Research on the Application of Green Ecological Concept in the Architectural Design of Kindergartens

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Abstract: Integrating green ecological concepts and design into the kindergarten architectures is a significant subject and full of challenges. Only by leading children to be close to nature and learning and living in a green and ecological kindergarten environment can we provide better education for children as much as possible. This article discusses the existing problems in the architectural design of kindergartens in our country, and studies the application principles of the green ecological concept in the architectural design of kindergartens at first. Then it takes the China’s Haichao Kindergarten as an example to analyze how the green ecological concept can be better used in the architectural design of kindergartens, and explores the design ideas and methods of Haichao Kindergarten. Finally, it summarizes the importance of green ecological design concepts in today’s kindergarten architectures.

1. Introduction
Sticking to the concept of sustainable scientific development, and considering from the perspective of low-carbon and environmental protection, the concept of green ecology is people-oriented. It is required to be green in terms of building materials and design methods, which reflects the innovative high-tech means in the new era, and also reflects the designer’s concept of keeping pace with the times.

In the design, considering the relationship between children, building space and natural environment, designers usually start from the local natural ecological environment, combining with the concept of green ecological design. Using green energy, we can design a high-quality green ecological kindergarten building.

2. Problems in kindergarten architectural design in China
Today, with the stable development of China’s economy and the continuous progress of society, the development of modern children’s architecture in China is also steadily improving. In the past 20 years, the kindergarten architectural design in China has been improving in the aspects of systematic planning, the use of new materials and new energy, and design innovation. However, at this stage, the kindergarten architectural space design in China will also face many problems, which need to be overcome.

2.1 lack of integration of architectural space and nature
In fact, domestic kindergarten building space is lack of integration with the natural environment. Most of the domestic kindergartens belong to the supporting facilities of residential areas, and most of the
planning and construction of small and medium-sized kindergartens are very limited. In this case, it is difficult for kindergarten buildings to achieve reasonable planning and integration with natural elements, especially the lack of natural elements in outdoor venues. There are widespread large areas of rubber floor and cement floor, which is easy to cause accidents and is not conducive to either the development of kindergartens or the growth of children.[1]

2.2 children’s psychological and behavioral characteristics were not combined
It is not difficult to find that most of the domestic children’s architectural space sees the problem of adult subjective design, and little is known about children. In the kindergarten architectural design, it is easy to produce the problem of not considering the details carefully, and it is difficult to achieve the meticulous care and thoughtful service for children. In the design process, the kindergarten was not planned and designed from the perspective and psychology of children, and the needs of children were not deeply understood. Therefore, the architectural space design is more in line with the hearts of adults. If the height and shape of window sill and door handle are not well considered, furniture and wall corners are not rounded, and balustrades and handrails are made of cold stainless steel, it will cause inconvenience to children, making children’s participation very low and unable to convey children’s actual needs and aspirations.[2]

2.3 the concept of sustainable development is not considered
We lack the consciousness of sustainable development when we design the environment of kindergarten. We often destroy the environment and reshape it. It is difficult to add facilities on the basis of preserving the nature. At the same time, it lacks the idea of local materials, so we should do our utmost to keep the existing natural elements, and make full use of natural materials and design flexibly. It also lacks the use of green materials and energy, and often chooses expensive or synthetic materials, which not only wastes resources, but also causes harm to human body.

2.4 lack of integrated design of architectural space
At present, kindergartens pay more attention to architectural decoration design, and many design companies in China will focus on architectural space decoration design, and work hard under the surface to achieve good-looking, which will lack the overall grasp and thinking of kindergarten architectural space, so that the designed kindergarten has no soul. Many kindergartens in China are seriously lack of integrity, functionality and sustainability in the design of architectural space environment, which is also the main problem in the design of architectural space in kindergartens in China, lacking the idea of keeping pace with the times and craftsmanship spirit.[3]

3. Application principles of green ecological concept in kindergarten architectural design

3.1 principle of energy conservation
Green ecological kindergarten design reduces resource consumption and improves the utilization rate of green energy. In the design process, we should make the best use of the material and use less to win more, and stick to the simple and practical design thinking. Designers are required to continuously improve their self-cultivation, and apply the green building design concept to the actual architectural engineering design practice. In the design, environmental protection materials should be selected and developed to ensure that the materials will not produce harmful substances, reduce the damage to the environment caused by decoration, minimize the pollution of building materials to the surrounding environment and human body, and implement energy saving and consumption reduction in all aspects of kindergarten design. At the same time, we should strengthen the recycling of resources, reduce resource waste, recycle waste resources, turn waste into treasure, and realize the maximum value of resource utilization.[4]
3.2 the principle of ecological harmony
Kindergartens should pay attention to the integration of architecture and surrounding environment, and the harmonious development with nature. In the design, we should pay attention to the use of natural light and strengthen daylighting. Transparent materials such as glass can be used in the treatment of the facade. Large area glass windows can make the sunlight fall into the room and make the room transparent. At the same time, children can enjoy the outdoor scenery through the glass windows and grow up in an indoor and outdoor environment. As for the materials, we often choose wood and other warm material, and give children a natural warm feeling. At the same time, in the architectural space decoration to achieve simple, harmonious, natural effect, for children to create a safe, comfortable living and learning environment. The outdoor space of kindergarten should also retain a lot of natural elements, such as sand, mud, vegetation, etc. The most open place should not be plastic and cement. The most important thing is that children should receive "three baths" outdoors, namely sunshine bath, water bath and air bath, which is a necessary condition for children’s healthy growth.[5]

3.3 the principle of scientific design
Designers should conduct scientific research and understanding on children’s heart, body and behavior characteristics, and plan and design kindergarten from children’s point of view, so as to avoid careless consideration of details in architectural space design. For example, in the interior design of lockers, tables and chairs, it is necessary to avoid unreasonable design according to adult standards, which will affect the use of children and induce safety accidents. Through a lot of research, we know that if the scale of the kindergarten building space is too large, it will cause a certain sense of pressure on children’s vision and psychology. At the same time, children will prefer bright and harmonious small space. Therefore, when planning and designing the kindergarten building space, designers should firmly grasp the psychological characteristics of children, and try to add some interesting small space design in the kindergarten building. In the design process, we should consider from multiple angles to ensure the scientificity, rationality and safety of kindergarten architectural design, and create a harmonious and healthy environment for children’s learning and life.

3.4 flexible principle
Many specifications and construction standards have been set up for kindergarten architectural design in China, which put forward very specific requirements for the minimum standards of the area, volume and other aspects of each children’s building functional space. Many foreign high-quality kindergartens have achieved the combination with nature and the use of natural resources in the design process. However, due to some explicitly stipulated construction standards in China, the development and innovation of green ecological concept in Kindergarten Design in China are limited to a certain extent. These provisions were originally designed to make our kindergarten architectural design more standardized and reasonable. Unexpectedly, they have become one of the obstacles to the innovation and development of green ecological kindergarten architecture in China.

3.5 the principle of holistic design
The architectural space environment design of kindergarten plays a very important role for children. Kindergarten environment refers to all the external conditions and things that affect children’s development in kindergarten. Environment can not only have an impact on children’s learning and life, a good environment can make children actively participate in, let children interact with the environment and create the environment through their own ability, and make it their home. Therefore, when designing a kindergarten, designers should have an overall view. They should not only coordinate the design with the surrounding environment as a whole, but also clarify the children’s behavior and psychological characteristics for detailed design, so as to meet the needs of functional space and beauty, and also meet the children’s physical and mental health development.[6]
4. Application of green ecological concept in kindergarten architectural design

Designed and built by GLA construction company, Hangzhou Haichao kindergarten is located in Wangjiang unit in the downtown area of Hangzhou, with a land area of 5338 square meters. The kindergarten is planned to have 16 classes, and the land is in irregular shape, surrounded by high-density residential areas and roads. Through long-term observation of children’s life style and psychological characteristics, the kindergarten design puts forward the design concept of "sunshine, air, rain, playground", which breaks the invariable spatial pattern of traditional kindergartens in China. It is designed from the perspective of children to provide children with sunshine, rain, fresh air, safe and healthy games and living places.

4.1 architectural space design

With regards to space planning, the designers skillfully arranged the main body of the building on the northwest side to reserve enough space for children’s outdoor activities in the southeast. At the same time, the classroom is far away from the city road, effectively avoiding the impact of road noise on indoor children’s learning and life. In the upper layer of the building, the design method of retreating platform is used. On the one hand, the volume of the building is gradually weakened. On the other hand, more outdoor playing places are provided for children, so that children can have a dialogue with heaven and earth, meet the sunshine, air, rain and embrace nature to the greatest extent. The southeast side is connected with the main building through the wind and rain corridor, which forms a rich and interesting outdoor activity site and an area separated from the urban road, providing children with a sense of security and free play space, so that they can play at ease. (Figure 1-2)
4.2 design of rainwater recovery system
Regarded as a rain garden, the green ecological characteristics of Haichao kindergarten are very obvious. In terms of the use of green energy, Haichao kindergarten has its own perfect rainwater circulation system, and also has a mature outdoor environment with the value of rain and flood management education. The sponge characteristics of the whole campus are very prominent. The kindergarten combines the local climate conditions, makes full use of natural resources, and reflects the characteristics of adjusting measures to local conditions and guiding the situation. The design of the kindergarten advocates energy conservation and recycling of water resources through rainwater collection, filtration and storage technology. The utilization of rainwater collection system not only improves the utilization rate of water resources in kindergarten, but also greatly reduces the heat island effect of campus. This kind of design makes the whole kindergarten green, ecological and environmental protection. At the same time, in order to improve the environment of green ecological education, Haichao kindergarten adds the function of rainwater storage in the outdoor leisure space, and uses the sunken design of landscape square to create. It is not only a classroom for children’s outdoor teaching, but also makes the sense of sustainable development deeply rooted in the hearts of the people. In each link of rainwater collection, illustrated explanation signs are set up, and pictures are attached to let children understand. The management concept of rainwater storage is slowly conveyed to children, so that they can establish green awareness and water saving habits, and create a sustainable living environment.

4.3 green material design
Haichao kindergarten mainly considers the use of green building materials, decoration using eco-friendly materials, to avoid the emission of pollutants, causing harm to children. Material selection mainly uses steel, wood, aluminum alloy profiles, glass, environmental protection paint and other renewable recycling materials. At the same time, the reasonable use of light makes it possible for the sky or indoor light gently shine into the building, forming an interesting environment. In order to let children feel the texture of different materials and understand the names of different materials through
their own practice in play, the designers try to make "wood like wood, steel like steel, and stone like stone" to maintain the texture of the original building materials of the kindergarten.

5. Summary
Green ecological kindergarten building design is in accordance with the national concept of sustainable development and energy conservation and environmental protection, which is the future development trend of education buildings in China. In the design process, to provide a greener ecological living environment for children, we need to pay attention to the kindergarten location, material saving and energy saving, the integrity and safety of the design, the integration with nature and other factors.

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