

Research Article

A Research on the Biophilic Concept upon School's Design from Hot Climate: A Case Study from Iraq

Amjad Almusaed ¹, Asaad Alasadi,² and Asaad Almssad ³

¹Jonkoping University, Department of Construction Engineering and Lighting Science, Jonkoping, Sweden

²The University of Basrah, Department of Architecture Engineering, Basrah, Iraq

³Karlstad University, Faculty of Health, Science and Technology, Karlstad, Sweden

Correspondence should be addressed to Amjad Almusaed; amjad.al-musaed@ju.se and Asaad Almssad; asaad.almssad@kau.se

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In recent years, there have been solid global trends and severe attempts by ministries of education in the world to improve the reality of educational institutions and schools through the design and construction of schools and educational systems that meet the requirements of the age by applying the concepts of sustainable and effective systems to the new generation. They called for a promising future and hence the need to activate the applications of the biophilic schools. The theme of the biophilic schools is closely related to the concept of sustainable environmental structures that deal with the surrounding natural environment with intimacy, which is one of the most important new methods of design and construction at present, where ecological challenges are powerfully evoked in the making of their design decisions. Biophilic schools are an essential part of a new concept that wants to design revolutionary educational systems with new economic outputs that are valuable but do not depart from the idea of sustainable schools in general. It represents an expression given to schools designed to be environmentally sensitive and healthy for their occupants and educational systems based on experience, humanity, and attraction. Indeed, many architects have begun to explore and develop new architectural designs linked with the concepts of biophilic schools. Through the researchers' awareness of the negative circumstance experienced by school buildings in Iraq and by investing in the recommendations of an applied field research, it was reached to crystallize the research problem represented in the obstacles that schools suffer from, which calls for the search for developmental solutions for an efficient educational environment, and in order to reach this goal, by informing researchers about new global experiences in this field, the research presented its hypothesis in choosing the model of biophilic schools that exist in many countries in the world, because of what it can provide from successful and fruitful educational and urban components. The researchers reached many conclusions and recommendations aimed at applying the research hypothesis and achieving its goals.

1. Introduction

The application of sustainability concepts in architecture has become an essential part of contemporary design concepts, which evoke environmental and economic challenges and direct them efficiently towards creating a suitable living environment that contributes to reducing the adverse effects that buildings cause on the environment, thus helping to form a vital architectural and urban formation [1]. The concept of contemporary design has been linked to applications of new concepts that have led to a reduction in

environmental costs and contributed to the formulation of some architectural bases that are subject to the concepts of sustainability, as it reinforces the link between environment and development, which led to the emergence of the concept of (sustainable development), as indicated by the fourth principle approved by the conference Rio de Janeiro in 1992 [2]. Schools are among the most widespread buildings in the world and have societal importance for embracing a large segment of occupants, for not short periods of time. The concepts of sustainable architecture can be applied to the formulation of school buildings in a way that positively

impacts the educational process, reduces the depletion of natural resources, and contributes to creating an efficient, high-performance educational environment [3]. The concept of sustainability in buildings corresponds to the concept of biophilic architecture, which works on merging structural and natural formations in an integrated manner and in formulas that allow the application of the concepts of natural balance, reduce the negative effects that constructive formations cause on nature and the local environment, and avoid negative impacts on the life of society. The biophilic school project is considered one of the pioneering projects in support of any sound educational process in the world, as specialists and theorists of the concept of schools that activate the green component in their formations see that they are institutions working to prepare an active generation in society and make citizens understand the importance of the environment and nature as an acquisition that is difficult to neglect and working on social formations seeking to implement the concepts of sustainability, as biophilic schools work to develop their internal and external spaces in terms of sustainability, health, and the provision of clean energy [4–6]. It is possible to realize the validity of this style of thinking and architectural orientation in making the human environment in countries with hot climates, whose spaces require additional care in caring for the internal environment of the buildings.

Biophilic design is a new design approach that aims to connect the occupants of the architectural space in a complementary way with the natural environment so that they become a new living form, in which the modernity of the place and technology is mixed with the magic of nature and its features, which give the place a new psychological and material nature with high symbolism and create a healthier and more productive environment which seeks to optimize the use of the conditions of the place and establishes communication between the user of spaces and the external environment. Furthermore, this approach supports the theory that humans have an innate biological affinity towards the natural world, as they spend most of their time inside the static physical space with little life, which stimulated the idea of interactive space between the two environments, and this has revolutionized the needs of the new generation obsessed with nature in urban areas [7, 8].

In 2006, the application of some concepts of biophilic architecture began, through the concept of green buildings, which contributed to changing the reality of architectural theories, as the new architecture was defined in the context of producing an environment that helps create healthy living spaces, happy coexistence environments, and the organization of a combined green natural variety. With the structural configurations looking for well-being and psychological comfort, all that is natural, including light, fresh air, plants, and water, represent basic natural elements in the biophilic formation, where natural light contributes to simulating the rhythm of the human biological clock, which regulates the human relationship with the surrounding natural environment and keeps his continual communication with the external environment. Water is an important

element in the standards of biophilic architecture because of its health and psychological benefits, as it contributes to lowering blood pressure, reducing heart rate, restoring memory, and increasing feelings of calm [9]. The natural, virgin air makes us feel the virgin nature, increases our intellectual and physical productivity, makes the senses sharp, and increases mental focus. It represents a positive environment that stimulates the senses towards making an efficient world, forming effective social relationships and constructive human communication [10].

Biophilic schools deal with the environmental issue with great intimacy, as they are designed to be environmentally sensitive and provide a healthy environment for their occupants, as they are one of the design methods that work to build healthy and effective schools for the educational process, based on reducing the consumption of natural resources and making buildings humane in their interaction with their occupants [11] and activating the natural element in construction, for the sake of public health, and taking care of the material and moral comfort in improving the environmental conditions of closed and open spaces. It is concerned with the quality of living in the internal space and not harming the surrounding environment [12]. New buildings are designed, implemented, and operated with methods and technologies that provide a safe and comfortable urban environment.

The aim of the study is to add more knowledge about the biophilic school concept in school design from hot climate and how biophilic school can improve the learning environment. To achieve the goal, a qualitative approach is appropriate. A qualitative study aims to explain something and provide an increased understanding of different individuals' experiences and their thoughts about specific scenarios. The research goals are to encourage the adoption of biophilic as a phenomenon in school's model from a hot climate, where the benefits are to provide the educational process with concepts and standards whose application will lead to developing the current reality of schools and the educational environment in Iraq.

2. Methodology and Materials

Integrating flora with building components—so-called biophilic building practice—has been practiced for many years and is one of the measures undertaken in the greening of urban areas. Of late, new biophilic building solutions have emerged as aspects of holistic design and city governance on the resurgent wave of blending nature with modernity [13]. The qualitative information analyzed in this survey consists of in-person interviews, questionnaires, and a document study. Interviews, as per Säfsten and Gustavsson, are appropriate tools to understand the experiences and perceptions of different people, which are not necessarily bound to be the same or similar [14]. By document study, the authors imply the use of secondary documents—visual, written, digital, and physical material [15]—as sources of data/information. Surveys enable the researcher to reach many people in a short period of time, and Bertram considers them

to be handy data-collection tools for research [16]. Primary data for the survey have primarily been collected through in-person interviews with experts. The survey using a questionnaire is targeted at “users of schools and thereby school campuses.” The document study and the literature review are performed to acquire deeper knowledge and thorough understanding of the subject matter. They also complement the primary data collected from the field through surveys and interviews. The questions which need to be raised and answered are as follows:

- (i) What is the role of the biophilic school concept in hot climate countries today?
- (ii) How can the biophilic school concept be used to strengthen the education environment?

Comparative analysis, whereby global case studies are analyzed and compared/contrasted with what exists locally to find similarities and differences and uncover possible improvement options, enables learning and sharing.

2.1. Biophilic School Standard Design. Biophilic schools contribute positively to the educational process, as they render the educational space likable and conducive to creative learning. This likeability also increases the daily attendance at school of the students and augments the positivity of the interaction between the students on the one hand and the ambiance on the other hand. Students, consequently, do not consider learning to be a stressful experience. It ceases to be drudgery; it becomes enjoyable, thanks to the proximity to nature [16]. It has been empirically proven that investing in a healthy environment—providing thermal comfort conditions, reducing noise, and resorting to natural lighting, for instance—promotes positive results [17]. Siting the school is very critical here. Builders often are heard saying “the only thing that matters is location.” This is all the more important for a biophilic school. Proximity to natural greenery and accessibility to public transport, which makes it easy to commute from home to school and back, will ensure that private vehicles need not be used. This mitigates environmental (atmospheric more particularly) and visual pollution.

The general shape of the building is regulated for efficient acquisition of thermal and light energy and the mitigation of the effects of external noise. This influences the selection of the types of trees and plants to be grown on the site [18]. Fresh air also plays an important role in improving functionality in the interior space, which must regulate the conditions for continuous daily ventilation, as air quality is one of the basic determinants of a sustainable building. Also, interior space designers should find solutions to integrate the indoor environment with the green outdoor environment [19]. Some teaching sessions can be alfresco to enable the students to have access to fresh air and sunlight. This has been shown to contribute to quicker understanding and better learning. Shanti Niketan in West Bengal (eastern India)—a 100% open-air school—conceived by the Nobel Laureate Gurudev Rabindranath Tagore, is a case in point. Moving outdoors also gives a practical edge to some

theoretical subjects, which cannot be as effectively learned, within the four walls of a classroom, like biology, in which case the situational experience gives students an enhanced ability to apply their theoretical knowledge by interacting closely with the external environment [20].

As the concept of “biophilic schools” is embedded within the broader concept of “sustainable schools,” green spaces are a vital element in the sustainable design process. Their nexus with the built environment and classroom spaces provides the users of these built spaces and their neighborhoods with a psychologically comforting and mentally relieving ambiance, which goes a long way in overcoming the expected pressures exerted on human occupants by building formations. Green spaces are living spaces that are organized and employed according to creative design ideas, which intend to organize spaces and formulate a flexible picture of living components through the presence of vital elements such as water or covering the soil terrain with a gardening fabric in harmony with the structural formations, roads, and urban facilities. From this, we obtain a depth of thought, calmness, and tranquility that is necessary for the educational process, and green spaces play a vital role in supplying the environment with the oxygen necessary for health and contribute to reducing the rates of physical, chemical, or biological pollution [21]. Students’ movement in the corridors outside school or between the various closed spaces confers vitality to the relationship between spaces. Pedestrian pathways are important in organizing the relationship between outer spaces. These linking pathways are essential in biophilic design, where the movement paths play a pivotal role in formulating the general fabric of urban spaces, including outdoor school spaces. The movement paths should be simplified to create an accessible reading of the urban components and be balanced and not exaggerated. The school functions require their inclusion in the educational program that encourages the use of regular shapes [6, 22].

The presence of water in all its formations plays an important role in bringing about the required process of change in the contexts of the successful architectural work of the green biophilic schools, as the presence of water bodies gives comfort and joy while creating a heightened sense of calm and relaxation, which suppresses intellectual stress and nervous tension and augments the so-called *joie de vivre*. Research has shown that the presence of water in living spaces helps in improving focus and contributes to restoring memory, as well as enhancing perceptiveness. Different water formations and systems help reduce the feeling of long waiting times and give individuals a sense of confidence and security, all of which contribute to improving the results of the educational process [23].

Natural lighting contributes to improving the quality of education, as adherence to the curriculum of biophilic schools increases the necessity for exposing students and teaching staff to higher levels of light during the day, which helps regularize healthy sleep cycles for students. Exposing architectural spaces to natural sunlight has a disinfecting effect, with consequent salubrious benefits [21, 24]. There is no doubt that exposure to high noise levels due to traffic

distracts students, diminishes their general performance in academics, and hampers their linguistic and communication skills [25]. The design standards in biophilic schools seek to create efficiency in two main aspects of the architectural environment, the efficiency of the interior spaces and the evaluation of their features, by the need for action and the desire for a good feeling connected with the necessity of using the interior space. On the other hand, the standards seek to mature the elements of the environment.

The external environment, as referred to earlier, is a complement to the internal one. It offers the students a feeling of freedom and comfort and renews their ability to engage effectively in the internal environment with a heightened sense of interest. It must be characterized by fluidity, flexibility, and vitality to be able to link the different spaces in the building block and the ambiance. The vitality in the architectural environment comes about thanks to the fluidity of interaction among the spaces. Needless to say, a lot of effort and creativity go behind designing such biophilic architectural forms to serve the intended holistic purposes.

2.2. A Review on a Biophilic School from Hot Climate Experiences: Green School in Bali-Indonesia Example

2.2.1. School Idea and Conceptions. It is an international school located in Bali (Indonesia) that caters to the educational needs of elementary-grade children. It has fulfilled the criteria for sustainability as a green school. The school was established in 2008 to benefit children in villages located in the middle of a forest that overlooks rice fields. Its mission was to spread environmental awareness and sustainability. Local building materials extracted from those forests were used, their formations were built from bamboo canes, and the plant environment was diversified to create a rich green natural environment.

This was a new type of school, commensurate with the approach of the modern Indonesian society in providing an educational environment consistent with sustainable living. The architects have tended to create many green outdoor public spaces, a popular sight in tropical southeast Asia. The basic design idea of the school building is influenced by the need for activation of communication between the school's educational functions and the external environment. The building's functions have now seamlessly merged with the dense green space, making it a quintessential biophilic school. The concept of integrating gardens and water in the courtyard with the school building design makes the experience of being near the school space, uplifting psychologically and spiritually [19].

2.2.2. School Design and Biophilic Standards' Implementation. The open space configurations require that they be shaped to offer an element of surprise and a feeling of comfort and calmness. The school has sought to achieve that environmental value between the buildings by activating the element of directing attention to the inner courtyard, which is equipped with water bodies. The designers have sought to

transfer the aesthetic value from around the school to the center of the courtyard, through more speculative foci, represented by the elevation of the land, the type of soil and vegetation, and the diversity of water areas, which enabled these areas to be distinguished, so the vegetation and water cover were visually enhanced to achieve changes in the terrain characteristics and soil type.

This comparative analytical approach reveals the Bali school as inspirational (see Figure 1) that can be replicated in Iraqi schools—both physically and psychologically—when the temperatures soar in the summer months.

From the classrooms, the students had a view of the wilderness resorts around the school building, teeming with wildlife [26–28].

3. Study Case

The education process in Iraq suffers from a clear quality decline and a clear lack of the spaces allocated for the completion of that process, as schools are no longer able to provide the educational process requirements efficiently but rather have a degree of negativity that affects the educational process results. The development programs were aborted in the education sector.

3.1. Empirical Study. To determine the state of the educational institutions in question, a field study was conducted for a school, which is very similar to the other schools where we studied and coped with, which is part of our experience and our daily experiences. Therefore, one of the Middle Euphrates schools in the city of Hilla has been chosen, which is Al-Buhtari Intermediate School for Boys, as presented in Figure 2.

Al-Buhtari School for Boys is located on the eastern side of the Tigris River, in the middle of a residential neighborhood; the building consists of two floors, on a land area of 4700 m², with a length of 81 m meters and a width of 58 m. The school has a courtyard of 1100 m². The classrooms occupy an area of 1400 m² and the administration occupies an area of 400 m². At the front of the entrance to the school, there are areas designed to be green areas of 1800 m² (see Figure 3).

3.2. School Open Spaces' Descriptions. The open spaces in the school were divided into two categories:

- (i) The first is the green spaces, which lack care and have turned into simple green areas that do not have real value.
- (ii) The second is the schoolyard, which is designated a playground, and it is a barren yard lacking the planning and functional requirements.

Administration rooms and classes were closed spaces that lacked many of what was related to a positive educational environment and were no more than a place to accommodate students. A sample population consisting of thirty participants was chosen randomly from different regions to evaluate the information obtained on the reality of

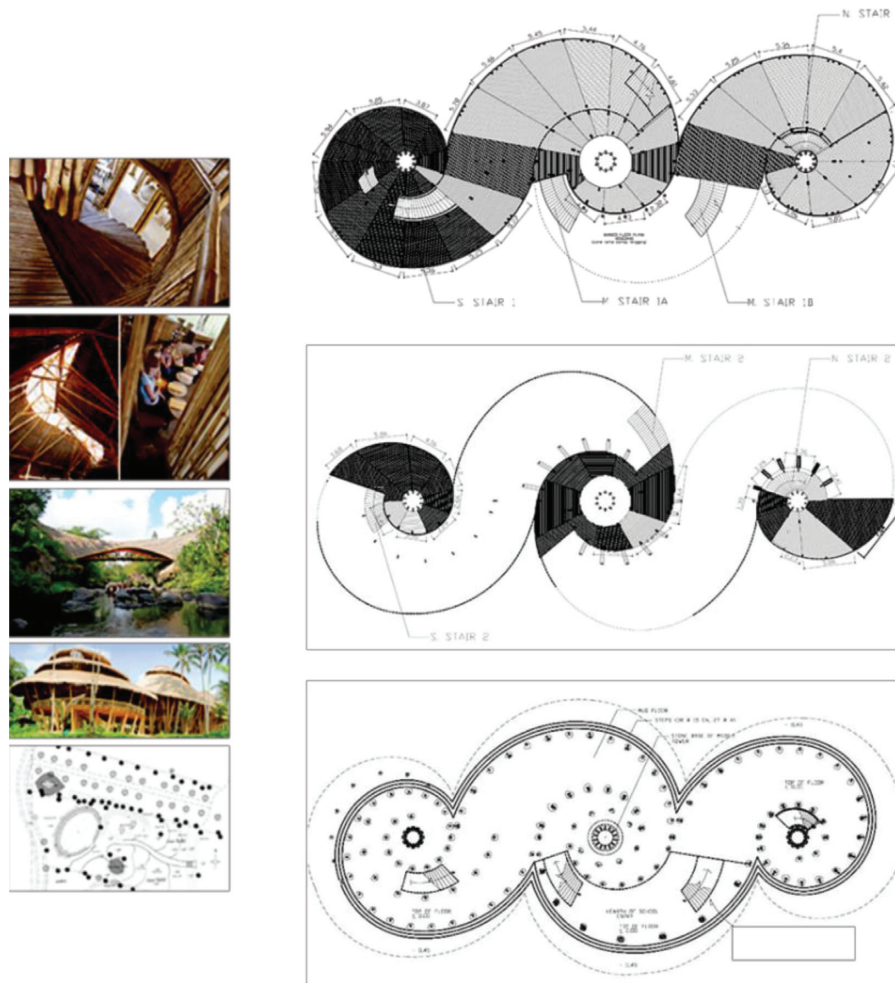


FIGURE 1: The basic plans and photos of the Green School in Bali.



FIGURE 2: Description of the internal and external spaces of Al-Buhtari School for Boys.

the condition of the school under study. The opinions came through a set of connections. The interviews were conducted with a semistructured approach. The interviews were

conducted with digital video calls in Microsoft Teams or via an e-mail interview. The study will read and review the general orientation of the surveyed people according to the



FIGURE 3: The general site for Al-Buhtari School for Boys.

local community culture, show the desire and ambition related to the future, and show the extent of awareness of the need for an advanced educational process. Activating the answer to these axes will lead to an analysis that supports the development of schools and the educational process in Iraq.

4. Results

The schoolyard in the design of schools provides students and users of educational spaces with an open outlet and recreation of the souls. Theories for schools in hot climate conditions see that the schoolyards are transformed into a functionally activated miniature forest within the school buildings. It was found that the development of children's thinking process corresponds to the expansion of the circle of playing in green spaces [29]. In the case study from Al-Buhtari School situation, the external spaces of the school, there was a clear deficiency in the performance of the space to its function, and there was severe atrophy in the parking space, even though gardens and green spaces are in the opinion of the participants a very important element that must be adopted. From the results of this study, it is possible to conclude the research problem, represented by the obstacles that schools suffer from in terms of structure, planning, and services, which calls for the search for developmental solutions that adopt our steps towards producing an efficient educational environment and to reach positive solutions. Approaching this goal, the research presents its hypothesis in choosing the model of biophilic schools, which are currently present in many countries in the world, for what it can offer in terms of successful and fruitful study and construction. The results of the survey show that more research is needed on how educational spaces can be evaluated and quantified. The interview respondents pointed

out the difficulty of evaluating the meaning of the biophilic concept without examples; hence, it would be appropriate to study how building, teaching spaces and teaching processes for this purpose can be improved. In describing the results of the survey, the information was classified as follows: in assessing the movement between sections of the school building (see Figure 4), the answers were neutral where the plan of the building was not revealed in the integrative communication between the internal and external spaces, which obscured the importance of the external spaces, ignoring their obvious shortcomings, the disappearance of their required role, and their inability to sponsor activities that could serve the action in the internal spaces.

But when the question was about the preferred design for gardens and outdoor spaces, the participants unanimously chose the contemporary style. It is a model that diversifies the elements of external activities, their diversity, and their integration in enriching the external environment of human action (see Figure 5).

On the necessity of activating the terrain parks, the answers were very desirable, as shown in Figure 6. The diversity of the topography of the garden space can suggest a clear opportunity to enrich the diversity of movement in it and thus encourage the effectiveness and activity of students and enrich their time with various activities and practices.

And when more than one natural element was proposed to attract attention, the answers were unanimous in choosing flower beds. It is one of the main elements that help soften the garden space's climate and enriches the visual scene with what is exciting and enjoyable (see Figure 7).

Many of the students have explained that it is needed to expand the current green areas. This confirms the great need for green spaces and the need to increase their percentage, as they represent the main opportunity for external activities

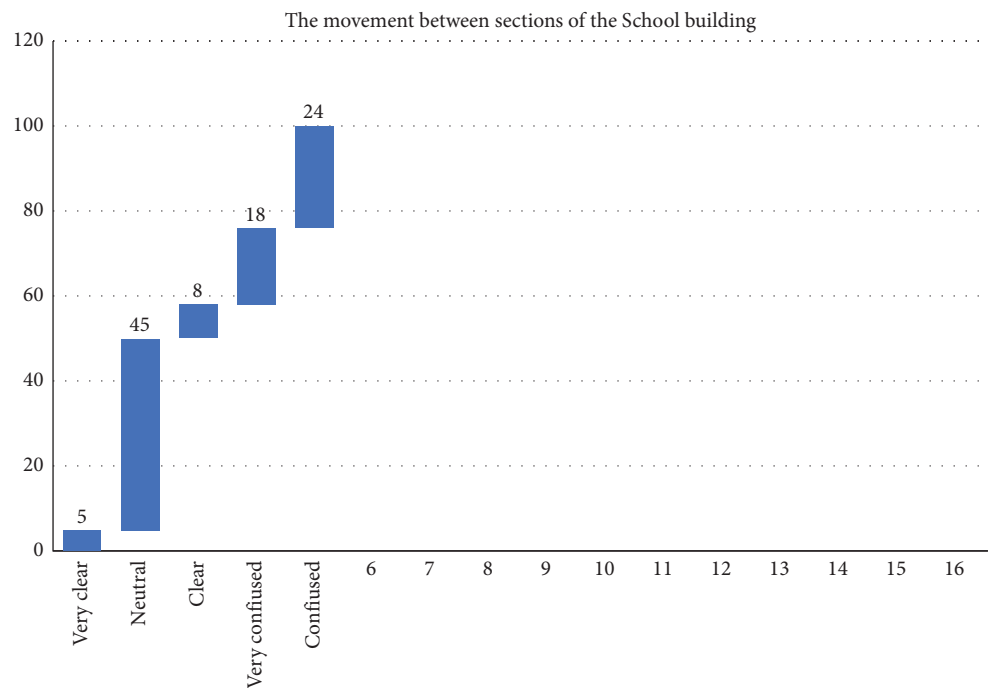


FIGURE 4: Moving between the building section to create an integration between outside spaces and inside.

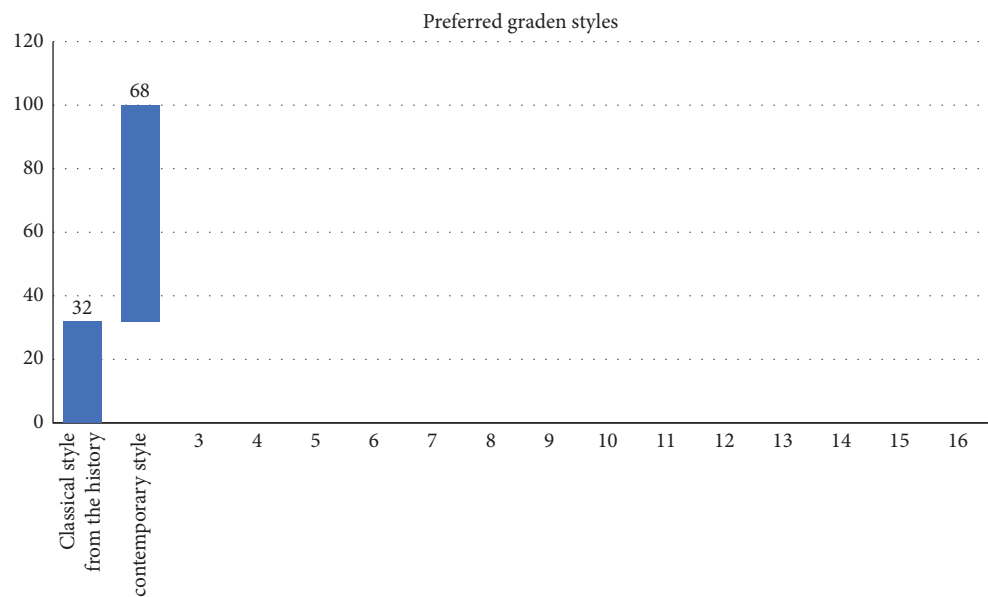


FIGURE 5: The most effective style for students.

and provide sensory and emotional pleasure in the daily life of students [30].

And about the shading of the outer corridors and the proposed material for that, the answer boxes were willing, and she chose the climbing plants. As the shadows in the school environment in hot areas become an important need to prevent the overwhelming and uncomfortable presence of the sun, which hinders the exploitation of outdoor spaces (see Figure 8), and since the methods of creating shade are many and varied, climbing plants are one of them and the most effective in softening the atmosphere [31]. On the most

preferred trees for cultivation, the answers were unanimous in choosing the palm tree. Opinions were also unanimously agreed on the importance of water in activating the value of open spaces. It can easily be imagined the great role of water bodies in softening the atmosphere in the outer spaces in this city, which is in a region with a hot climate.

The opinions found that the school’s design is not subject to international design standards, so it was necessary to find design solutions commensurate with the educational process and a sustainable green environment. Here, there is a need to invest in the available policies and techniques of

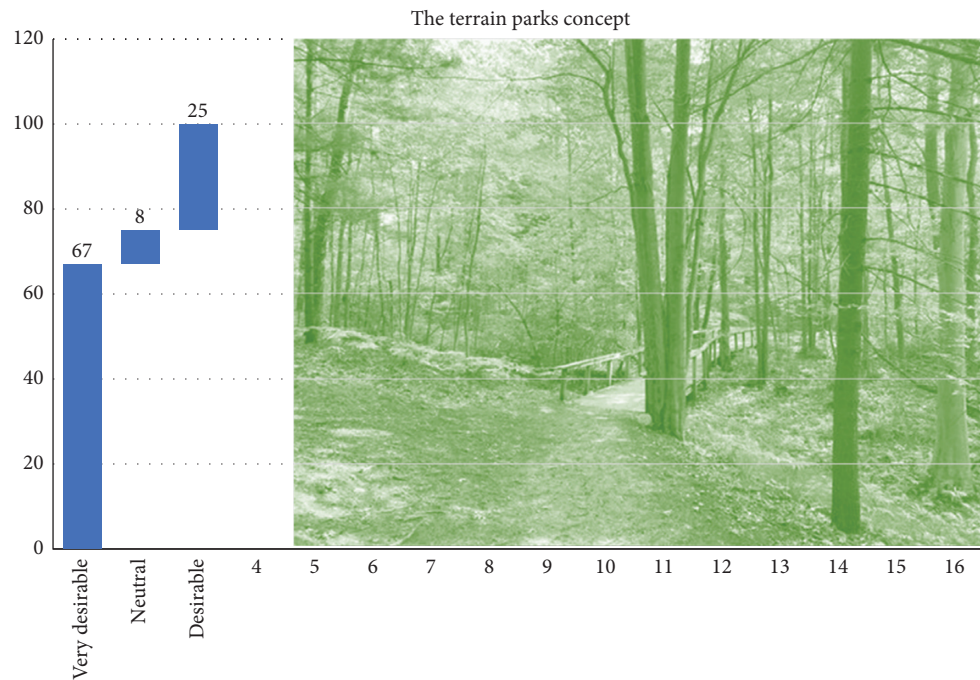


FIGURE 6: The terrain park concept.

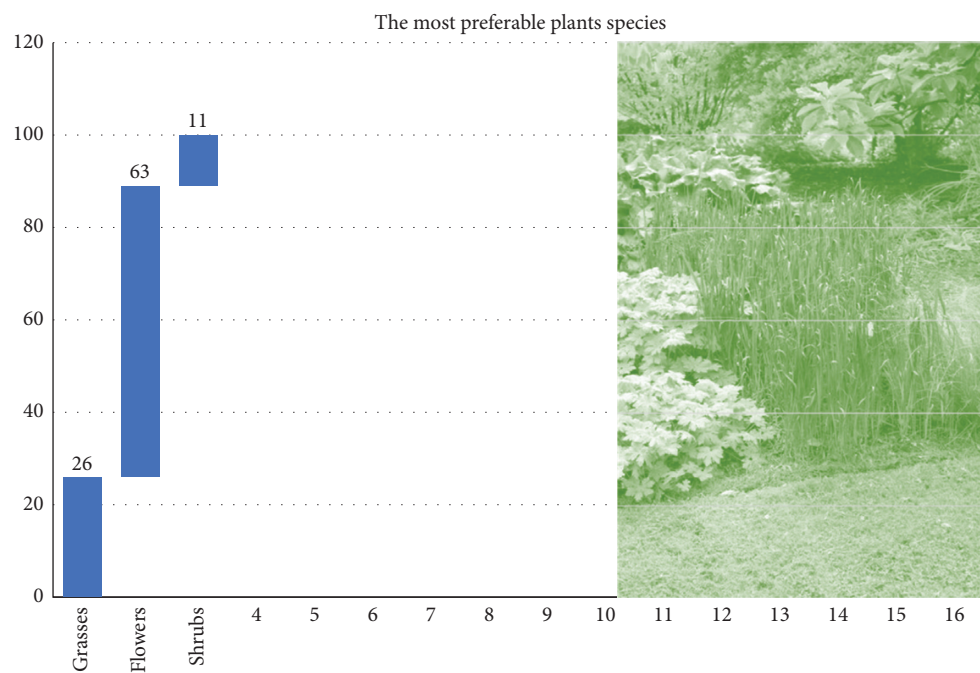


FIGURE 7: The most preferable plants species.

contemporary biophilic schools. The opinions also recommended that the sports stadium areas be of the utmost importance, and this matter calls for expanding the school's structure to include sports facilities. It is certainly a basic need, as students are in age stages in which their desire for movement, activity, and vitality increases. It is difficult to invest and produce all of this except in sports. The participants advocated the importance of finding restaurants and student gathering places as an important goal. These are

proposals aimed at developing life and social effectiveness in a way that enriches human relations and communication, which is useful and important in academic life, building relationships between students and creating opportunities for interaction, communication, and exchange of experiences between them. Many people saw the school's internal corridors as worthless. It is a sign that confirms the absence of an important element in the outer space that helps in investing and employing the desire for movement and the

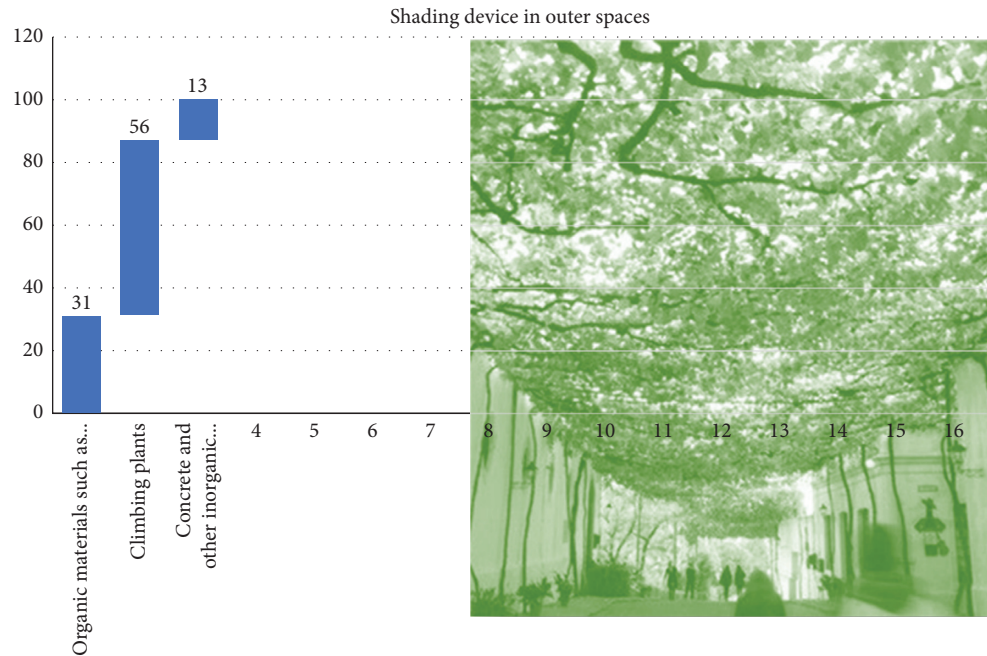


FIGURE 8: Shading device for outer spaces.

need for it in the use of outer space as a complement to the inner space. The opinions of the participants prefer the separation between the internal and external space. It is a desire that reveals the need to develop external spaces for free and flexible activities. They complement the requirements of activities in internal spaces, where human action is the most disciplined and attached to basic educational practice. The participants' opinions assumed that the internal spaces (classrooms) were not prepared for the educational process, as there is a lack of their special requirements, and the desire to develop the educational space was raised.

The results of the questionnaire were complex, but they unanimously agreed on the need for change. The study found a major deficiency in the performance of outer space functions, even though green spaces are very important elements. The addition of terrain in the gardens is highly required to give the open spaces a state of change and diversity. The presence of flower beds is necessary to activate visual attraction. The palm tree was the most preferred, which corresponds to the feeling of familiarity and familiarity with these trees. The importance of activating the water component in open spaces was found (see Figure 9). Regarding educational buildings, the study found that sports halls are required in the design of an integrated school as it assists the educational process. And in its absence, there is a clear deficiency in the maturation of the educational process and its enrichment with complementary spaces of pleasure and learning; in addition, cultural forums and communication between students or teachers are important as they help serve the educational space and support the idea of science and learning community [32, 33]. This has become necessary considering the culture of learning about the other and its educational curricula, as well as the multiplicity and

diversity of learning sources and the need to communicate with the educational staff to take care of learning led by students.

5. Discussion

The idea of the biophilic school is based on the interactive orientation with the outdoor green spaces. Therefore, according to the recommendations of the school in charge, the architects have tended to design the school spaces to enhance interaction with the outside and enrich the school life inside the building. Bamboo has been used to become the frame, floor, and furniture of tables and chairs in creative forms. The designers have tended to apply the concept of incubation, through outdoor spaces that tend to be closed to themselves and with different spaces, which have an openness to gardens and green spaces. The designers applied the concept of incubation through the building's arch-like shape, as the whole school opens onto gardens and open ground. The biophilic school suggested that its facilities need to be designed according to the Iraqi climate and traditional buildings concepts [34]. In this case, it is required to use the local building materials compatible with the environmental and thermal conditions on the site. This trend can be invested in Iraqi schools by using local bricks in construction and finishing as a material with appropriate thermal behavior. It can resist transition thermal temperature from outside to inside, which reduces the harsh effect of the sun's rays during the summer months. Through the information that has been reached regarding the negative reality of the Iraqi school on the one hand and the positive information provided by the standards of the biophilic school and some global models from these schools, more care needs to be considered in developing green outdoor spaces in the school,

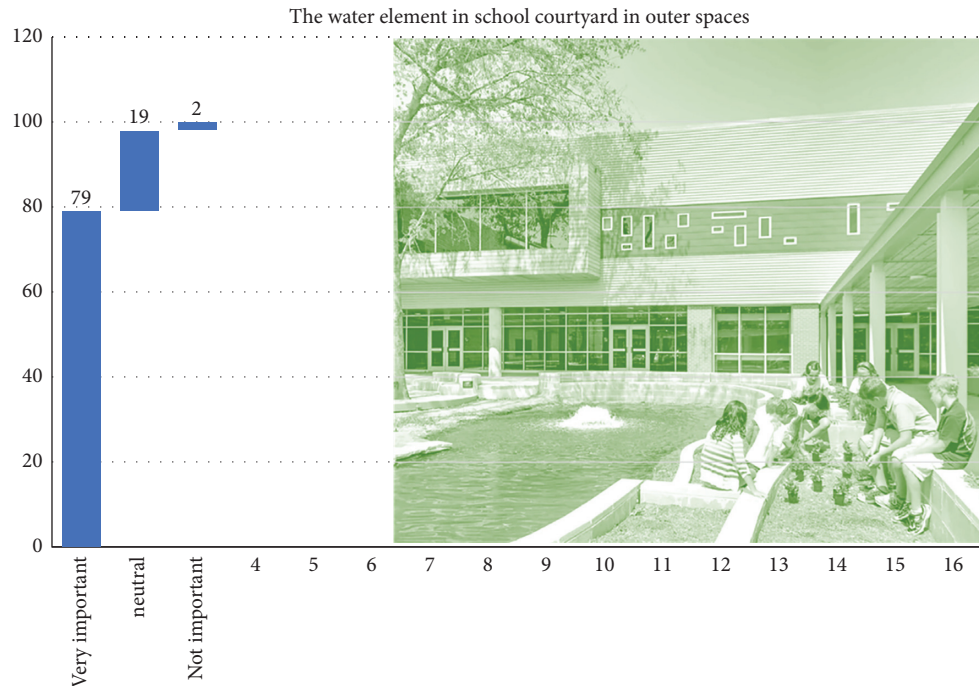


FIGURE 9: The water element in the school courtyard.

where open outdoor spaces need to be enriched with multiple trees, vegetation, water areas, and fountains. Clear attention should be paid to developing the components of the inner courtyard, making it a space for fun and play, and equipping it with what encourages its use and spending time in it from outdoor recreational activities, where a child's social, emotional, physical, and spiritual well-being stands to be influenced during the time they spend away from their parents/guardians [35]. As in many examples of biophilic buildings around the world, the development of communication between the internal spaces of the building and the external open spaces will have a positive outcome for the occupants and the environmental condition of the internal space, where Krstic et al. [36] find the positive role of the interaction between the learning interior spaces and the open exterior space, which depends on the core, structure, and layout of the architectural buildings. It is an important role of creating interaction between interior and exterior space, where the visual connection, continuity, and building design are the main factors that affect the physical and psychological situation of users' comfortability, which in parallel affects the behavior [37]. In the biophilic concept, the idea of sustainability involves improving the quality of life, thus permitting individuals to live in a beneficial environment, with improved social, economic, and environmental circumstances [38]. The sustainability constraints are to a better or lesser extent interconnected. The challenge for designers is to bring together these various sustainability requirements in pioneering approaches [39]. Therefore, it becomes required in the design phase to adopt the sustainability standards in the construction of school buildings, including the use of local building

materials that are compatible with the city's climate, as well as the use of horizontal and vertical vegetation, where construction surfaces can be covered with decorative plants, and the roof garden can be used and activated as part of the open outdoor spaces and for this positive effect. As for thermal comfort, special pathways must be created between the buildings and the various activities in the open areas. This requires roofing the paths to develop efficient shades to avoid the harsh rays of the sun in a hot period. In this way, communication between the activities in the building and the outdoor areas can be made more efficient. According to Sam and Kouhroostami, the human innate tendency to interact with the natural environment has been developed by psychologists. This interaction should be placed in educational environments (schools) [40]. Therefore, engaging the educational program with external spaces can be used in some cases as a space for practical or theoretical lessons compatible with communication with outer space [41, 42].

6. Conclusions

Biophilia in education buildings must assume a different form in the reading process. Biophilia can be represented as a natural phenomenon integrated into the building's design concept or a technique and technology that are required for a modern lifestyle. The research has tried to formulate the practical requirements that serve to develop the educational environment in Iraq. It urges educational institutions to increase the interest in introducing biophilic concepts within the requirements of the comprehensive design process for the urban environment in general and schools in particular

in a manner that secures an incubating environment that increases the cultural and educational gains of schools and contributes to the development of society and its institutions, where the concepts of biophilia are mainly linked to human principles that make us live our reality by integrating it with nature.

The organization of the relationship between school buildings and outdoor greenspaces creates a flow of fresh air between outdoor cultivated areas and classrooms. The use of the aerodynamic phenomenon may trigger this. Besides that, it requires investing the plant barriers and trees in providing sound insulation for the school and keeping it away from the effects of noise and acoustic pollution near its buildings. Research findings can provide useful recommendations for rescuing local schools that are failing to meet various international standards in the educational environment and for providing practical recommendations for rescuing schools in the local environment. The idea of a mixed biophilic system that reconciles the built environment with the green environment came as a highly valued human and environmental solution. In the light of this, ethical standards of respect for mankind, the human value of nature, and the elimination of the burdens of the built environment on nature, which caused the deterioration of the surrounding natural environment, were activated. This led to the thought of an architecture that honors the green plant element.

Data Availability

The data used to support the findings of this study are included within the paper.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

- [1] N. Soares, A. G. Martins, A. L. Carvalho et al., "The challenging paradigm of interrelated energy systems towards a more sustainable future," *Renewable and Sustainable Energy Reviews*, vol. 95, pp. 171–193, 2018.
- [2] E. Douglas, H. Gordon, *Green Schools as High Performance Learning Facilities*, National Clearinghouse for Educational Facilities at the National Institute of Building Sciences, Washington, DC, USA, 2010.
- [3] A. Almusaed, A. Almssad, I. Yitmen, I. Akiner, and M. E. Akner, "Coherent investigation on a smart kinetic wooden façade based on material passport concepts and environmental profile inquiry," *MDPI Energy in Construction and Building Materials*, vol. 14, 2021.
- [4] Nick Williams, "Achieving sustainable urban form: K. Williams, E. Burton and M. Jenks; E & FN Spon, London, 388pp," *Land Use Policy*, vol. 21, no. 2, p. 202, 2001.
- [5] A. Almusaed and A. Almssad, "Urban social sustainability-case study; gellerupparken-Denmark," *Sustainability in Urban Planning and Design*, IntechOpen, Gellerupparken, Denmark. , <https://www.intechopen.com/online-first/urban-social-sustainability-case-study-gellerupparken-denmark>, 2021.
- [6] R. E. Barlow, "Landscape design," *A Cultural and Architectural History*, Abrams, NY, USA, 2001.
- [7] B. W. Wheeler, M. White, W. S. Timmins, and M. H. Depledge, "Does living by the coast improve health and wellbeing?" *Health & Place*, vol. 18, no. 5, pp. 1198–1201, 2012.
- [8] A. Nábělek and A. Donahue, "Perception of consonants in reverberation by native and non-native listeners," *Journal of the Acoustical Society of America*, vol. 75, pp. 632–634, 1984.
- [9] A. Almusaed and A. Almssad, "Building materials in eco-energy houses from Iraq and Iran," *Case Studies in Construction Materials*, Elsevier, Amsterdam, Netherlands, 2015.
- [10] W. W. Nazaroff and C. J. Weschler, "Cleaning products and air fresheners: exposure to primary and secondary air pollutants," *Atmospheric Environment*, vol. 38, no. 18, pp. 2841–2865, 2004.
- [11] A. Almusaed and A. Almssad, "City phenomenon between urban structure and composition," *Sustainability in Urban Planning and Design*, IntechOpen, London, UK, 2019, <https://www.intechopen.com/online-first/city-phenomenon-between-urban-structure-and-composition>.
- [12] A. Loureiro and S. Veloso, "Green exercise, health and well-being," *Handbook of Environmental Psychology and Quality of Life Research, International Handbooks of Quality-of-Life*, Springer, New York, NY, USA, 2017.
- [13] L. Novosadová and W. van der Knaap, "The role of biophilic agents in building a green resilient city; the case of birmingham, UK," *Sustainability*, vol. 13, no. 9, p. 5033, 2021.
- [14] K. Säfsten and M. Gustavsson, *Forskningsmetodik. För Ingenjörer Och Andra Problemlösare*, Studentlitterature, Lund, Skåne, Sweden, 2019.
- [15] Merriam and E. Tisdell, *Qualitative Research: A Guide to Design and Implementation*, Jossey-Bass, Hoboken, NJ, USA, 2015.
- [16] I. Bertram, *Hur ser en bra enkät ut? En kritisk granskning av befintliga frågeformulär*, Lup Student Papers, Punjab, India, 2009.
- [17] M. Fairuz and P. J. Shahidan, "Plant canopy planting design in modifying urban thermal environment: theory and guidelines," in *Proceedings of the PLEA 2008–25th Conference on Passive and Low Energy Architecture*, Dublin, Ireland, October 2008.
- [18] A. Almusaed, A. Almssad, and A. Alasadi, "Analytical interpretation of energy efficiency concepts in the housing design," *Journal of Building Engineering*, vol. 21, pp. 2352–7102, 2019.
- [19] T. Titman, *Special Places–Special People, the Hidden Curriculum of School Grounds*, Learning through Landscapes, Dorking, UK, 1994.
- [20] K. Williams, E. Burton, and M. Jenks, *Achieving sustainable urban form: conclusions*, K. Williams, E. Burton, and M. Jenks, Eds., E & FN Spon, UK, 2000.
- [21] M. Matsch, *Zero Waste: A New Systems Approach Gaining Global Ground*, EcoCycle Times, Australia, 2000.
- [22] E. B. Rogers, *Landscape Design: A Cultural and Architectural History*, Abrams, New York, NY, USA, 2001.
- [23] A. Almusaed, *Biophilic and Bioclimatic Architecture, Analytical Therapy for the Next Generation of Passive Sustainable Architecture*, Springer, New York, NY, USA, 2010.
- [24] A. Amjad, A. Almusaed, and A. Almssad, "ANP model for evaluating the performance of adaptive façade systems in complex commercial buildings," *Construction and Architectural Management Journal*, vol. 28, no. 10, 2021.
- [25] A. Almssad, A. Almusaed and A. Almusaed, Environmental reply to vernacular habitat conformation from a vast areas of

- Scandinavia,” *Renewable and Sustainable Energy Reviews*, vol. 48, pp. 825–834, 2015.
- [26] A. Almusaed, I. Yitmen, A. Almssad, and R. Z. Homod, “Environmental profile on building material passports for hot climates,” *Sustainability*, vol. 12, no. 9, 2020.
- [27] D. G. Shendell, R. Prill, W. J. Fisk, M. G. Apte, O. Blake, and D. Faulkner, “Associations between classrooms’ CO₂ concentrations and student attendance in Washington and Idaho,” *Indoor Air*, vol. 14, no. 5, 2004.
- [28] A. Almusaed, “Introductory Chapter: overview on grass topic,” *Grasses-Benefits, Diversities and Functional Roles*, Intech open, London, UK, 2017.
- [29] A. Almusaed and A. Almssad, “City phenomenon between urban structure and composition,” *Sustainability in Urban Planning and Design*, Intech open, London, UK. , <https://www.intechopen.com/online-first/city-phenomenon-between-urban-structure-and-compositionv>, 2020.
- [30] E. Smith, J. Lemke, M. Taylor, H. L. Kirchner, and H. Hoffman, “Frequency of voice problems among teachers and other occupations,” *Journal of Voice*, vol. 12, no. 4, pp. 480–488, 1998.
- [31] U.S. Access Board, *Classroom Acoustics for Children with Disabilities*, U.S. Access Board, Washington, DC, USA, 2009.
- [32] A. Almusaed, *Biophilic and Bioclimatic Architecture*, Springer-Verlag London Limited, London, UK, 2011.
- [33] M. Mollazadeh and Y. Zhu, “Application of virtual environments for biophilic design: a critical review,” *Buildings*, vol. 11, no. 4, p. 148, 2021.
- [34] T. Peters and S. Verderber, “Biophilic design strategies in long-term residential care environments for persons with dementia,” *Journal of Aging and Environment*, pp. 1–29, 2021.
- [35] J. Dymont and T. S. O’Connell, “The impact of playground design on play choices and behaviors of pre-school children,” *Children’s Geographies*, vol. 11, no. 3, pp. 263–280, 2013.
- [36] H. Krstic, A. Trentin, and G. Jovanovic, “Interior-exterior connection in architectural design based on the incorporation of spatial in between layers. Study of four architectural projects,” *Spatium*, vol. 1, no. 36, pp. 84–91, 2016.
- [37] Q. Oday and A. Joan, “Relationships between interior and exterior spaces as a factor of efficient university buildings,” *International Journal of Design & Nature and Ecodynamics*, vol. 15, no. 5, pp. 757–762, 2020.
- [38] O. Ortiz, F. Castells, and G. Sonnemann, “Sustainability in the construction industry: a review of recent developments based on LCA,” *Construction and Building Materials*, vol. 23, no. 1, pp. 28–39, 2009.
- [39] O. Peter, E. A. Chinyio, and P. O. Olomolaiye, “Design of a sustainable building: a conceptual framework for implementing sustainability in the building sector,” *Buildings*, vol. 2, no. 2, pp. 126–152, 2012.
- [40] M. Sam, M. Kouhirostami, and M. Azimi, “The impact of nature and outdoor learning on students,” *GRID-Architecture, Planning and Design Journal*, vol. 3, no. 2, pp. 272–290, 2020.
- [41] R. Z. Homod, A. Almusaed, A. Almssad, M. K. Jaafar, M. Goodarzi, and K. S. M. Sahari, “Effect of different building envelope materials on thermal comfort and air-conditioning energy savings: a case study in Basra city, Iraq,” *Journal of Energy Storage*, vol. 34, Article ID 101975, 2021.
- [42] A. Almusaed and A. Almssad, “Biophilic architecture, the concept of healthy sustainable architecture,” in *Proceedings of the 23th Conference on Passive and Low Energy Architecture (PLEA2006)*, Geneva, Switzerland, September 2006, http://web5.arch.cuhk.edu.hk/server1/staff1/edward/www/plea2018/plea/2006/Vol1/PLEA2006_PAPER151.pdf.