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DESIGNING A HIGH SCHOOL IN MEDAN CITY WITH THE APPLICATION OF BIOPHILIC ARCHITECTURE

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Abstract
The design of this high school is a strategy to improve the educational infrastructure in order to produce excellent students. The research method used is descriptive data collection. This method involves collecting, reviewing, and analyzing literature studies relevant to the design topic. A literature study was conducted by conducting a comparative study of several buildings to gain an in-depth understanding of the High School. This high school uses the Biophilic architectural theme to create a better environment that is conducive to the health and well-being of its users and supports the excellent curriculum applied to the school to be designed. Biopilik can be reflected in the physical form of the building and its natural environment. The results show that the application of the concept can be taken from several examples with visible design success, achieving a good concept with a relevant theme as well as possible in order to achieve a building that realizes activities optimally for its users.

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biophilic architecture, curriculum support, health and well being, high school, Medan City

1. Introduction

Everyone Needs Education. Education is a conscious and planned effort to create a learning atmosphere and learning process so that students can actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves and society (SISDIKNAS Law No.20 of 2003).

Senior High School (SMA) is a secondary education level in formal education that is carried out after completing basic education in the form of Elementary School (SD) or equivalent and Junior High School (SMP) or equivalent. This secondary education is taken over a period of 3 years, starting from Grade 10 to Grade 12 with students who are generally aged 15-18 years.

According to the Central Bureau of Statistics (BPS), there were 1,074 schools, 24,285 teachers, and 385,619 students in North Sumatra in 2020/2021. Medan City is a large city with a population of 2,494,512, including 190,263 children between the ages of 15 and 19. In Medan City alone, the number of senior high schools (SMA) in 2020/2021 reached 221 schools, with 4,488 educators and 70,799 students (BPS Kota Medan).

Learning activities at the Senior High School (SMA) are determined by the curriculum that is applied at the school. Which, Curriculum is a plan or arrangement about the objectives, content, and learning materials as well as the methods used by schools as guidelines for organizing learning activities in achieving certain educational goals.

In Planning and Designing this School Building will later use the concept of Biophilic Architecture Because, it can provide a number of significant benefits for the learning experience and well-being of students and teaching staff. The application of biophilic architecture to school buildings not only creates a better physical environment, but also supports the holistic development of students in terms of academic, social, emotional, and environmental.

Biophilic architecture is a building design approach that emphasizes the integration of natural and environmental elements into the built space. The concept is based on the understanding that humans have a natural attachment to nature, and spending time in environments that reflect natural elements can provide a range of wellbeing and productivity benefits. Biophilic architecture incorporates elements such as plants, water, natural light,

natural stone and organic textures into building design. The ultimate goal is to create an environment that stimulates the senses, calms, and provides an emotional connection between humans and nature.

Besides Theme, Location is also one of the things that must be considered. If the location and function of the building are not well integrated, the building may not be optimal in providing the desired services, inhibit visual, social, and cultural connections between the building and its surroundings, cause conflicts with zoning regulations, spatial planning, or local development regulations, and can cause difficulties in accessibility. Therefore, the planning and design of this school will be located in Medan City due to its environmental location that is in accordance with the function of the building to be designed.

2. Literature Review

2.1 Senior High School

According to Constitution No.2 of 1989, a school is a tiered and continuous educational unit to organize teaching and learning activities. The Senior High School is the level of secondary education in general education in Indonesia which is carried out after taking basic education in the form of Elementary School and Junior High School.

Senior High School Education Services, Technically carried out by an Education unit that specifically provides its services to Senior High Schools. Based on its organization, the Senior High School Education Unit can be divided into 3 types.

- State Senior High School : Education units organized by the government,
- Private Senior High School : Education units organized by the community,
- SMA Cooperation Education Unit : Education Unit organized by a cooperation institution between a foreign party and an Indonesian party.

One senior high school has a minimum of 3 study groups and a maximum of 27 study groups.

2.1 Biophilic Architecture

Biopholic Architecture is an architectural concept that aims to create an architectural space between humans as users and the natural environment, so that users can gain psychological and material satisfaction. The concept is based on the understanding that humans have a natural attachment to nature, and spending time in an environment that reflects natural elements can provide a range of wellbeing and productivity benefits. Biophilic architecture incorporates elements such as plants, water, natural light, natural stone and organic textures into building design. The ultimate goal is to create an environment that stimulates the senses, calms, and provides an emotional connection between humans and nature.

Architectural concepts, based on their implementation, include three main design patterns that are divided into 14 Design Principles (William, Catherine Ryan, Joseph Claney, 2014), including:

	Principles of Design	Description
	Visual connection with Nature	Human and nature interaction through vision is directly linked to natural elements, living systems and natural processes.
	Non-Visual Connection with Nature	The interaction of humans and nature using hearing, smell, touch, and the stimulation of the sense of taste, which results in tranquility with natural elements, living systems and natural processes.

Nature in Space	Non-Rhythmic Sensory Stimuli	A short-lived relationship with nature that can be analyzed statistically but cannot be predicted with precision.
	Thermal / Airflow Variability	Creates a subtle change in air temperature, relative humidity, airflow across the skin and surface temperature that mimics the natural environment.
	Presence of Water	conditions that create an experience of a place through seeing, hearing or touching water.
	Dynamic and Diffused Light	Utilize various light intensities and shadows that change over time to create conditions that occur in nature.
	Connection to Natural Systems	Awareness of natural processes, especially the seasonal and temporal changes characteristic of a healthy ecosystem
Natural Analogues	**Principles of Design**	**Description**
	Biomorphic Forms and Patterns	Awareness of natural processes, especially the seasonal and temporal changes characteristic of a healthy ecosystem.
	Material Connection to Nature	Materials and elements from nature that are minimally managed, reflect the local or geological environment and create a distinct sense of place.
	Complexity and Order	Information acquired by complex sensory abilities, embracing spatial notions similar to those found in nature.
Nature of The Space	**Principles of Design**	**Description**
	Prospect	A free view over a distance, for surveillance and planning.
	Refuge	A place for withdrawal from environmental conditions or the main flow of activity where individuals are protected from behind and above the head.
	Mystery	A space with a good state of mystery has a sense of anticipation, or a seductive nature, offering a sense of rejection of sorts and will compel one to further investigate the space.
	Risk / Peril	A threat can be identified along with reliable protection.

Source : 14 Patterns of Biphilic Design
https://www.terrapinbrightgreen.com/wp-content/uploads/2014/09/14-Patterns-of-Biophilic-Design-Terrapin-2014p.pdf

3. Methodology

Discusses the methodology of applying Biopholic Architecture to secondary school buildings. It includes the method of site selection, the steps that need to be followed in designing, and obtaining the necessary data. Site selection for school design involves the consideration of several important factors. The following are some of the factors that are usually considered in site selection: Accessibility, Safety, Surrounding Environment, Land Availability, Land Infrastructure and Facilities and Resource Availability.

4. Result and Discussion

4.1 Project Description

The title of this project is Application of Biophilic Architecture High School in Medan City. In this design, the building has a function as a fulfillment of educational needs that are able to provide services and facilities as well as educational facilities.

Source : Google earth, 2023

Based on the analysis of several locations that have been carried out by the author, this location is the most appropriate location because it has fulfilled the location criteria in this design. The design location is on the road of Air Transportation, Suka Damai, Kec. Medan Polonia, Medan City. with Fisk Data is as follows:

1. Project Case: High School
2. Project Status: Fictitious
3. Land Area used: 2000 m2 / 2 Ha
4. Contour : Flat

4.2 Area Boundaries

The boundaries of the area in the design of this high school are as follows:

1. North: Commercial

Source : Google earth, 2023

2. East : Residential

Source : Google earth, 2023

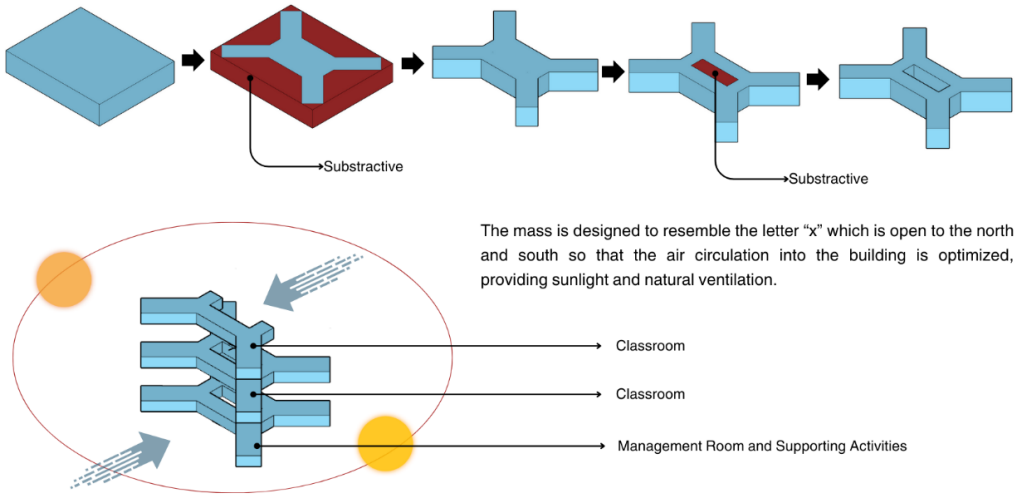
3. South: Vacant Land

Source : Google earth, 2023

4. West: Residential

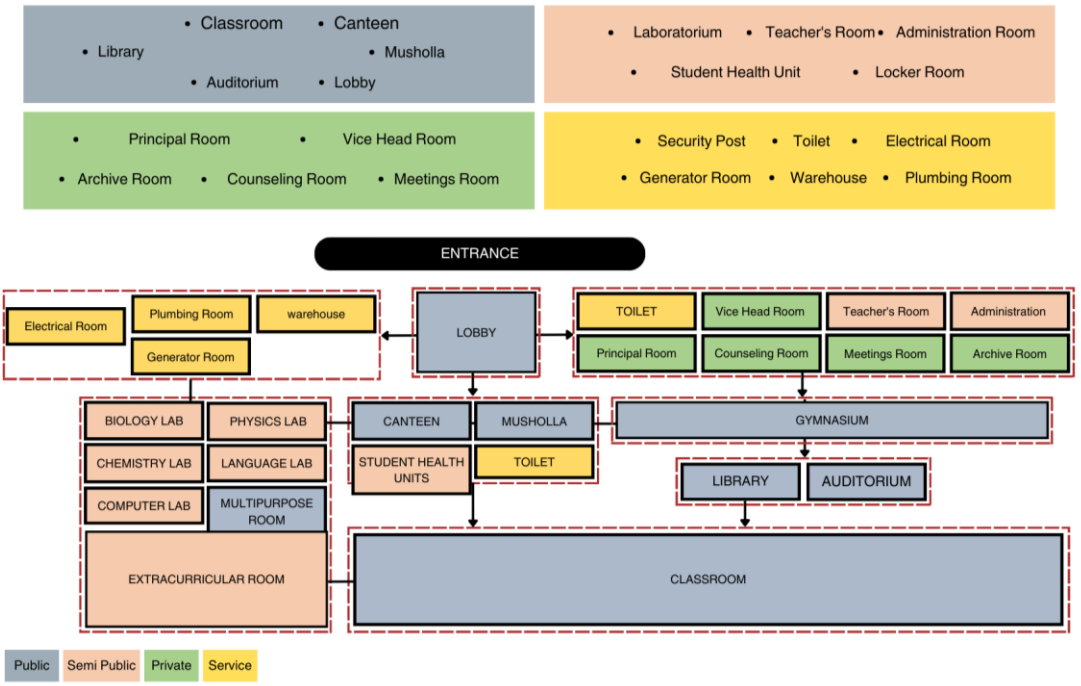
Source : Google earth, 2023

4.3 Form/Mass Concept



Source : Author, 2023

4.4 Zoning



Source : Author, 2023

4.5 Program Space

Activity grouping consists of educational activities, management activities, incidental activities, service activities and supporting activities. The determination of the amount of space in this designed building uses references from architectural standards such as:

1. Architect Data (DA)
2. Neufert's Arcshitect Data (NAD)
3. Regulation of the Minister of Education and Culture (PERMENDIKBUD)
4. Time Saver Standart of Building Types (TSS)
5. Personal Assumption (AP)

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Space Requirements	Amount	Capacity	Size Standard	Calculations	Total	Source
Classroom	21	21 Persons	2m^2/ persons	(21x21x2)+30%	1.150 m^2	PERMENDIKBUD
Library	1	300 Persons	1.3m2/ persons	(1x300x1.3)+30%	507 m2	DA
Biology Lab	1	21 Persons	2.4m2/ persons	(1x21x2.4)+30%	66 m2	PERMENDIKBUD
Physics Lab	1	21 Persons	2.4m2/ persons	(1x21x2.4)+30%	66 m2	PERMENDIKBUD
Chemistry Lab	1	21 Persons	2.4m2/ persons	(1x21x2.4)+30%	66 m2	PERMENDIKBUD
Computer Lab	1	21 Persons	2m2/ persons	(1x21x2)+30%	55 m2	PERMENDIKBUD
Language Lab	1	21 Persons	2m2/ persons	(1x21x2)+30%	55 m2	PERMENDIKBUD
Multipurpose	2	100 Persons	1.3m2/ persons	(2x100x1.3)+30%	338 m2	DA
Auditorium	1	700 Persons	1m2/persons	(700x1)+30%	910 m2	DA
Principal's Room	1	4 Persons	5m2/ persons	(1x4x5)+30%	26 m2	TSS
Vice Head Room	3	4 Persons	5m2/ persons	(3x4x5)+30%	78 m2	TSS
Teacher's Room	1	21 Persons	5m2/ persons	(1x21x5)+30%	136 m2	PERMENDIKBUD
Administration Room	1	5 Persons	4m2/ persons	(1x5x4)+30%	26 m2	PERMENDIKBUD
Archive Room	1	3 Persons	2m2/ persons	(1x3x2)+30%	8 m2	AP
Counseling Room	1	5 Persons	2m2/ persons	(1x5x2)+30%	13 m2	DA
Meeting's Room	1	40 Persons	2m2/ persons	(1x40x2)+30%	104 m2	DA
Toilet	16	1 Persons	2m2/ persons	(16x1x2)+30%	42 m2	PERMENDIKBUD
Warehouse	1	2 Persons	18m2	(1x2x18)+30%	47 m2	PERMENDIKBUD
Security Post	2	2 Persons	4m2/ persons	(2x2x4)+30%	21 m2	AP
Generator Room	1	2 Persons	6x4.5m2/gens	1x2x(6x4.5)+30%	72 m2	AP
Canteen	1	200 Persons	1.3m2/ persons	(1x200x1.3)+30%	338 m2	AP
Electrical Room	1	-	6m x 5m	(6m x 5m)+30%	40 m2	AP
Plumbing Room	1	-	6m x 5m	(6m x 5m)+30%	40 m2	AP
Lobby	1	100 Persons	1.1m2/ persons	(1x100x1.1)+70%	187 m2	DA
Locker Room	21	20 Persons	2m2/ persons	(21x20x2)+30%	1.092 m2	AP
Student Health	1	2 Persons	3 x 4 m2	2x(3x4)	24 m2	PERMENDIKBUD
Musholla	1	200 Persons	0.85m2	(200x0.85)+30%	221 m2	NAD
TOTAL						1.524 m^2

Source : Author, 2023

4.6 Theme Implementation

1. Visual Connection with Nature

Presenting a garden on each floor of the building and also a green house because students not only learn in the classroom, but also outside the classroom. The green house id presented to support the school curriculum so that students know about the process of plant, growth, plant life cycle, ecosystem interactions, and the importance of environmental conservation.

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Source : https://agroteknologi.umm.ac.id/id/pages/greenhouse.html

2. Material Connection With Nature

a. Use of wall and floor materials in the building

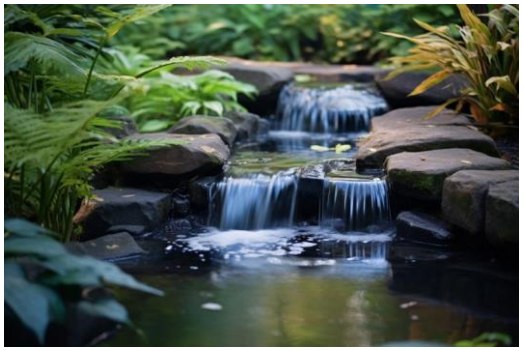
Source : https://depositphotos.com/photos/natural-stone-material.htmlUse of color on the building

b. Use of color on building

Source : https://amywax.com/nature-color-palettes-looking-to-our-planet-for-color-inspiration/

3. Presence of Water

This principle is about enhancing the human experience through the sight, sound and touch of water. The presence of water creates positive emotions such as less stress, more calmness and lower blood pressure.



Source : https://biophilicflair.com/the-role-of-water-features-in-creating-tranquil-biophilic-spaces/

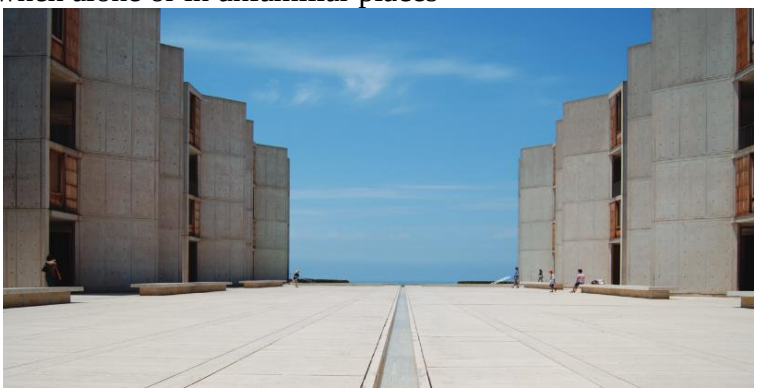
4. Thermal & Airflow Variability

Exposure to natural factors such as adequate ventilation and light is biologically important.

Source : https://www.researchgate.net/figure/a-b-The-benefits-of-thermal-and-airflow-variability-Faelledgarden-Nursing-Home-in_fig4_352231560

5. Prospect

Well-designed Prospect space feels open and private, but also A sense of security and control, especially when alone or in unfamiliar places



Source : https://www.terrapinbrightgreen.com/wp-content/uploads/2014/09/14-Patterns-of-Biophilic-Design-Terrapin-2014p.pdf

5. Conclusion

References use Vancouver style with numbering order as follow:

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