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The Application of the Biophilic Design Approach for Student Apartment in Mataram City

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Abstract. Architects use the biophilic design approach to address housing challenges by incorporating nature into indoor spaces. This paper aims to offer solutions for comfortable housing that reduce the negative effects of global warming. The method includes identifying potentials and problems, conducting literature reviews, applying biophilic design principles such as natural lighting and ventilation, integrating indoor and outdoor spaces, and using natural materials. By applying these principles, the student apartment is designed to minimize energy consumption and create a healthy living environment.

Keywords: Biophilic, Comfortable, Healthy, Natural, Student Apartment

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INTRODUCTION

Background

In contemporary urban settings, residents continuously face threats such as pollution, convenient-driven lifestyles, and unhealthy environments. Rapid urbanization results in densely populated areas dominated by buildings and infrastructure development (Kaffah et al., 2020). This condition leads to a lack of green spaces in cities and limits city dwellers' interaction with nature, causing them to spend most of their time indoors.

Sontarigan (2017) posits that exposure to natural environments significantly enhances occupants' physical and psychological health, underscoring the vital need for nature-human connectivity. In this context, architectural solutions can play a pivotal role. Biophilic design, which integrates natural elements into building architecture, has been identified as having restorative impacts on occupants, fostering quicker recovery, healthier living conditions, and stress reduction (Syakhsyiyah, 2018). This design philosophy particularly applies to diverse building types, including student apartments.

A student apartment is a housing concept specifically designed as a residence for students in Mataram City. Mataram is the capital of West Nusa Tenggara Province, with a population of 449,259. The education sector in NTB has rapidly grown. According to Indonesia's Statistics (2023), there were 112,812 students in NTB in 2022, a 10% increase from 102,717 in 2021. Furthermore, according to Mataram's Statistics Bureau (2023), there were 98,426 students in Mataram City in 2021, meaning over 90% of NTB's students are in Mataram.

The interconnection between campuses and student housing is essential, particularly for students originating from distant locations. Typically, these individuals find accommodation in dormitories, leased quarters, or housing provided by the university (Sucipta et al., 2022). However, these accommodations are often used merely as places to

sleep, with students spending most of their time on campus or at social spots. This may be due to uncomfortable housing or the lack of facilities to support students' activities and needs.

Designing a student apartment close to the campus can solve some of the issues students face. Since the apartment is intended for students, construction and maintenance costs should be kept low to make the units affordable. Hence, the biophilic design, which extensively utilizes natural energy sources and enhances the connection between humans and nature, is applied. This aligns with students' roles as the next generation (iron stock) who are concerned about the environment. Biophilic design can help minimize energy use and operational costs (Iqbal, 2024), making it an ideal approach for designing this student apartment.

Design Purpose

To apply biophilic design principles in planning a student apartment to create comfortable and healthy housing while reducing energy use and operational costs.

LITERATURE REVIEW

Definition of Biophilic Design

According to Justice (2021), biophilic is an approach or concept architects use to solve housing problems by bringing nature into indoor spaces, providing psychological and physiological benefits for users. The application of biophilic design is not limited to "greening" buildings by adding plants inside. Still, it should serve as a solution to mitigate the negative impacts of global warming, allowing users to achieve physical comfort and improve their health (Amjad Almusaed, 2011, in Hadny Zakiyaturrahmah et al., 2017).

Principles of Biophilic Design

According to Karima et al. (2020), biophilic design encompasses two primary dimensions: organic and vernacular. Organic refers to forms that reflect the human-nature relationship, whether directly, indirectly, or symbolically, such as large windows connecting indoor spaces with nature. Vernacular refers to buildings or outdoor spaces that connect culture with the ecology of a geographical area, creating a certain atmosphere.

The biophilic design theory outlined by Terrapin in his book 14 Patterns of Biophilic Design includes several principles that can be applied to building design, divided into three main groups (Hadny Zakiyaturrahmah et al., 2017):

- *Nature in the space*, this principle relates to non-visual connections with nature, managing temperature and airflow, incorporating water elements, and connecting buildings with nature.
- *Natural Analogues*, this principle involves adapting natural elements into analogical or similar forms in design. These analogies, including biomorphic forms, patterns, and natural materials, are developed and applied to buildings.
- *Natural of the Space*, this principle explains the spatial qualities, allowing users to feel a natural ambience. It includes perspectives such as a sense of freedom and protection from disturbances.

Furthermore, according to Kellert et al. (2009) in Sumartono (2015), biophilic design has six main elements: environmental features, natural forms, patterns and processes, light and space, spatial relationships, and human-nature evolutionary connections.

Definition of an Apartment

The term "apartment" originates from the United States and refers to a building used as a residence with dozens to hundreds of individual units. According to the Indonesian Dictionary (KBBI), an apartment consists of bedrooms, a bathroom, a living room, and other spaces on one floor of a building. Student apartments are equipped with facilities that support student activities. According to De Chiara (2001) and Puspitasari et al. (2022), standard apartment units consist of bedrooms, living rooms, bathrooms, and kitchens, with external facilities such as sports amenities and parking lots.

For student apartments, several planning criteria apply, including site selection, area zoning, space layout, and building facilities (Alfithor et al., 2020). However, apartment residents often lead individualistic, work-focused lives with minimal social interaction (Santoso, 2017), possibly due to the lack of communal spaces or amenities that promote interaction.

METHODOLOGY

The methodology used in the concept development of this design includes:

- Exploration, mapping the potential and challenges of student housing.
- Data collection through literature studies, biophilic design reviews, and precedent studies.
- Review of biophilic design principles: nature in the space, natural analogues, and natural of the space.
- Design analysis, processing the collected data to develop functional programs, user analysis, facility identification, and biophilic design applications.
- Architectural analysis, translating functional and performance programs into designs through site analysis, spatial requirements, building form analysis, and biophilic design integration.

RESULTS & DISCUSSIONS

Analysis

Site Analysis

The site is located on Jalan Gajah Mada, Pagesangan Barat, Mataram District, Mataram City, with an area of 6,480 m². According to Mataram City's Regional Regulation No. 5 of 2019, the space intensity for the trade and services zone has a maximum building coverage ratio (BCR) of 70% and a minimum green space ratio (GSR) of 20%. Therefore, to support the biophilic principle of "nature in the space," which focuses on the integration of outdoor and indoor spaces, as well as the "natural of the space" principle, which emphasizes creating a sense of connection with nature, a GSR of 30% will be used.

Sunlight Analysis

One of the biophilic design principles, "nature in the space," regulates lighting inside the building. Figure 1a illustrates the sun's movement, rising in the east and setting in the west. In the morning, maximum light comes from the site's east side, providing direct sunlight. In the afternoon, the entire site will be exposed to direct sunlight. By evening, intense sunlight comes from the west. To optimize natural lighting and prevent excessive heat, the building's longest side and openings are oriented north-south, in line with the sun's movement and biophilic design principles.

(a) (b)

FIGURE 1. Micro-climate Analysis (a) Sun Path Movement on the Site, (b) Wind Movement on the Site

Wind Analysis

In addition to lighting, the biophilic principle of "nature in the space" also regulates ventilation. Figure 1b shows that the strongest winds come from the southeast, east, and northeast. To enhance airflow, the building masses will be spaced apart, allowing wind to circulate freely between the structures.

View Analysis

Views on the site are essential to integrating outdoor and indoor spaces, a key aspect of the biophilic design principle "nature in the space." Figure 2 shows the site's positive and negative views. The area lacks green open spaces (GOS) for natural scenery, with the surroundings comprising Jalan Gajah Mada, the UIN Campus, shops, and residential areas. To address this, a central green space in the form of a park will be created, offering a natural view and an outdoor seating area accessible to all residents.

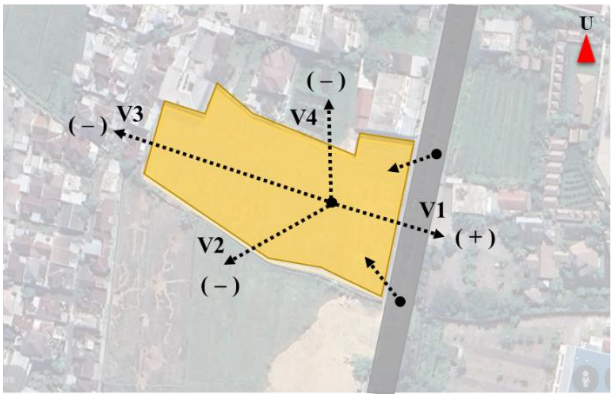


FIGURE 2. Positive and Negative Views on the Site

Building User Analysis

According to Relia (2018), users of the student apartment building can be grouped based on their activities, consisting of residents, management, and visitors.

- Building residents, i.e., students renting apartment units and who have access to all available facilities.
- Building management, i.e., staff responsible for the building's management and maintenance.
- Building visitors, i.e., people who visit the building.

Space Requirements Analysis

- *Main Zone Space*, includes studio-type units and two-bedroom units,
- *Public Facilities Zone Space*, includes lobby, communal room, cafeteria, minimarket, prayer room, fitness room, and restrooms,
- Management Zone Space, includes staff room, pantry, laundry room, mechanical room, cctv room, fire control center (FCC), storage, and restrooms,
- Parking Zone Space, includes resident parking, management parking, and visitor parking.

Space Relationships Analysis

The total area required for this design is shown in Table 1 below. This total area includes the total floor area of the building, excluding the corridors, and does not include open spaces or garden areas. The built area of the ground floor is 4,788 m², and the green open space (GOS) or landscape area is 2,052 m².

TABLE 1. Space Requirements

Space Zone	Total Area
Main Zone	5.856 m^2
Management Zone	195 m^2
Public Facilities Zone	400 m^2
Service Zone	1.420 m^2
Total	**7.871 m^2**

Concept

Site Zoning Concept

The site's zoning follows the biophilic design element "nature in the space," which emphasizes integrating outdoor and indoor areas, as seen in Fig. 3. To maximize public open space, zones will be strategically placed. Additionally, building placement will consider the distance from the road to minimize noise.

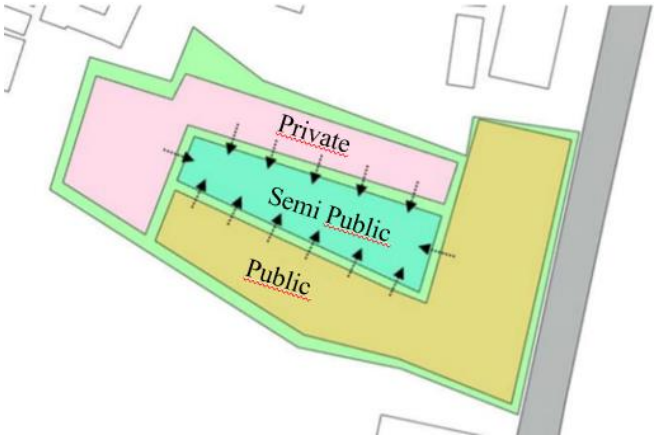
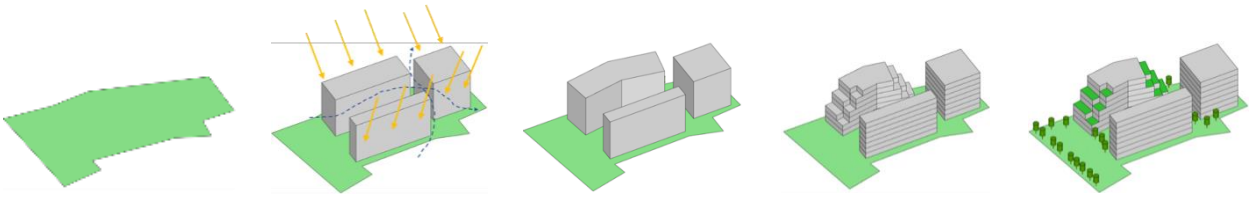


FIGURE 3. Site Zoning

Massing Concept



(a) (b) (c) (d) (e)

FIGURE 4. Shape Transformation (a) Building Site, (b) Stage 2 Transformation, (c) Stage 3 Transformation, (d) Stage 4 Transformation, (e) Stage 5 Transformation

Figure 4 illustrates the transformation of the site's initial form into the final building mass, which aligns with biophilic design principles. Figure 7b shows Stage 2, where the massing is arranged according to the established zoning, consisting of three forms. This stage incorporates the biophilic design principle of "nature in the space," focusing on ventilation and lighting. As a result, the building mass is spaced apart to facilitate air circulation and designed to be slender to allow direct sunlight into the apartment units. Therefore, each apartment unit will be equipped with openings in the form of windows to provide access to natural light and ventilation, as shown in Fig. 5.

FIGURE *5*. Apartment Bedroom

In Stage 3 (Fig. 4c), one of the forms transforms to conform to the site's shape, maximizing the central area of the site designated as green open space (GOS). The green open space (GOS) will be located at the center of the site, featuring a garden and seating area designed with organic circular shapes to reflect the biophilic principle of natural analogues, as seen in Fig. 6.

FIGURE *6*. Garden and Seating Area

In Stage 4 (Fig. 4d), one of the forms is partially removed, creating varying volumes on each floor to establish an outdoor communal area with scenic views. Figure 7a illustrates this outdoor communal area, accessible via the corridors and designed for all residents. It includes several plants to enhance the natural atmosphere and provide a pleasant view.

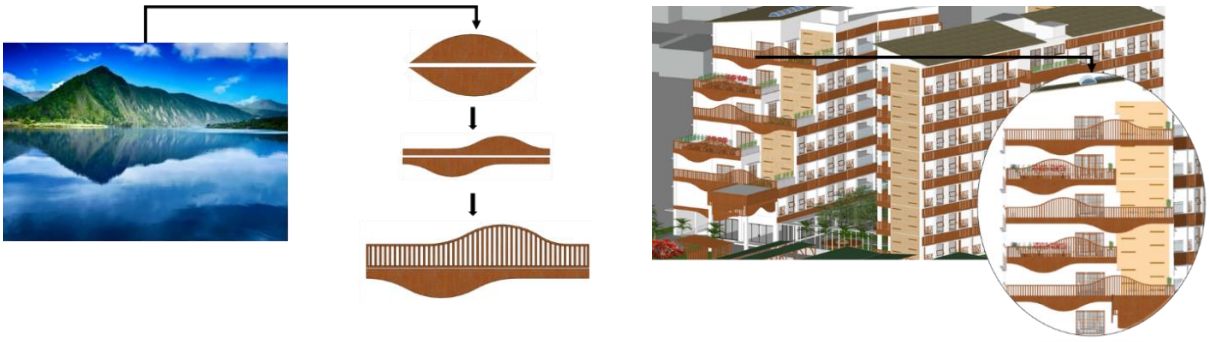
(a) (b)

FIGURE *7*. Communal Area, (a) Outdoor Communal Area, (b) Indoor Communal Area

In Stage 5 (Fig. 4e), the final massing is presented, integrating both indoor and outdoor spaces. Along with the outdoor communal area, an indoor communal space is also provided, following the biophilic principle of "nature of

the space." As shown in Fig. 7b, plants are incorporated to create a natural atmosphere within the building, serving as partitions for the communal space and lobby.

Building Appearance Concept



(a) (b)

FIGURE *8*. Building Facade, (a) Design Concept, (b) Final Design

The facade incorporates the biophilic design principle of "natural analogues," with organic forms resembling mountains and their reflections (Fig. 8a). Mountains were chosen because they symbolize grandeur, rising high above their surroundings. In line with the design concept of this apartment, which consists of seven floors, it will stand out prominently compared to the surrounding buildings (1 to 4 floors). Figure 8b shows the facade positioned at the front of the building, offering a clear view of the site as it faces the road. This natural analogue principle is also applied to the balcony railings (Fig. 9), which feature irregular lines resembling tree branches.

FIGURE *9*. Balcony Railing

CONCLUSION

Based on the analyses conducted in the previous chapters, the author concludes the following points:

- Biophilic design can enhance user comfort by using openings in the room units for access to natural light and ventilation (nature in the space). Additionally, earth-tone colours that are associated with nature and the addition of plants in indoor spaces help create a natural impression (natural of the space).
- Several interior and facade elements in this design use organic and dynamic forms, characterized by curved lines that align with the biophilic design element of natural analogues.
- Since this design targets students as its users, site selection must consider location suitability, accessibility, surrounding supporting facilities, and land availability.
- The student apartment design will include both indoor and outdoor communal spaces for socialization, as well as other supporting facilities such as a lobby, canteen, minimarket, and fitness room.

REFERENCES

1. Alfithor, M. J., Hardiyati, S., & Peningkatan, A. (2020). Penerapan Karakter Millennial Pada Konsep Perancangan Apartemen Mahasiswa Di Purwokerto. Dalam Juli (Nomor 2). https://jurnal.ft.uns.ac.id/index.php/senthong/index
2. Badan Pusat Statistik Kota Mataram Bps-Statistics Of Mataram Municipality Kota Mataram Dalam Angka Mataram Municipality In Figures. (2023).
3. Hadny Zakiyaturrahmah, A., Nugroho, R., & Pramesti, L. (2017). Penerapan Teori Biophilic Design Dalam Strategi Perancangan Sekolah Alam Sebagai Sarana Pendidikan Dasar Di Karanganyar.
4. Iqbal, M. M. (2024). *Perancangan Pasar Induk Singaparna dengan prinsip bioklimatik* (Doctoral dissertation, Universitas Islam Indonesia).
5. Justice, R. (2021). Konsep Biophilic Dalam Perancangan Arsitektur. Dalam Jurnal Arsitektur Arcade (Vol. 5, Nomor 1).
6. Kaffah, M. F., Firzal, Y., & Susilawaty, M. D. (2020). Penerapan Prinsip Biophilic Design pada Perancangan Apartemen Soho di Kota Pekanbaru. *Jurnal Arsitektur ALUR–Vol*, *3*(1).
7. Karima, M., Firzal, Y., & Faisal, G. (2020). Penerapan Prinsip Desain Arsitektur Biofilik Pada iau Mitigati n And isaster Management Center. Arteks : Jurnal Teknik Arsitektur, 5(2), 307–316. https://doi.org/10.30822/arteks.v5i2.448
8. [8] Puspitasari, E., Wulandari, A. P., & Purwantiasning, A. W. (2022). Kajian Tipologi Pola Ruang Hunian Vertikal Untuk Mahasiswa Di Margonda Depok Studi Kasus : Apartemen Taman Melati Margonda 2 Depok 1 (Vol. 03, Nomor 01). Http://Journal.Uib.Ac.Id/Index.Php/Jad
9. Relia, D. (2018). Student Apartment In Seturan Yogyakarta With Biophilic Design Approach.
10. Santoso, S. A. (2017). Komunikasi Interpersonal Antar Penghuni Apartemen Puncak Bukit Golf Dalam Membangun Hubungan Persahabatan. Jurnal e-Komunikasi, 5(2).
11. Sontarigan, F. (2017). Panduan Desain Arsitektur dengan Pendekatan Biophilic Design pada Bangunan Perkantoran.
12. Statistik Indonesia 2023. (2023).
13. Sucipta, A., Muflih Nasution, A., & Rambe, Y. S. (2022). Penerapan Arsitektur Hijau Pada Perancangan Apartemen Mahasiswa Di Medan. Jurnal Arsitektur Terracotta |, 3(3), 149–159.
14. Sumartono. (2015). Prinsip – Prinsip Desain Biofilik
15. Syakhsyiyah, A. Q. (2018). Cancer Care Center Di Umbulharjo, Yogyakarta Perancangan Bangunan Yang Menyehatkan Terhadap Psikologis Pasien Kanker Melalui Pendekatan Biofilik