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Biophilic Design as A Source of Inspiration in The Development of Creativity Process: An Example of Interior Architecture Design Studio

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Abstract
Based on taking advantage of the healing power and aesthetic wealth of nature, biophilic design theory has had an important place in the architectural literature for the last few decades. Previous studies suggested that biophilic design was not only a part of theoretical debate among scholars but also had practical implications. In fact, a wealth of studies suggested that buildings, and especially the interiors, designed upon biophilic design approach, sustained positive impact on the health and well-being of users and significantly increased the performance and creativity levels. In that regard, biophilic design can make a significant contribution to the development of creativity in design education setting. Furthermore, biophilic design can also provide guidance on how creativity should be incorporated into learning and teaching experiences. Therefore, inclusion of biophilic design in design education curriculum would be beneficial for both students and instructors. Although for centuries nature has been used as an aesthetic model for design, biophilic design has an important potential as a design education paradigm thanks to the fact that it has certain principles and a systematic. The present article aimed to introduce the biophilic design theory, underscore its significance, and suggest how the theory could make a contribution to learning and teaching processes by fostering creativity in interior design education setting. Accordingly, how biophilic design strategies nurtured and developed creative thinking skills was demonstrated on the basis of design outputs of the 6th semester interior design studio. The results suggested that the students included rich patterns of nature in their designs with an artistic sensitivity, used colors, textures, and motifs similar to those in nature, and showed a tendency to include visual folds and/or elevation differences in interiors similar to those found in nature. Furthermore, they exhibited better protective behavior towards the natural environment in their designs.

Keywords
Interior design; Interior design education; Interior design studio; Creativity; Biophilic Design.

1. Introduction

Design process is challenging by nature. Especially interior design requires adoption of a multidimensional perspective from technology to philosophy, from ecology to psychology. In the sense thereof, it is important and necessary for interior architects to have creative skills, develop various strategies against the problems they encounter, and accommodate new perspectives. Accordingly, the design studio, one of the most important elements of interior architecture education, where students can learn how to design, is extremely important in the training of interior architect candidates, who are expected to produce qualified spaces (Gunday Gul & Afacan, 2018).

The design studio features a teaching model characterized by predominantly fostering the problem-solving skills (Maturana 2014). Regardless of the teaching model, the main purpose is to provide students with required design thinking knowledge and facilitate their development (Kim et al., 2015). Knowledge pools

from different disciplines are also used to create design projects (Nicol & Pilling 2005). The essence of design studios is to provide the designers of the future with creative thinking skills. In the context thereof, nature proves to be an important resource for both learning and teaching.

Recent empirical studies in the relevant literature reported that there was a positive correlation in the human brain between nature, the built environment, and creativity (Abdelaal & Soebarto, 2018), that getting closer to nature would have a positive impact on mind circulation and imagination (Williams et al., 2018), and encourage creativity (van Rompay & Jol, 2016), and increase productivity (Richerson & Boyd, 2008). As a matter of fact nature is a permanent source of inspiration for architectural and design aesthetics in many ways, especially in terms of form, concept, and structure (Van Eck, 1994).

Biophilic design is one of the most popular theories in the architectural literature, which aims to take advantage of the positive impact of nature on human beings. Biophilic design is not only associated with boosting creativity in individuals, but it also contributes to innovation in design (Zhong et al., 2022). Therefore, the incorporation of biophilic design theory into design education may help young designer candidates to develop creative and practical design proposals. This is because of the fact that biophilic design involves observing and examining nature, and understanding the characteristic compositional rules, and accordingly, it helps both students and practitioners with expanding and enriching their creative palettes (Joye, 2011). As an educational design education paradigm, biophilic design provides educators and students with an opportunity for cognitive and emotional restoration.

Another benefit of biophilic design in the curriculum of design education is to help educate environmentally-conscious designers. Previous studies suggested that individuals interested in and interacted with nature developed environmental awareness and exhibited more favorable ecological behaviors (Hartig et al., 2001; Hartig et al., 2007). Thus, biophilic design education is associated with an increase in the opportunities to experience biophilia and therefore, can reduce the process of disappearance of experience (Joye, 2011).
The present study hypothesized that young designers could produce more creative solutions if and when the biophilic design, which was known to have a significant contribution in the development of creative thinking skills, was included in design studies, and accordingly aimed to introduce biophilic design, emphasize its importance, and most importantly to investigate the correlation between this design theory and creative processes. A design studio process that blended biophilic design principles and traditional studio approach was designed with an aim to investigate whether and how the biophilic design encouraged, nurtured, and developed creativity in design studios. The scope of the study was limited to the 6th semester interior design studio.

2. Biophilic Design and Principles as a Source of Inspiration

Based on the human tendency to connect with nature (Kellert & Calabrese, 2015), biophilic design has attracted increased attention as a design philosophy in recent years (Gillis, & Gatersleben, 2015). Biophilic design is essentially a design approach that fosters inspiration from nature and promotes the use of natural elements and processes in the design of the built environment (Kellert, 2008). It has a positive effect on the health and well-being of users (Joye, 2007; Ryan, et al., 2014; Gray & Birrell, 2014). A wealth of previous studies also suggested that spaces designed pursuant to biophilic design principles significantly increased the performance and creativity levels of users (Sanchez et al., 2018; Bolten & Barbiero, 2020; Peters & D'Penna, 2020).

It was Kellert who first introduced the systematic principles of Biophilic Design approach in 2008, nevertheless, the most current and systematic study, which has become a design guide today, belongs to Browning and Ryan (2020). Browning and Ryan categorized the individuals' experiences of nature in the built environment under three titles; namely, Nature in the Space, Natural Analogues, and Nature of the Space.

Those classifications and sub-principles are detailed below:

- Nature in the Space: Based on the user's direct encounter with natural elements in the built environment.
- Visual connection with nature; a view of the systems, processes, and/or elements of nature,
- Non‐visual connection with nature; deliberate and positive references to auditory, tactile, olfactory, or other stimuli of nature,
- Non‐rhythmic sensory stimuli; stochastic and temporary connections with nature,
- Thermal and airflow variability; thermal values such as air temperature, relative humidity, etc. that mimic natural environments,
- Presence of water; experiences that allow seeing, hearing, and touching water,
- Dynamic and diffuse light; nature-like conditions with varying intensity and colors of changing light and shadow,
- Connection with natural systems; an awareness created upon seasonal and temporal changes of natural processes.
- Natural Analogues: Based on an indirect or symbolic experience of nature,
- Biomorphic forms and patterns; nature-specific contours, patterns, textures, and other symbolic references in that regard,
- Material connection with nature; minimal processing of natural materials, materials and elements reflecting local ecology and geology, and creating a distinctive sense of place,
- Complexity and order; rich sensory information based on spatial hierarchies similar to those found in nature.
- Nature of the Space: Reflection to the built environment of the spatial experiences that could be experienced in nature.
- Prospect; Unobstructed vision from a distance so as to perceive the environment and make decisions,
- Refuge; Places that enclose and surround the person so as to ensure getting away from the environmental conditions or the main activity flow,
- Mystery; partially obscured views and other sensory tools that encourage further exploration,
- Risk/peril; an identifiable threat in combination with reliable protection,
- Awe; stimuli that alter perception and include other biophilic patterns.

In the case of the design studio in question, the above-described principles of biophilic design were blended with design criticism, an integral part of traditional design education (Gunday Gul & Afacan, 2018) and a means the instructor resorts to communicate with students (Oh 2010; Oh et al. 2013).

3. Design Studio Case

The design studio case presented in this study is the 6th semester project of the interior architecture department of eight consecutive design studio courses.

The study was carried out during the spring semester, 2022-2023 academic year in the scope of the interior design studio VI (IMT302). The students were provided the plans and sections of a 24-classroom primary school building and asked to re-function that building. The aim was to provide that building with a new function, either a community center, a research center, or a student center. The building consisted of 4 floors and 6,400 square meters, including the basement. Three student groups with equal numbers were formed in the project course with a total of 21 students enrolled. Accordingly, seven students each were assigned to community center, research center, and student centers groups. Each student worked individually. The conference hall and the foyer area associated with the conference hall were included as mandatory spaces in each project. The 14-week detailed working process of the Design Studio is given in Table 1.

Week	Subject	Process
1	Introducing the project and the subject	**Instructor:** - Introducing the project and the design problem; - Lecture on the theoretical domain of the philosophic design approach and its principles, possible design approaches towards interiors, and exemplify by means of practical implementations; - Create student groups by subjects: Assign students to the community center, research center, and student center groups. **Homework:** - As regards subject assigned to them, an investigation of the buildings that incorporated biophilic principles in the design and the designs of leading architects in this field; - Create architectural programs that include spatial calculations upon user requirements; - Create the diagrams: Bubble, adjacency, and zoning diagrams; - Determine the nature-based concepts that would guide the design; - Color palette works in compliance with biophilic design; - Develop all the preparatory work into a presentation and present it openly to all students enrolled in the course.
2	Concept Formation	**Instructor:** - Assign preparatory work for the formation of the concept; **Homework:** - Make necessary developments in line with the assignments; - Suggestion of the concept; - Presentation of an A2-size concept sheet
3	Concept Development	**Instructor:** - Assignments regarding the concept sheet **Homework:** - Make necessary improvements in line with assignments; - Develop the concept in line with assignments.
4	Preliminary project studies	**Instructor:** - Explain to students possible applications of biophilic design-based approaches in spatial organization studies through examples. **Homework:** -1/200 Furnished “Spatial Organization Study” of the entire building -1/200 Two Sections (passing through stairs, doors, and windows)
5 6 7	Preliminary project studies	**Instructor:** **-** Correction of spatial organization studies. **Homework:** -1/200 Furnished “Spatial Organization Study” of the entire building -1/200 Two Sections (passing through stairs, doors, and windows)
8		**MIDTERM WEEK**

9	Selected Area: Preparatory Work	**Instructor:** - Based on biophilic design approach, an exemplary introduction to the spatial, visual, auditory, etc., attributes that which should be considered in the design of the conference hall and foyer area, which is determined as the selected area. **Homework:** - Research for natural materials that could be used in places with acoustic requirements; - Conduct research on biophilic-based spatial configurations of the conference hall and foyer area; -Investigate ergonomic requirements in the conference hall and foyer area; - Research for lighting elements that could be used in the conference hall and foyer area; - An investigation of biophilic-based furniture that could be used in the conference hall and foyer area; - Develop all the preparatory work into a presentation and present it openly to all students enrolled in the course.
10	Selected Area: Preparatory Work	**Instructor:** - Assign preparatory work for the selected area **Homework:** - Analyze the wall, floor and ceiling surfaces of the selected area together with furniture and draw 1/50 scale technical plans; - Draw 1/50 scale floor plan of the selected area; - Draw 1/50 scale ceiling and lighting plan of the selected area; - 3D modeling and rendering of the selected area.
11	Selected Area: Final Project Studies	**Instructor:** - Assign two- and three-dimensional work for the selected area **Homework:** - Analyze the wall, floor and ceiling surfaces of the selected area together with furniture and draw 1/50 scale technical plans; - Draw 1/50 scale floor plan of the selected area; - Draw 1/50 scale ceiling and lighting plan of the selected area; - 3D modeling and rendering of the selected area.
12	Selected Area: Final Project Studies	**Instructor:** - Assign two- and three-dimensional work for the selected area **Homework:** - Analyze the wall, floor and ceiling surfaces of the selected area together with furniture and draw 1/50 scale technical plans; - Draw 1/50 scale floor plan of the selected area; - Draw 1/50 scale ceiling and lighting plan of the selected area; - 3D modeling and rendering of the selected area. - Present the renders by placing them on the architectural elements sheet
13 14	Selected Area: Final Project Studies	**Instructor:** - Assign two- and three-dimensional work for the selected area **Homework:** - Analyze the wall, floor and ceiling surfaces of the selected area together with furniture and draw 1/50 scale technical plans; - Draw 1/50 scale floor plan of the selected area; - Draw 1/50 scale ceiling and lighting plan of the selected area; - 3D modeling and rendering of the selected area. - Present the renders by placing them on the architectural elements sheet

Table 1. Title of the table in sentence case.

The project was introduced to the students during the first meeting as can be seen in Table 1 above. This was followed by a presentation to the students about the biophilic design approach and principles, and possible interior design approaches. For the second week, the students were asked to make a research about the structures with biophilic principles incorporated in their designs and the designs of leading architects in this field, and in addition, to prepare diagrams and color palettes pursuant to biophilic principles, to identify concepts that overlap with the biophilic approach, and finally to prepare a concept sheet. The conceptual phase was completed by the end of the third week, and preliminary project studies were started at the fourth week. At that stage, the students started to work on the furnished spatial organization of the building assigned to them and weekly presented their work in 1/200 scale, both in terms of plan and section. During the furnished spatial organization work, the students were asked to include certain design features in their projects, especially with respect to the principles of biophilic design. Accordingly, the students were encouraged to use niches, semi-enclosed areas, cabins, and body wrapping elements in relation to the concept of refuge, where 'fluid and open design of interiors' and focus on the feeling of density established by lighting and materials and including wide openings' were suggested in relation to the prospect and awe concepts, respectively (Figure 1 and 2).

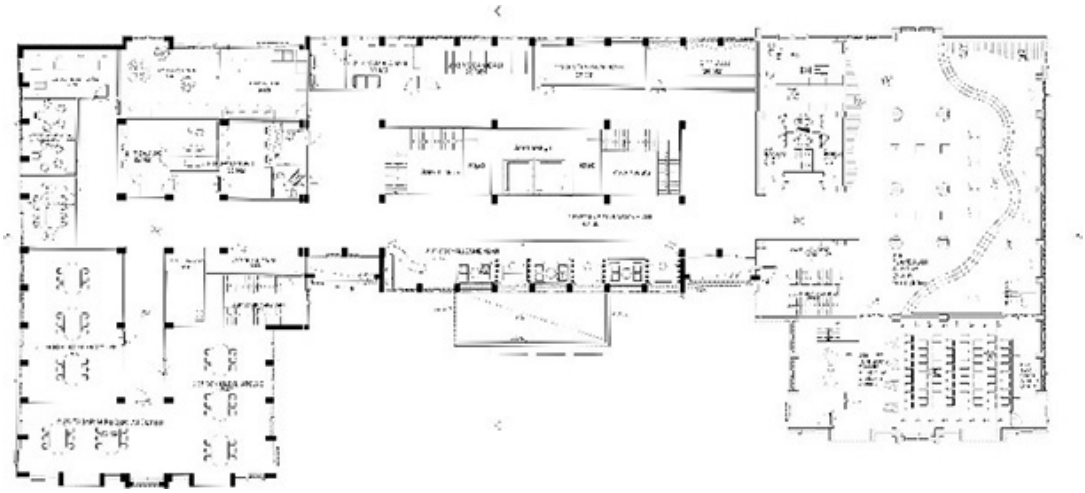

Figure 1. 1/200 scale furnished spatial organization work - conference hall and foyer area floor plan / by Sümeyra Durak, student.

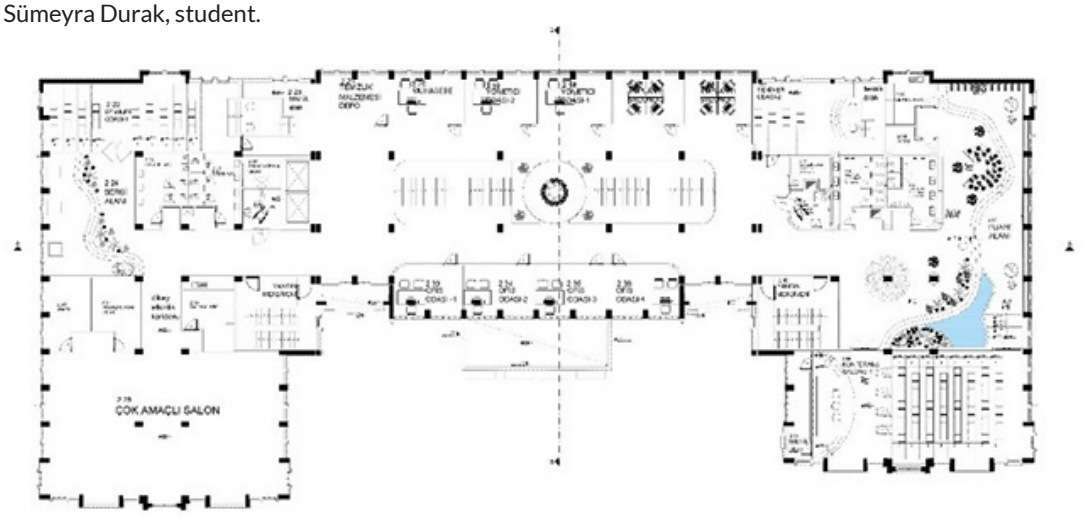

Figure 2. 1/200 scale furnished spatial organization work - conference hall and foyer area floor plan / by Betül Bolat, student.

Following the 1/200 scale spatial organization work, the students started the 1/50 scale plan and section work and simultaneously carried out three-dimensional modeling for the conference hall and foyer area, which was determined as the selected area. The students transferred their three-dimensional works to the architectural elements sheet. That sheet was organized so as to include all interior elements that fell under the responsibility of an interior architect. The sheet included sections relevant to main entrance, floor, ceiling, column, vertical surface, gallery, fronting (for the purposes of the project, foyer entrance), stairs, elevators, furniture, integrated interior design, and finally, school, studio, and student information (Figure 3).

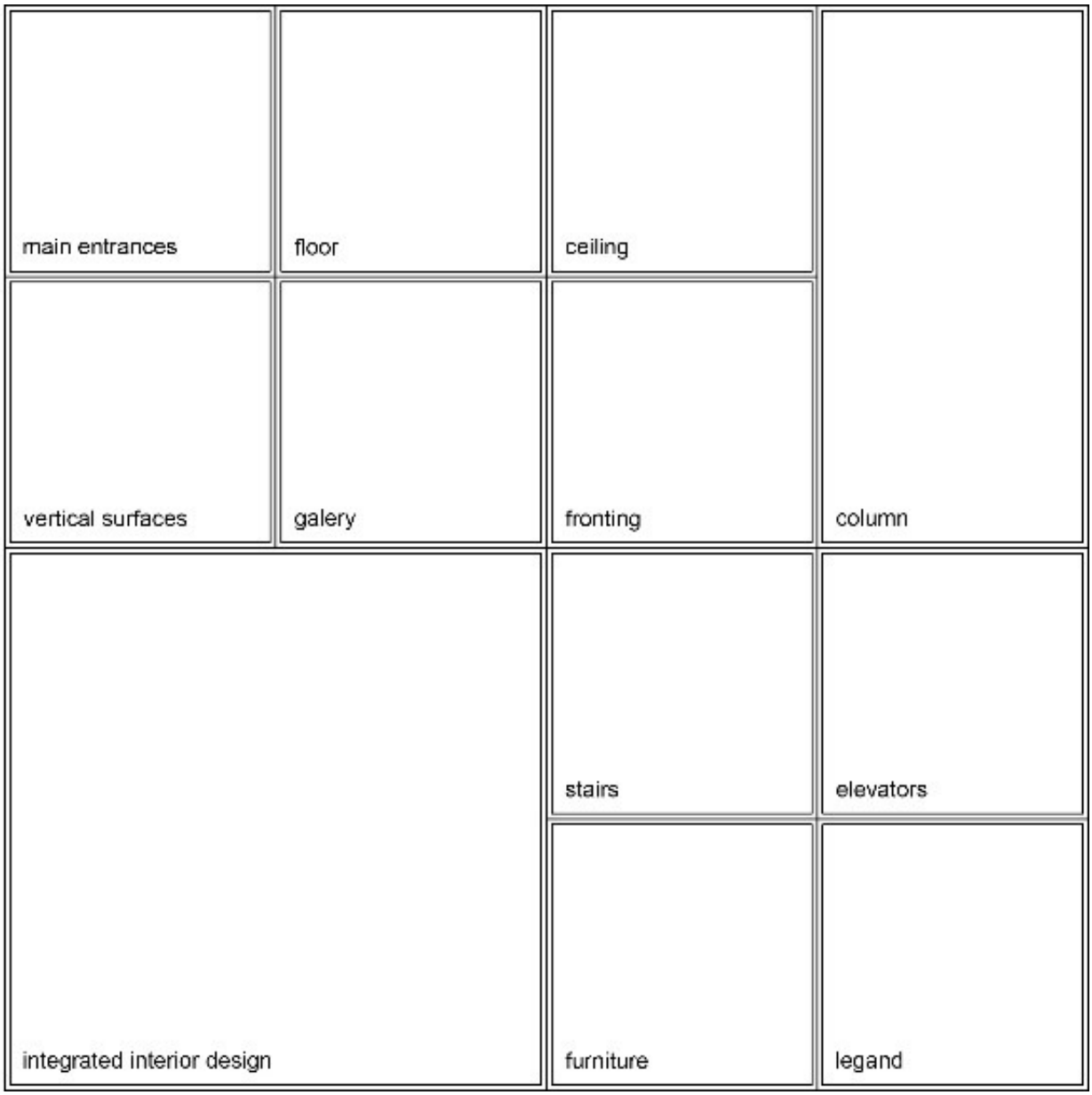

Figure 3. Architectural elements sheet

A group of students created their spatial organization upon inspiration from the fluid geometries of nature. Differences by level strengthened those geometries. The use of the material preserving its natural texture and earthy colors were considered an important parameter of the design. Planting elements were included and also small niches were designed where users could spend time alone whenever they wanted to do so. The fluid geometries of the ceiling and floor surfaces were overlapped (Figure 4 and 5).

Figure 4. Architectural elements sheet / research center design by Betül Bolat, student.

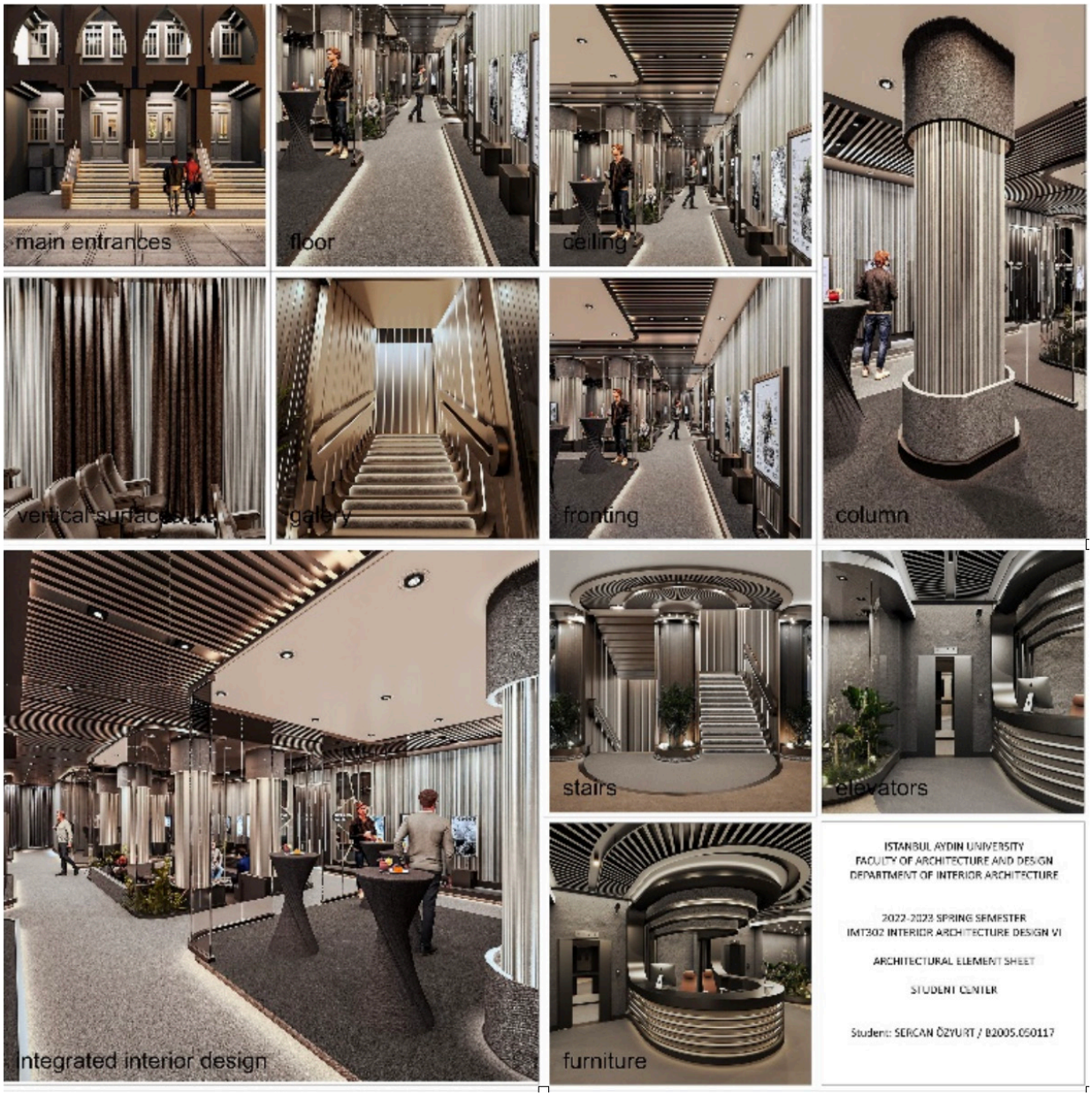

Figure 5. Architectural elements sheet / student center design by Sercan Özyurt, student

A group of students preferred linear designs. Guiding lines, modular layouts, and repeating geometries were the shared features of those projects. The students included colors and motifs similar to those in nature, tactile natural elements, plant elements, niches and furniture that wraps the body in their projects (Figure 6 and 7).

Figure 6. Architectural elements sheet / student center design by Berfin Yuksel, student

Figure 7. Architectural elements sheet / community center design by B. Kardelen Karaoz, student

Another group of students who chose linear designs came up with different approaches in their designs. For example, a student who set out with the theme of the ocean used colors and movements unique to the ocean in the interior design (Figure 8). Oceanic patterns and submarine ecosystems were prominent features in that student's design. Another student created interior vertical gardens, using the reflective surfaces of natural stones as a design input. A similar contrasting approach was also evident in colors thanks to the use of red versus green (Figure 8 and 9).

Figure 8. Architectural elements sheet / research center design by Yagmur Kansu, student

Figure 9. Architectural elements sheet / student center design by Yasemin Cosansu, student

4. Conclusion and Recommendations

The present study aimed to introduce the biophilic design theory and to show to what extent creativity could contribute to the learning and teaching processes upon incorporation of the theory in interior design education. Accordingly, the design outputs of the 6th semester interior design studio -on the basis of biophilic design principles- were used to investigate how biophilic design strategies nurtured and developed creative thinking skills.

It was observed during the workshop aimed to improve creative skills that the students found solutions for many problems that were not easy to solve by means of traditional design methodologies, and that they improved their creativity, thinking styles, and skills. Biophilic design provided the students with guidance not only as regards the problem-solving in design process, but also as regards expressing their ideas.

The students also developed new design strategies distinct from those of the previous 6th semester studio students and their own conduct in previous design studios. For example, students preferred spatial organizations that would increase visual communication in the interiors, included rich patterns of nature on horizontal and vertical surfaces, added vertical gardens or plant elements in the design, and made use of colors, textures, and motifs similar to those found in nature. Furthermore, they took special care to benefit from design principles such as rhythm, symmetry, balance, and harmony in their designs. The elements that the students designed with love and enthusiasm included visual folds, elevation differences, and small arrangements that created sudden surprises similar to those in nature.

Upon interviews held with the students at the end of the semester, the students reported that the biophilic design principles created both an artistic and protective sensitivity towards the natural environment, and they felt more creative.

As a result, nature is a milieu in which people benefit not only in physical but also spiritual terms. In addition to its healing power, nature is also characterized by aesthetic qualities. Based on benefiting from the healing power and aesthetic wealth of nature, biophilic design can make important contributions in developing creativity in the course of design education. It can also provide valuable guidance as to how creativity should be fostered in learning and teaching experiences. In the sense thereof, the inclusion of biophilic design in the design education curriculum would be beneficial for both the students and instructors. Although for centuries nature has been used as an aesthetic model for design, biophilic design has an important potential as a design education paradigm thanks to the fact that it has certain principles and a systematic. For example, biophilic design created a rich source of inspiration for interior architecture students, who were expected to design interiors that respected nature and were sensitive to human psychology, and to propose original and creative approaches in terms of design. Similarly, it offered a multidimensional teaching method for instructors, who aimed to provide students with creative skills as well as professional and technical skills.

Evidently, there are other rich and detailed design theories based on natural environment including green design and sustainable design etc. Nevertheless, unlike those approaches, biophilic design had groundbreaking power in terms of encouraging creativity, especially in interior architecture education. As a matter of fact biophilic design as a design theory is closely associated with certain scientific disciplines, including ecology, neuroscience, and evolutionary psychology etc. Consequently, in the modern world with increased environmental problems and with people on the brink of losing their connection with nature each day, the inclusion of biophilic design in the interior architecture education system will provide young interior architect candidates with important and rich perspectives not only in practice but also in theory.

Conflict of Interests and ethics

The author declares no conflict of interests.

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