

Biophilic Design for Bringing Educational Spaces to Life

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Abstract: Bringing living structures to our educational spaces, especially universities, when most educational spaces are devoided of natural features, is a concept that needs to be pervasive within the architects and designers who are responsible to create healthy and creative spaces for the students. Our biology and psychology are in a sustainable need for a connection with the natural environment. The biophilia hypothesis demonstrates that human beings are attracted naturally towards the natural environment and the detachment from it generates negative consequences that affect the physical, psychological and social aspects of the human being. Within this paper, it is argued that educational spaces need to correlate with the environment through the adoption of biophilic design as it is a design approach that aims to rebuild the connection between the natural world and the built environment through adopting biophilia principles and elements

Not every educational space can be designed with total response to the biophilic approach; however, it is the architect's responsibility to correlate natural features with the educational space in order to achieve a healthy environment for the students. In this article, the concept of biophilic design in the built environment and integrating the nature with the interior and exterior spaces will be first illustrated, followed by a discussion about Innovation center "OZU X" at Ozyegin university campus adoption of biophilic design elements as well as the effects biophilic design on the psychological and social health of Ozyegin university students.

Keywords: Biophilia, biophilic architecture, green university, environmental psychology

Introduction:

Formal education in universities provide a pedagogy that has limited contact with the natural environment, this is because of the long teaching and learning hours which are conducted at classrooms that suffer from limited natural ventilation and lighting, with window openings that mostly have views to the outside built environment. Such universities facilitate the separation of the students from the natural environment during their study hours; this absence of the natural sense has negative impacts on the student's mental and physical health (Kellert, 2005a). The paper focuses on the concept of biophilic design, principles and elements and how they are adapted in Innovation centre "OZU X" at Ozyegin University campus. Then the paper will present the contribution of adopting the biophilic design in the innovation centre "OZU X" at Ozyegin University in enhancing Ozyegin University student's mental and physical health.

To understand the concept of Biophilic Architecture/Design in universities, first, we need to go through the notion of "biophilia". In the year of

1984, Edward, O. Wilson introduced for the first time the term "biophilia" that later became the Biophilic hypothesis (Hegerwagen, Kellert, Mador, 2013). The term "biophilia" is integration between the words "bio" and "philia" and their meaning are "being alive" and "the attraction people feel towards the natural environment" respectively (Kayihan, 2018). Wilson explained in his book "biophilia" that every human being has deep interest and attraction to the natural environment and world. He argues that human connection with the environment will result in human well-being (Africa, Sachs, 2015). Since human evolution was in a biological environment their bodies and psychology depend constantly on the interaction with the natural environment (Kellert, 2005b). Human sensory and body are sensitive to environmental features such as odour, sound, light, water, landscape and animals (Hegerwagen, Kellert, Mador, 2013). Human well-being relies on five essential factors: environment, social, economic, psychological and physical factors (Blom, 2013). Human exposure to natural environment features such as fresh air and visual contact with water features and sensing the odours of the vegetation in

daily base results in improving human being well-being and life quality. From this notion, the concept of Biophilic design/Architecture has been evolved.

Gordon Orians's hypothesis also suggests that human-beings are psychologically connected to particular landscape features. He proved his hypothesis through his studies on human habitat selection and the environment (Heerwagen, and Hase, 2001). Heerwagen and Hase explained the reason behind Orians's hypothesis, that the long history of human hunting and food gathering in the early history affected the psychologically of the human and evolved an attraction between the human and the natural environment which is deeply rooted in humans brains (Heerwagen, and Hase, 2001). Existing trends in architecture and designing field mostly focus on several criteria such as form and function and ignore other important design input such as psychological and human preferences (Holm, 2006). Thus comes the necessity of the biophilic design as it focuses on filling the detached gap between the existing buildings and the natural environment in order to enhance the existence of the nature within the built environment. The notion of biophilia has been developed further by Kellert who suggested the adaptation of the context with the built environment (Kellert, Heerwagen, Mador, 2008) by merging the natural structures with the man-made structures such as using natural materials, include vegetation in the interior of the structure and allow the flow of natural ventilation and light into the building, and therefore his suggestion has become an important element in the architectural design (Kellert, 2005b).

Biophilic design is a restorative environmental approach that benefits both human being and the environment. In order to analyze biophilic design contribution in enhancing OZU X student's mental and physical health it is important to understand biophilic design's two main dimensions and principles. The first dimension as Kellert illustrated is the Organic or Naturalistic dimension. All the shapes and forms in the environment can be categorized under this dimension. In other words, Kellert described this dimension as the direct and indirect experience of human affinity towards the forms and shapes in the natural and built environment. For instance, direct experience is referred to the human contact with self-sustaining features of the natural environment as the animals, plants and natural light, while the indirect experience is the human contact with the nature that depends on the human to survive such as aquarium and potted plants. The second dimension of biophilic design is Place-based or vernacular dimension which is describing the building or landscape meaning to the people and how by the time it becomes integrated to the individual identity (Heerwagen, Kellert, Mador,

2013). Moving to biophilic design principles, there are six principles Kellert described the biophilic design approach; environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, evolved human-nature relationships (Kayihan, 2018).

Studies on human behaviour and performance displayed that the surrounded environment either natural or artificial greatly affects human being physically and mentally and this exactly facilitate human well-being (Blom,2013). Human well-being can be achieved by living in a green environment that promote a well and healthy life which directly affect human behaviour, productivity, performance as well as learning abilities (Wilson, 1984). Grinde and Grinde-Patil (2009) stresses on the same concept, students who study in a biophilic environment are more effective and have high learning abilities, he further explains that the natural environment increases the concentration and also stimulates the brain during the learning process.

Biophilic design dimensions and elements at OZU X

OZU X building is one of the good examples that adopt the biophilic design within its environment. The building is located in Çekmeköy, in the Anatolian side of Istanbul province between vast green spaces from the north, east and west sides. The building was designed in a site that faces the forest from the east and west directions. OZU X is area is 80m x 40m, located under the under the ground level from three sides and open to the sunken garden in the fourth side. The inner space of the building consists of laboratories for Engineering and Architecture students. A curves linear circulation path connects all the laboratories and lead to meeting spaces. To enter the building a ramp is provided as the first access option, while staircase and elevator might be used as well –Figure 1.



Figure 1: Innovation Center OZU X
Source: <http://www.ecarch.com>

OZU X has adopted biophilic design dimensions and elements within its architecture and design. The organic dimension emphasizes the direct experience of nature at OZU X which can be noticed from the integrating of the natural elements such as the plants, animals, water, natural light and natural landscape within the interior and exterior campus environment. Environmental psychology focuses in the relation between the behavioral patterns of the man and the environment and understanding how the environment has indirect effects on student's behavior, state of mind which in order affect their performance (Blom, 2013). The linking between the human and the nature affects the behavioral patterns positively, stimulate the brain, and provide high concentration and productivity. On the other hand, students who study in a built environment with buildings that suffer from isolation from natural features are more able to adopt psychological and or physical distress that decrease their attention, productivity and performance during the learning classes and lectures. Such building is categorized under sick building syndrome which does not only affect few s in the environment, but also its effect spreads between the students and the academic staff, thus the performance and the productivity of the lecturers in the teaching and discussion sessions will be reduced to lower levels.

OZU X design has also adopted the second dimension in biophilic design; place-based dimension. This dimension is based on the first dimension, as the continues presence of the students in the campus that adopt natural elements in its exterior and interior spaces, a meaningful sense about learning and being productive will grow in their unconscious.

In order to achieve biophilic design goals in enhancing universities student's mental and physical health, and achieving high performance and productivity, biophilic design principles should be analyzed regarding the site and integrated during the early design phase. Kellert provided six basic design elements based on biophilic design approach:

- Environmental features,
- Natural shapes and forms,
- Natural patterns and processes,
- Light and space,
- Place-based relationships,
- Evolved human-nature relationships,

OZU X is designed with creative diversity that links outdoor areas with indoors, so students have the enough opportunity to keep in touch with the natural environment. Although every opening in the campus buildings is a connection between the nature and the students, the challenge is how to integrate climate, seasons, smell and texture and other elements of the

nature through this opening. Thus biophilic design principles were carefully integrated into OZU X as it is clear when analyzing the exterior and interior spaces of the campus.

OZU X Environmental Features

The most obvious element of biophilic design is Environmental Features. It is the direct use of the natural world within the built environment. According to Wilson's biophilia hypothesis, human being has a natural attraction to the nature, thus adopting different environmental features has a positive impacts on the students mental and physical health. Sunlight is an important feature to be considered in designing the built environment. Natural light is a preferred feature by most people, thus university classrooms design should be designed in a way that allows enough penetration of daylight into the classes in order to enhance student's concentration during learning hours and stimulate their productivity. OZU X design has implemented this concept very well. Since the building is constructed under the ground it needs a creative way to illuminate the interior of the building during the day with the sunlight rather than depending on the artificial lighting systems. A cylindrical projected glass walls is constructed in the interior that brings the exterior sunlight into OZU X interior spaces almost all day hours – Figure 2. While attending workshops and lectures at OZU X, students still have the chance to be exposed to the natural light and absorb all its benefits. Another environmental feature that was implemented in OZU X building plants. All the inner spaces and studios of OZU X are enclosed by a curtain wall that shows the natural exterior landscape around the building. This view provides the students with maximum transparency to the nature and connects them continuously to a healthy view that enhances their performance.



Figure 2: OZU X Skylight
Source: <http://www.ecarch.com>

The second element of biophilic design is natural shapes and forms which includes applying natural motifs to the building surfaces, adopting columnar structure, implementing oval and arches in the exterior façade and interior of the building, and avoiding using straight lines and right angles. In the case of OZU X, a mixture of curve shapes and straight lines is used in the design of the interior space structure and furniture in order to meet all students' needs while spending time in the center. OZU X building adopted curved shapes in its structure and furniture. As for the interior structure, a curved curtain wall encloses the main studio spaces and opens to the main linear curved circulation areas which connect several teaching classes and studios – Figure 3.



Figure 3: OZU X Circulation paths
Source: <http://www.ecarch.com>

Moreover, curved automatic curtains enclose a meeting space in the middle of OZU X in order to provide a quiet atmosphere space for meetings and discussions –Figure 4. Looking for the furniture of the building, a half circular seats and sofas are located next to the main entrance of the building and are part of coffee service station where the students can continue their work and enjoy their coffee using those seating.



Figure 4: OZU X Meeting spaces
Source: <http://www.ecarch.com>

OZU X Natural patterns and processes

Biophilic indirect element is embedded in the natural patterns and processes that can be adopted within the exterior and interior building design. Under this category “Information Richness” is found which can be seen in the variety and richness of wide range of natural elements such as the landscape, natural texture and natural daylight. OZU X design is rich with natural information and processes that are clearly within its interior and exterior spaces. OZU X has implemented “Complementary Contrast” sub-element which also under natural and processes category which describes disparity of features in the interior spaces in order to express the limits and boundaries of the spaces through utilizing the contrast of seeming opposites, like light and darks between by playing with the light tense between the circulation and study spaces, high and low leveling, and openness and encloses of the classes and studios. This contrast gives a different feeling when moving from space to space which keeps students attracted during their mobility in the building –Figure 5.



Figure 5: OZU X Light and shadow contrast
Source: <http://www.ecarch.com>

OZU X interior design has played with the light and spaces in a creative way. The natural and artificial lighting system which has been utilized in OZU X has been studied. OZU X has utilized different light systems in some circulation spaces while the majority of the study rooms, classes and studios are depending on indirect daylight to illuminate them on the first hand and on artificial light as an alternative light source –Figure 6. The usage of several artificial light systems such as diffused lighting system around the coffee service station and seating area, warm lighting system in the meeting spaces as well as direct lighting system in the studio spaces, is very important for providing a pleasant view for the students in order to provide them with a convenient mindset, not only that but when utilizing the natural light in study spaces, it gives the students the suitable illumination that allows them to be more productive and perform better in their tasks. While when analyzing spatial relationship between the spaces of OZU X, a clear relationship between the natural and the artificial elements can be seen, as looking at the studio spaces that have a curtain wall which opens towards the back green areas. Two cylindrical glass structures are located in the building with natural plants in them that bring the exterior nature inside the underground building.



Figure 6: OZU X Artificial Lighting
Source: <http://www.ecarch.com>

Place-Based Relationships

The fifth biophilic design element that has implemented in OZU X building is Place-Based Relationships. This category is mostly related to the connection between the building as a whole unit and the surrounding nature. Geographical connection between the OZU X is clear when observing the green natural hill that is located along the borders of Ozyegin University campus and exactly near OZU X building. The geographical connection can be seen as the hill is high enough to be observed while using the ramp to walk downwards to enter OZU X as the building is constructed under the ground. This connection provides the students with a sense of continuity between the natural hill and the

underground structure in order to keep in their subconscious that they are still integrated to the outside natural world which will in return provide them with a calm feeling and a good mindset to work on their tasks. This is exactly what Wilson described that enhance the relationship between the human being and nature benefits mental and physical health (Wilson, 1984).

Evolved Human-Nature Relationships

The sixth biophilic design element and the final is Evolved Human-Nature Relationships. “Prospect and refuge” is the description of how integrating the nature with the built environment provide human being with shelter and sanctuary feeling, while prospect sense is because the colorful nature and especially green color is known for its positive impact on the mental health of the human being. As OZU X design had implemented most of biophilic design principles, it provides the students with the needed prospect and refuge sense especially during their final exams and presentations which is held at the building.

Conclusion

In conclusion, architectural environment has both direct and indirect effects on human psychology as the human being has evolved in the nature. Human evolution in the nature has caused in creating a deep connection and attraction between the man and the natural environment. This is exactly the meaning of biophilic design which emphasis on the connection between human being in the built environment and the natural world. This is an important issue to be considered by the architects and designers who are responsible for designing a healthy and pleasant built environment for human beings. When talking about students psychological health, it comes to the mental issues about teaching and learning methods without giving much attention to the physical structure in which the students are spending long hours learning and participating in different educational task. Adopting biophilic design in educational spaces is an important issue in order to provide the student with a healthy learning environment. OZU X at Ozyegin University campus in Istanbul is one of the good examples that have implemented biophilic design in its exteriors and interiors. Six elements of the biophilic design have been utilized whether directly or indirectly. To conclude, such approach is a trial to revive the connection between the built environment and the nature in order to provide the students with a better place for them to be creative and innovative

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