Application of Behavioral Architecture Concept on Space Order Natural Laboratory

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Abstract. Elementary school natural laboratory is one of the learning facilities for students to produce a quality learning process. The laboratory is also a place for teaching and learning through practicum methods that interact and observe with living things directly. This natural laboratory is designed with a spatial layout based on the concept of behavioral architecture. The location of this research in Nation Star Academy Elementary School, Surabaya. Natural laboratories are very important in supporting Science subjects so that teachers can be optimal in explaining natural science in real terms. The research method used are qualitative and analytical. The data used in these methods consist of literature studies, interviews, observations of similar objects, and documentation. The result of this research is the design of a natural laboratory as a support for Elementary School Science subjects with the concept of behavioral architectural design in space order laboratory, which directs user behavior in achieving more ergonomic and efficient space requirements.

Keywords: Natural Laboratory, Space Order, Behavioral Architecture

1   Introduction

A laboratory is a place where experiments and investigations are carried out [5]. The laboratory is needed as a place to learn to provide real experiences for students and a means of supporting learning activities. A place considered laboratory when the place is used to train students in practical skills, demonstrations, experiments, research, and knowledge taking. The contest laboratory not only aims to improve the theory, but students can find knowledge own [3]. Laboratorium alam perlu dilakukan perencanaan dan perancangan supaya berfungsi secara optimal. The main aspects in planning and design are planning and designing form, space, and order. Form is an inclusive term which has several meanings, can refer to an external appearance that can be recognized or it can refer to a special condition. Space is spatial boundaries defined by the elements of form. An order is a systematic arrangement of interdependent parts into a single coherent unit that works as a whole.[2]

The laboratory can be in the shaped of an open space laboratory and a closed space laboratory. Closed space laboratory can shaped space or bounded the wall , while laboratory open space can be garden school , forest , a river or another neighborhood that can be used as a source of learning [15]. So that garden can be used as equipment permanently existing in unity laboratory school. Garden is completeness the natural laboratory with components community the life of it as , herbs , an animal , fungi , stone , and other organisms being closely jointed to chemistry environment directly or indirectly. Garden as media suggested the natural laboratory meet some principle namely; the garden must be able to function as an open space laboratory,

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so that chemical observation activities can be carried out; gardens must be able to become lungs that are able to neutralize air pollution, and psychological aspects / places for refreshing; gardens can provide a comfortable and beautiful feeling to the environment [7].

Based on the 2007 Natural Science Laboratory Management and Utilization Guidelines, the layout of the science laboratory can follow the pattern, namely; (1) the direction of the laboratory to the environment, namely north-south. The location is related to the amount of sunlight entering the window layout; (2) The area and type of laboratory space consists of; (1) Learning room, the minimum space area can accommodate one study group, with each student 2.4m2 / student. For a laboratory with a capacity of 40 students, an area of 96m2 is required, while for a minimum area of less than 20 students, the minimum area of laboratory space is 48m2. The minimum width of the laboratory room is 5m. The shape of the laboratory room should be square, to facilitate communication between teachers and students; (2) Preparation room, a room where teachers and laboratory assistants make preparations before learning activities. The minimum area for the preparation room is 18m2; (3) Storage Space. This room is used to store unused tools, equipment and materials, with a minimum area of 20m2 (5 x 4m) for storing a cabinet filled with chemical substances; (4) Dark room. Used to do photo processing or for other experiments that must be free of light; (5) Room or table to weigh. Based on the space requirements above, not the entire room is used, because in this study it is adjusted to the space requirements in the natural laboratory which are semi-closed space and open space. The laboratory space required is a learning room and garden.

The natural laboratory design and planning approach needs to use an architecture of environmental behavior, which in its application relates to human (social) and environmental (physical) relationships, which causes humans to behave differently in one setting (space). [5]. The principles of the theme of behavior that must be able to communicate with humans and the environment, accommodate the activities of its residents comfortably and pleasantly. Physically and psychologically comfortable as well as physically pleasing are manifested by processing forms and spaces, affecting the aesthetic value, composition and aesthetics of form. Which includes cohesiveness, balance, proportion, scale, and rhythm, and user behavior conditions, including age, gender, and physical condition. [1]

Behavioral architectural design in architectural building design consists of several concepts in the study; (1) Behavior setting is a physical or spatial element that becomes a place or space system as the creation of a certain activity; (2) spatial cognition is a collection of one's mental experiences with the physical environment; (3) environment perception expresses various visual phenomena regarding a person's perception of regulation [8]. Spatial planning in this natural laboratory is very important, because space becomes a container for activities that are pursued to meet the possible needs needed by humans, meaning that it provides space that can provide satisfaction for the wearer [6]. The space order in a natural laboratory is very important, because space becomes a container for activities that are sought to meet the possible needs needed by humans, meaning that it provides space that can provide satisfaction for the wearer [6]. In space order, it is necessary to optimize the quality of space so as not to create congestion and congestion. Crowding is a perception of density which means the number of people in a place, and crowding is a perception that is subjective [7].

Processing of spatial properties is based on the concept of behavior setting design. The determination process is inseparable from the existing conditions and the spatial context that occurs. Application of the nature of space in the study of architectural behavior consists of; (1) Fixed-feature space, that is, a barrier that is relatively fixed and cannot easily be moved like a massive wall; (2) semifixed-feature space, which is a space whose divider can be moved or can be moved or removed according to the needs and time of use; (3) Informal space, which is a

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space formed in a short time, like a space formed when two or more people gather [8]. The location of this research in Nation Star Academy Elementary School, Surabaya. This school does not have a natural laboratory to support teaching and learning activities in science lessons, because based on the Regulation of the Minister of National Education of the Republic of Indonesia Number 24 of 2007 concerning Standard of Facilities and Infrastructure for Elementary Schools, Junior High Schools, Senior High Schools, Science Laboratories, Elementary Schools can utilize classrooms that are equipped with science laboratory facilities. Basically this school has met the existing regulatory standards, but there are obstacles faced by science subject teachers, namely teachers who are not optimally explaining natural science in real terms. The aims of this research is optimize the natural laboratory as a means of supporting science learning. This research is focused on planning and designing a school natural laboratory at the National Star Academy Surabaya as a means of supporting science learning with the concept of behavioral architecture in an argonomic and efficient spatial arrangement.

2   Methods

The research method used is qualitative. Data collection methods used are primary data and secondary data. Primary data collection is obtained from interviews, observation of similar case studies, and documentation. Meanwhile, secondary data collection through literature studies and supporting documents. From the results of primary and secondary data, a qualitative analysis is carried out which will produce a space order concept based on the behavior architecture of elementary school students. With this research, it is expected to produce a natural laboratory design to support the subjects of the Nation Star Academy Elementary School, Surabaya. The research variables for creating a natural laboratory room layout for elementary schools are shown in Table 1.

Table 1. Space Order on Behavioral Architecture

Variable	Sub Variable
Behavior Setting Space Order	Fixed-Feature Space Semifixed-Feature Space Informal Space

3   Result and Discussions

The research location is at the Nation Star Academy elementary school, which is on Dharmahusada Indah Barat VI / 1 street, Mojo, Gubeng District, Surabaya. The location of the site which is used as a natural laboratory is on the west side bordering the swimming pool area with a size of 5.70 x 11.00 m. The site location is described in Figure 1.

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Fig. 1. Site Location.

3.1 Fixed-Feature Space

The application of designs with fixed-feature space in the natural laboratory can be seen in the natural laboratory building structure. The use of fixed-feature building structures is used to strengthen the natural laboratory building as the main learning space. This structure makes the difference in space into a fixed-feature, between an open space nature laboratory and a semi-closed space nature laboratory in the learning space.

Fig. 2. Fixed-Feature Space

The difference in fixed-feature space is also a different user activity. The exterior of the natural laboratory building is open space. The open space nature laboratory is used as an object of direct learning with the open space environment, so that animals (insects, butterflies, beetles, etc.) and woody plants, such as existing vegetation, namely mango trees, guava trees, jackfruit trees, and pulai trees can be used as learning objects. Building exterior plants can also be added according to the needs of learning objects, such as hibiscus flowers, jasmine flowers, orchids, etc. Laying of additional vegetation in between existing vegetation.

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Pulai Tree

Guava Tree

Mango Tree

Jackfruit Tree

Existing Vegetation
Additional Vegetation

Fig. 3. Vegetation

Fixed-Feature Space is also applied to the entrance of a semi-closed space nature laboratory. The use of massive doors and walls at the entrance is used as a natural laboratory accent. The use of yellow is the defining color of the Nation Star Academy School. Apart from being an entrance, the Fixed-Feature Space is also used as a security system for the natural laboratory. Fixed-Feature Space makes students unable to enter and exit during learning. Teachers will find it easier to control and supervise their students during learning activities.

Fig. 4. Entrance

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3.2 Semifixed-Feature Space

Semifixed-Feature Space in the natural laboratory is shown by semi-closed space laboratory walls using transparent materials. Use a non-massive wall to keep air flow in the natural laboratory room. Plants and animals in a semi-closed space laboratory require natural air ventilation. Therefore, Paranet wall / shading net / insect net / screen net is used to cover the entire side of the wall. Besides functioning to provide air circulation, insect nets / screen nets can also filter out sunlight and block the entry of insects from outside. Natural lighting to support plant photosynthesis uses a roof with a transparent material, namely UV plastic material for hydroponics, a type of Polyvinyl Chloride Film. This roof is able to ward off sunlight, but it gets dirty easily, so it requires maintenance.
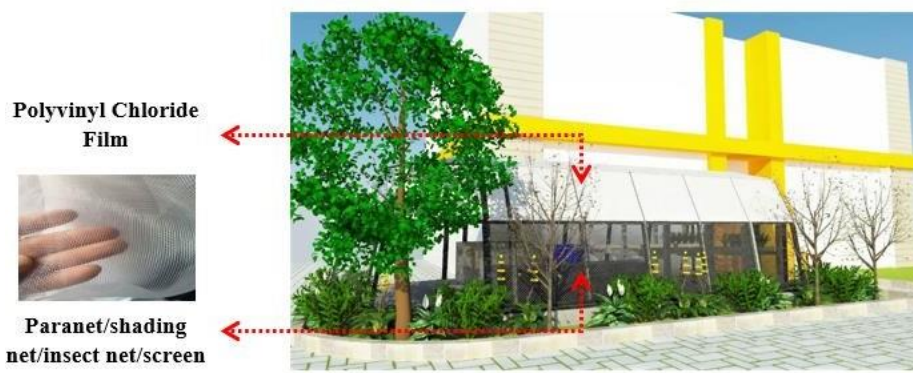

Fig. 5. Semifixed-Feature Space

3.3 Informal Space

The application of informal space design concepts is in the main learning space. In the main learning room, it is implemented by providing informal space, so that the users (teachers and students) can meet the availability of flexible space needs. In the main learning space there are several activities that can be done, that is; (1) learning in the aquaponics area, learning through hydroponic growth of plants and animals in aquaculture. Aquaculture uses tilapia species, with the consideration that tilapia is a warm water species that grows well in circulation tank and egg culture against fluctuating water conditions [13]. Whereas in the aquaponic system the planting media that can be used are water or shaft materials such as broken tiles, sand, gravel and husk charcoal depending on the type of plant and its intended use [9]; (2) aquarium, for the growth of worms, ants, etc .; (3) learning evaluation area. With unlimited use of space, it is hoped that learning can be carried out effectively, and use more argonomic space.

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Used by teachers and students in evaluating learning

Fig. 6. Evaluating Learning room

Aquarium Practicum Table

Fig. 7. Aquarium and Practicum Table

Fig. 8. Hydroponics and Aquaponics Technology

4   Conclusion

The Science Laboratory of the Nation Star Academy Elementary School, Surabaya is designed based on behavioral architecture. The concept of Behavioral Architecture is used in the Natural Laboratory Space Order. The application of space in the behavioral architecture of

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this elementary school natural laboratory is the Fixed-Feature Space which is seen in the semi-closed space nature laboratory building structure and the laboratory entrance. Fixed-Feature Space is used as a difference in user activity and is also a security system in this natural laboratory. Semifixed-Feature Space is applied with the use of non-permanent / massive walls. This natural laboratory wall uses materials that can be used for ventilation and lighting in a semi closed space laboratory. Informal space is applied to the main study room. This main study room does not have a fixed wall, so students and teachers can optimize the use of its space. The application of the three behavior settings is the basis for structuring the natural laboratory space order of the Nation Star Academy Elementary School, Surabaya. With the application of behavioral architecture in the design of this space is expected to make the use of space argonomic and efficient. So that learning activities can be optimal.

5   Acknowledgements

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