Unlike highly distracting stimuli, the soft fascination associated with nature does not completely interrupt work processes; rather, it enables mental recovery without requiring a full cessation of activity.

However, design should also account for the task-oriented nature of office environments. Spaces intended for concentrated work should provide appropriate lighting control, favorable acoustic conditions, and minimal distracting stimuli, whereas creative spaces may benefit from greater sensory diversity.

Furthermore, indoor environmental quality is a fundamental prerequisite for cognitive performance. Research by Allen et al. [27] indicates that ventilation, air quality, and indoor pollutants are directly related to employees' cognitive functioning. Consequently, Biophilic elements can produce positive outcomes only when they are incorporated into environments that also provide adequate ventilation, appropriate lighting, acoustic comfort, and thermal comfort.

5.5 | Effects on Employee Satisfaction

Workplace satisfaction is influenced by factors such as environmental aesthetics, comfort, efficiency, place identity, controllability, and the quality of social interactions. Biophilic design can enhance job satisfaction by reducing spatial monotony, increasing perceived warmth, and improving sensory quality.

Research by Nieuwenhuis et al. [8] demonstrated that enriching office environments with natural elements increases user satisfaction. Similarly, the use of natural materials such as wood and stone has been associated with greater perceptions of warmth and environmental comfort [38–41].

The importance of workplace satisfaction has become even more pronounced in the context of hybrid work. Employees are more likely to choose to work in the office when the workplace offers experiential and social value beyond its purely functional role. Indoor greenery, terraces, atriums, daylight, and high-quality sensory experiences can provide this added value.

At the same time, satisfaction depends on the authenticity of design. Users can readily distinguish between genuine environmental quality and superficial decorative interventions. Poorly maintained Biophilic elements—such as wilted plants, unhygienic water features, or inappropriate lighting—may even produce negative effects. Therefore, operation and maintenance are integral components of successful Biophilic design.

5.6 | Effects on Workplace Productivity

The relationship between Biophilic design and productivity should be interpreted cautiously. Productivity is a multidimensional concept and, depending on the nature of work, may be assessed using different indicators such as task performance, self-reported productivity, absenteeism, or organizational output. Consequently, directly attributing increases in productivity to Biophilic design would oversimplify this relationship.

Nevertheless, the pathways through which Biophilic design may influence productivity are relatively well established. Reduced stress, restored attention, increased satisfaction, and improved indoor environmental quality can create conditions that support sustained productivity [8], [10], [26–28]. In this context, sustainable productivity does not imply increasing work pressure; rather, it refers to maintaining performance while supporting mental health and reducing occupational burnout.

Moreover, Biophilic design may generate broader organizational benefits, including improved employee attraction and retention, enhancement of organizational brand image, and strengthening of workplace culture. However, longitudinal studies and real-world organizational data are still required to establish these effects with greater precision.

- I. Elements of Biophilic design: including natural light, the presence of greenery, water, use of natural materials, access to natural views, and open spaces.
- II. Environmental quality and experience: based on environmental structure, diversity and variety, sensory experience, sense of belonging and control over space.
- III. Psychological well-being and stress reduction: increased capacity for attention, emotional regulation, reduced mental fatigue, and reduced perceived stress.
- IV. Mental health and occupational satisfaction: increased vitality, positive emotions, job satisfaction, and perceived organizational support.
- V. Improved productivity and organizational performance: increased cognitive performance, increased work engagement, reduced absenteeism, and improved job performance.

6 | Design Strategies for Biophilic Offices

The design of Biophilic offices should begin at the early stages of spatial planning and be integrated as a holistic approach throughout the entire design process. The first strategy is daylight-based planning. In this approach, factors such as plan depth, building orientation, organization of workspaces, atrium and courtyard design, the placement of openings, and shading systems should be configured to ensure that high-quality natural light is provided equitably to users. In this regard, light quality, rather than merely its intensity, is of fundamental importance, as glare control, the reduction of excessive light contrasts, and the prevention of increased thermal loads are essential conditions for visual comfort.

The second strategy is the systematic integration of plants into the spatial organization. Plants should constitute part of the functional structure of the space rather than serving merely as decorative elements. Their placement along circulation paths, in pause areas, meeting rooms, window edges, relaxation spaces, and atriums can fulfill multiple functions, including defining spatial boundaries, moderating acoustic conditions, guiding movement, and creating restorative environments. Achieving this objective requires collaboration among the architect, landscape designer, building services engineer, and facility management team.

The third strategy is the creation of a spatial spectrum between openness and refuge. Completely open-plan offices may lead to increased perceptual pressure and reduced concentration, while excessively enclosed spaces can limit social interaction and organizational vitality. Therefore, the design should incorporate a diverse range of spaces, including collaborative work areas, focus rooms, semi-enclosed spaces, terraces, green relaxation areas, and short-term recovery rooms. This diversity enables users to exercise environmental self-regulation and is consistent with the principles of environmental psychology.

The fourth strategy is the use of natural and locally sourced materials. In the Iranian context, the use of materials such as brick, wood, stone, plaster, and tile can not only enhance Biophilic quality but also strengthen the sense of place and cultural continuity. However, material selection should be based on criteria such as durability, maintainability, thermal performance, and acoustic performance so that materials move beyond a merely symbolic role and contribute to the actual environmental performance of the workplace.

7 | Conclusion

This study aimed to investigate the impact of Biophilic design on employees' mental health in office environments by examining an interdisciplinary framework linking architecture, environmental psychology, and organizational studies. The findings derived from the integrative review and critical analysis indicate that Biophilic design is not merely an aesthetic or decorative approach; rather, it can function as an evidence-based environmental-psychological strategy capable of contributing to improved work experience, reduced stress, and enhanced organizational performance.

The results demonstrate that physical elements such as natural light, indoor plants, water, natural materials, open views, and refuge spaces have the greatest impact when designed as an integrated system, rather than as

isolated and decorative components. Natural light, as one of the most fundamental factors, plays an important role in regulating circadian rhythms, improving mood, and reducing mental fatigue. Alongside natural light, plants and other natural elements contribute to stress reduction and increased satisfaction by enriching sensory experience and enhancing the perceived quality of the environment. Similarly, natural materials and semi-enclosed spaces can humanize and strengthen the sustainability of the workplace experience by fostering a sense of belonging and perceived security.

From the perspective of environmental psychology, the findings indicate that the key mechanisms through which Biophilic design produces its effects include attention restoration, stress reduction, mood regulation, and increased perceived environmental control. These mechanisms influence employees' mental health both directly and indirectly and ultimately contribute to greater job satisfaction and an improved quality of work experience.

However, the study emphasizes that these effects are conditional upon design quality, appropriate maintenance, and integration with indoor environmental conditions. At the organizational level, Biophilic design can contribute to improved sustainable performance, increased productivity, reduced absenteeism, and the enhancement of organizational culture. Nevertheless, productivity in this framework should not be understood merely as an increase in output, but rather as the maintenance of performance while reducing burnout and promoting mental health. Therefore, the relationship between Biophilia and productivity is neither linear nor simple; instead, it is shaped through a chain of mediating variables, including environmental experience, psychological restoration, and job satisfaction.

A comparison of international and Iranian studies indicates that, although both bodies of research recognize the importance of nature in promoting mental health, differences exist in methodology and empirical depth. International studies tend to rely more heavily on empirical evidence, field experiments, and measurement models. In contrast, Iranian research, in addition to confirming general principles, offers valuable potential for connecting Biophilic design with cultural concepts such as the garden, courtyard, iwan, and local materials. It suggests that cultural context can play a decisive role in determining how Biophilic design is realized in office architecture.

Ultimately, the findings indicate that the success of Biophilic design depends on a systems-based perspective, quality of implementation, and attention to contextual conditions. Natural elements can generate sustained positive effects only when integrated with indoor environmental quality, thermal comfort, acoustic control, and effective facility management. Furthermore, the design of future offices should be based on spatial diversity, user choice, and opportunities for environmental self-regulation in order to respond to the diverse psychological and cognitive needs of employees.

Overall, this study concludes that Biophilic design in office environments can be employed as an effective strategy for promoting mental health, improving the quality of work experience, and enhancing the sustainability of organizational performance, provided that it moves beyond superficial and decorative interventions and develops into an integrated, evidence-based, and culturally responsive design approach.

Authors' Contributions

All aspects of the research and manuscript preparation were carried out by the author. The author has read and approved the final version of the manuscript.

Funding

Not applicable.

Data Availability

All data supporting the reported findings in this research paper are provided within the manuscript.

Conflict of Interest

The author declares that they do not have any conflict of interest.

Consent for Publication

The author confirms consent for the publication of this work.

Ethics Approval and Consent to Participate

This article does not contain any studies with human participants performed by the author.

References

- [1] Wilson, E. O. (1984). *Biophilia*. Harvard University Press.
<https://www.hup.harvard.edu/books/9780674074422>
- [2] Kellert, S. R., & Wilson, E. O. (1995). *The biophilia hypothesis*. Island Press.
<https://islandpress.org/books/building-life>
- [3] Kellert, S. R. (2012). *Building for life: Designing and understanding the human-nature connection*. Island Press.
<https://www.amazon.com/Building-Life-Understanding-Human-Nature-Connection/dp/1559637218>
- [4] Kellert, S. R., Heerwagen, J., & Mador, M. (2011). *Biophilic design: The theory, science and practice of bringing buildings to life*. John Wiley & Sons. <https://www.amazon.com/Biophilic-Design-Practice-Bringing-Buildings/dp/0470163348>
- [5] Hähn, N., Essah, E., & Blanus, T. (2021). Biophilic design and office planting: A case study of effects on perceived health, well-being and performance metrics in the workplace. *Intelligent buildings international*, 13(4), 241–260. <https://doi.org/10.1080/17508975.2020.1732859>
- [6] Yin, J., Yuan, J., Arfaei, N., Catalano, P. J., Allen, J. G., & Spengler, J. D. (2020). Effects of Biophilic indoor environment on stress and anxiety recovery: A between-subjects experiment in virtual reality. *Environment international*, 136, 105427. <https://doi.org/10.1016/j.envint.2019.105427>
- [7] Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology*, 11(3), 201–230. [https://doi.org/10.1016/S0272-4944\(05\)80184-7](https://doi.org/10.1016/S0272-4944(05)80184-7)
- [8] Nieuwenhuis, M., Knight, C., Postmes, T., & Haslam, S. A. (2014). The relative benefits of green versus lean office space: Three field experiments. *Journal of experimental psychology: Applied*, 20(3), 199. <https://psycnet.apa.org/doi/10.1037/xap0000024>
- [9] Yin, J., Arfaei, N., MacNaughton, P., Catalano, P. J., Allen, J. G., & Spengler, J. D. (2019). Effects of Biophilic interventions in office on stress reaction and cognitive function: A randomized crossover study in virtual reality. *Indoor air*, 29(6), 1028–1039. <https://doi.org/10.1111/ina.12593>
- [10] Lei, Q., Yuan, C., & Lau, S. S. Y. (2021). A quantitative study for indoor workplace Biophilic design to improve health and productivity performance. *Journal of cleaner production*, 324, 129168. <https://doi.org/10.1016/j.jclepro.2021.129168>
- [11] Ríos-Rodríguez, M. L., Testa Moreno, M., & Moreno-Jiménez, P. (2023). Nature in the office: A systematic review of nature elements and their effects on worker stress response. *Healthcare*, 11(21), 2838. <https://doi.org/10.3390/healthcare11212838>
- [12] Gonçalves, G., Sousa, C., Fernandes, M. J., Almeida, N., & Sousa, A. (2023). Restorative effects of Biophilic workplace and nature exposure during working time: A systematic review. *International journal of environmental research and public health*, 20(21), 6986. <https://doi.org/10.3390/ijerph20216986>
- [13] Yildirim, M., Gocer, O., Globa, A., & Brambilla, A. (2023). Investigating restorative effects of Biophilic design in workplaces: A systematic review. *Intelligent buildings international*, 15(5), 205–247. <https://doi.org/10.1080/17508975.2024.2306273>
- [14] Alipour, L., & Khoramian, M. (2024). Investigating the impact of Biophilic design on employee performance and well-being by designing a research instrument. *Kybernetes*, 53(11), 4431–4447. <https://doi.org/10.1108/K-08-2022-1134>

- [15] Mousavi, S. M., Mirzaei, R., Heidari, A., & Asadi, S. N. (2023). Investigating the effect of Biophilic architecture on improving the mental health of patients in healthcare environments (Case study: Farabi, 17 Shahrivar, and Omid hospitals in Mashhad). *Haft hesar environmental studies*, 12(44), 5-22. (In Persian). <http://hafthesar.iauh.ac.ir/article-1-1924-fa.html>
- [16] Samavati, A. A., Zare, L., & Keyhani, R. (2024). Analysis of design issues in office-commercial complexes using a Biophilic architecture approach to improve employees' mental health. *International conference on architecture, urban planning, art, industrial design, construction, and wisdom-based technology*. Tehran, Iran. Civilica. (In Persian). <https://civilica.com/doc/2234448/>
- [17] Azimi, A., Soheili, J. D., & Behzadpour, M. (2023). The impact of Biophilic design and vitality on employees' mental health and work performance in office environments: A comparative case study of the bagh-e irani studio office and soar design studio office. *The 2nd international conference on architecture-city: From biobased architecture to the ideal city*. Qazvin, Iran. Civilica. (In Persian). <https://civilica.com/doc/1897637/>
- [18] Tandro Saleh, N., Hojjati, V., & Movahed, K. (2023). Identifying the influential components of Biophilic architecture in reducing stress among housewives in residential complexes: A case study of Shiraz. *Housing and rural environment*, 42(184), 75-88. (In Persian). <https://civilica.com/doc/1950788/>
- [19] Arghiani, M., Saffar, M., & Mahvash, M. (2023). Investigating the design of educational space with the approach of reducing stress using Biophilic design. *Technology of education journal (TEJ)*, 17(2), 449-468. (In Persian). <https://doi.org/10.22061/tej.2023.9338.2834>
- [20] Khosravi Loghab, F., & Mohammadi-Zadeh, M. (2025). The impact of Biophilic architecture on the mental health of residents. *The 26th national conference on civil engineering, architecture, and urban planning*. Shirvan, Iran. Civilica. (In Persian). <https://civilica.com/doc/2288031/>
- [21] Browning, W. D., Ryan, C. O., & Clancy, J. O. (2014). *14 patterns of Biophilic design: Improving health and well-being in the built environment*. Terrapin Bright Green. Official Report. <https://www.terrapinbrightgreen.com/reports/14-patterns/>
- [22] Ryan, C. O., Browning, W. D., Clancy, J. O., Andrews, S. L., & Kallianpurkar, N. B. (2014). Biophilic design patterns: Emerging nature-based parameters for health and well-being in the built environment. *ArchNet-IJAR: International journal of architectural research*, 8(2), 62. <https://doi.org/10.26687/archnet-ijar.v8i2.436>
- [23] Ulrich, R. (1984). View through a window may influence recovery. *Science*, 224(4647), 224-225. <https://doi.org/10.1126/science.6143402>
- [24] Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology*, 15(3), 169-182. [https://doi.org/10.1016/0272-4944\(95\)90001-2](https://doi.org/10.1016/0272-4944(95)90001-2)
- [25] Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge University Press. <https://dn760009.eu.archive.org/0/items/experienceofnatu00kapl/experienceofnatu00kapl.pdf>
- [26] Council., W. G. B. (2014). *Health, wellbeing and productivity in offices: The next chapter for green building*. <https://worldgbc.org/article/health-wellbeing-and-productivity-in-offices-the-next-chapter-for-green-building/>
- [27] Allen, J. G., MacNaughton, P., Satish, U., Santanam, S., Vallarino, J., & Spengler, J. D. (2016). Associations of cognitive function scores with carbon dioxide, ventilation, and volatile organic compound exposures in office workers: A controlled exposure study of green and conventional office environments. *Environmental health perspectives*, 124(6), 805-812. <http://dx.doi.org/10.1289/ehp.1510037>
- [28] Al Horr, Y., Arif, M., Kaushik, A., Mazroei, A., Katafygiotou, M., & Elsarrag, E. (2016). Occupant productivity and office indoor environment quality: A review of the literature. *Building and environment*, 105, 369-389. <https://doi.org/10.1016/j.buildenv.2016.06.001>
- [29] Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*, 224(4647), 420-421. <https://doi.org/10.1126/science.6143402>
- [30] Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of environmental psychology*, 25(3), 249-259. <https://doi.org/10.1016/j.jenvp.2005.07.001>
- [31] Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological science*, 19(12), 1207-1212. <https://doi.org/10.1111/j.1467-9280.2008.02225.x>

- [32] Tennessen, C. M., & Cimprich, B. (1995). Views to nature: Effects on attention. *Journal of environmental psychology*, 15(1), 77–85. [https://doi.org/10.1016/0272-4944\(95\)90016-0](https://doi.org/10.1016/0272-4944(95)90016-0)
- [33] Lohr, V. I., Pearson-Mims, C. H., & Goodwin, G. K. (1996). Interior plants may improve worker productivity and reduce stress in a windowless environment. *Journal of environmental horticulture*, 14(2), 97–100. <https://doi.org/10.24266/0738-2898-14.2.97>
- [34] Boubekri, M., Cheung, I. N., Reid, K. J., Wang, C. H., & Zee, P. C. (2014). Impact of windows and daylight exposure on overall health and sleep quality of office workers: A case-control pilot study. *Journal of clinical sleep medicine*, 10(6), 603–611. <https://doi.org/10.5664/jcsm.3780>
- [35] Bringslimark, T., Hartig, T., & Patil, G. G. (2009). The psychological benefits of indoor plants: A critical review of the experimental literature. *Journal of environmental psychology*, 29(4), 422–433. <https://doi.org/10.1016/j.jenvp.2009.05.001>
- [36] Knight, C., & Haslam, S. A. (2010). The relative merits of lean, enriched, and empowered offices: An experimental examination of the impact of workspace management strategies on well-being and productivity. *Journal of experimental psychology: Applied*, 16(2), 158. <https://psycnet.apa.org/doi/10.1037/a0019292>
- [37] Raanaas, R. K., Evensen, K. H., Rich, D., Sjøstrøm, G., & Patil, G. (2011). Benefits of indoor plants on attention capacity in an office setting. *Journal of environmental psychology*, 31(1), 99–105. <https://doi.org/10.1016/j.jenvp.2010.11.005>
- [38] Burnard, M. D., & Kutnar, A. (2015). Wood and human stress in the built indoor environment: A review. *Wood science and technology*, 49(5), 969–986. <https://doi.org/10.1007/s00226-015-0747-3>
- [39] Fell, D. R. (2010). *Wood in the human environment: Restorative properties of wood in the built indoor environment* [Thesis]. <https://dx.doi.org/10.14288/1.0071305>
- [40] Watchman, M., Potvin, A., & Demers, C. M. H. (2017). A post-occupancy evaluation of the influence of wood on environmental comfort. *BioResources*, 12(4), 8704–8724. <https://doi.org/10.15376/biores.12.4.8704-8724>
- [41] Lipovac, D., & Burnard, M. D. (2021). Effects of visual exposure to wood on human affective states, physiological arousal and cognitive performance: A systematic review of randomized trials. *Indoor and built environment*, 30(8), 1021–1041. <https://doi.org/10.1177/1420326X20927437>
- [42] Hartig, T., Mang, M., & Evans, G. W. (1991). Restorative effects of natural environment experiences. *Environment and behavior*, 23(1), 3–26. <https://doi.org/10.1177/0013916591231001>
- [43] Hartig, T., Korpela, K., Evans, G. W., & Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian housing and planning research*, 14(4), 175–194. <https://doi.org/10.1080/02815739708730435>