Advances in Social Science, Education and Humanities Research, volume 341
5th International Conference on Arts, Design and Contemporary Education (ICADCE 2019)

Research on the Space Design of Kindergarten Activity Unit

Example of Graduation Design of South China University of Technology

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***Abstract*—Kindergarten activity units play an important role in the growth of children and are important places for children to learn, live and play. Faced with the rapid increase in the number of children and the limited construction land of kindergartens, this paper explores how to effectively use space to integrate life and games into a limited range of activities. Taking the graduation design of North Campus of the South China University of Technology as an example, starting from the discovery of the problem can study how to solve the low utilization rate of the active unit and propose the overall layout of the activity unit. The interior space is designed according to the child's own behavioral characteristics and psychological needs. The solution measures problem-oriented design strategies and provides a reference for the design of kindergarten activity unit spaces.**

Keywords—active unit space design; low space utilization; child center theory; solution strategy

I. INTRODUCTION

A. Status

With the continuous growth of China's economy and rising income levels, people began to pursue quality education services and resources. Kindergarten education is not only an important part of basic education in China, but also the basic stage of school education and lifelong education. Therefore, preschool education has received extensive attention — Children spend more than two-thirds of their time on kindergarten. They should meet the needs of preschool children's learning, communication, entertainment, and other activities. It is an integral part of kindergarten design and plays a vital role in the healthy growth of children's body and mind [1].

Since January 1, 2016, the implementation of the “two-child” policy in China has led to a surge in pre-school education for school-age children. According to former literature, children will increase by 17.7388 million between 2016 and 2022 [2], which will put tremendous pressure on the distribution of preschool education resources. At this stage, China's development and construction entities are mainly divided into public kindergartens and private kindergartens.

Governments and developers are reluctant to provide enough land to build public buildings such as schools, in that priority in land supply is usually reserved for high-margin housing and commerce. Construction funds and land area for kindergartens are often compressed, and kindergarten construction sites are particularly tight.

B. Difficulties

In the face of the surge in children, the construction of kindergartens is very tense. The activity units are an important part of kindergartens. How to effectively use space, integrate life, learning and games into limited housing areas and adapt to mandatory norms is the difficulty of this project. These paper shares ideas by analyzing the combination of graduation design methods and practical research.

II. THE PROBLEM OF ACTIVE UNIT SPACE DESIGN

Prior to the graduation design of the North District Kindergarten of the South China University of Technology, the existing South China University of Technology kindergartens was visited. The survey included the process of the children in the kindergarten day, the class, the state of the game, and the behavior of the entire room in the activity room. Interactions between teachers and children such as picture collection, information recording and data collection of the kindergartens are examined; the following questions in the activity unit are summarized.

A. Low Space Utilization

From the following schedule of kindergarten activities in South China University of Technology (as shown in "Table I"), the two points can be analyzed:

- Most of the children in the kindergarten are in the activity room.
- The activity frequency of the activity room is the highest in the activity unit. While the bedroom is only used for two hours at noon for the longest time.

From the activity schedule and the plane analysis chart, the bedroom unit is used for a short time in the active unit, but it occupies a large area of the active unit. The bedroom

took only two hours at noon, but it occupies nearly half of the active unit area and the space utilization is not high (as shown in "Fig. 1"). At the same time; the activity area of the children's activity room is divided into a public area and a theme area. The public area is generally used to complete lectures, movies, music courses and other courses in the form of a whole class; the subject areas are generally grouped in groups, and the children in the subject area are divided into It is an art district, a building area, a science district, a living area, and a book area. Children are free to choose areas of interest to attend classes, and these courses are very popular (as shown in "Fig. 2"). Children usually take classes in these two different areas. In public areas, the subject area is idle; in the subject area, the public area is idle; therefore, space utilization.

TABLE I. AUTHOR SELF-PAINTING

Time	Life links and activities	Event Location
8:00—9:00	Admission, morning, regional games	Outdoor activity area
9:00—10:00	Morning exercise, early morning, educational activities	Activity unit - activity room
10:00—10:50	Moral education, group education activities, class	Activity unit - activity room
10:50—11:05	Washing hands and preparing meals before meals	Activity unit - bathroom
11:05—12：00	lunch	Activity unit - activity room
12:00—14:15	Nap	Activity unit - bedroom
14:15—14:45	Get up, wash, noon	Activity unit - bathroom, bedroom
14:45—15:30	Outdoor time	Outdoor activity area
15:30—16:30	Indoor game activities, class	Activity unit - activity room
16:30—17:30	Departure time - waiting for parents to pick up	Activity unit - activity room

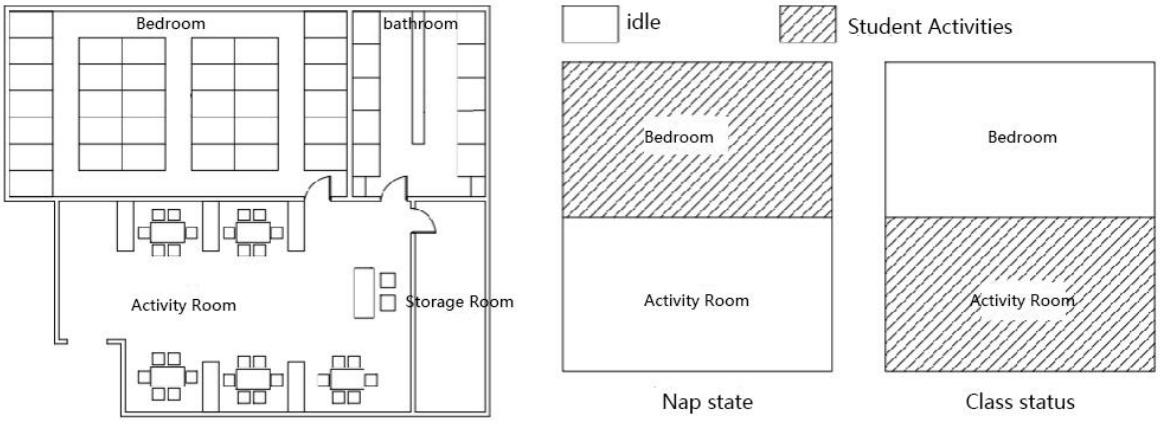

Fig. 1. Plane analysis picture 1.

[a] Image source: painted by the author.

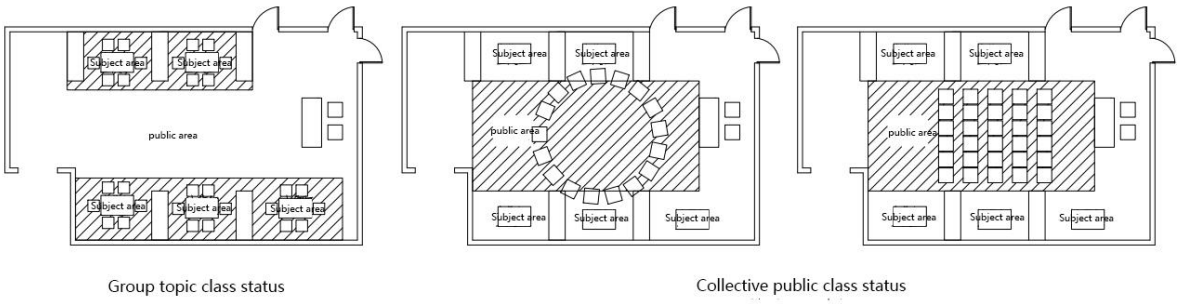

Fig. 2. Plane analysis picture 2.

[a] Image source: painted by the author.

B. Ignoring the Child's Subjectivity

In traditional education, children are subordinate and affiliated. Teachers organize their teaching according to their own understanding of education, and less consider children's own characteristics and needs. The famous American educator Dewey put forward the idea of "children's center theory", which means "children are the starting point, the

center, and the purpose. The development of children and the growth of children are the ideal places." Children-centered, embodied in education the process requires teachers to consider the personality characteristics of children so that each student can develop their strengths and respect the child's dominant position in educational activities. However, at present, most kindergartens in China are designed from the perspective of building norms and traditional design habits; arbitrarily using figurative shapes or symbols and unusually bright colors to create space for kindergarten buildings, there is no real use of children at all. The main body is the starting point. For example, the time and form of the existing South China University of Technology kindergartens found that children's activities are dominated by teachers. Usually, several people live around the desk themselves, and the activity rooms serve as restaurants. They are not flexible enough, the furnishings are neat and uniform and the children's activities are uniform (as shown in "Fig. 3"). The way, content, and location of young children's activities are severely limited, which is not conducive to the individualized development of young children. At the same time, the lack of communication space for young children limits the communication between children in different units.

Fig. 3. Kindergarten site survey photos.

[a] Image Source: filmed by the author at the South District Kindergarten of South China University of Technology.

III. The Program Design Research Process

A. Project Overview

The South China University of Technology Kindergarten is a full-time kindergarten sponsored by the University. It has been in existence for 66 years since its inception. From the initial 420 or so children of 14 classes to the current increase in the demand for children entering the park, the current campus and the unloading the number of children growing up can't adapt to the future development of kindergartens and new educational models. It is planned to build another new campus on campus, covering an area of about 11,000 square meters and a total construction area of about 17,000 square meters. It should accommodate 30 class units and several public activity classrooms, faculty and staff rooms and sufficient outdoor activities space as required.

However, in the current situation of a large increase in the number of children, the area originally containing 30 class units is now increased to 60 classes (as shown in "Fig. 4"). The existing venues and areas of the kindergarten are particularly tense. How to more efficiently use limited space to meet the needs of young children under mandatory regulations is the core issue of this design; further design of indoor activity units based on existing building solutions is shown in "Fig. 5".

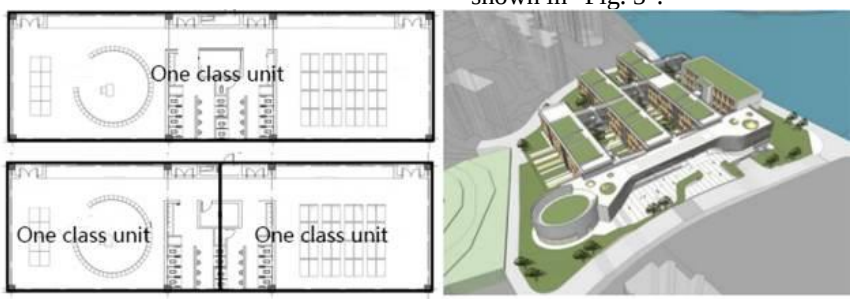

Fig. 4. Diagram.

[a] Image source: Huagong Kindergarten newspaper construction technical drawings.

Fig. 5. Architectural plan.

[a] Image source: Huagong Kindergarten newspaper construction technical drawings.

B. Design Positioning

In the case that the existing venues and areas of the kindergarten are extremely tense, it is hopeful to use the space more efficiently to meet the needs of young children and to improve the space utilization rate of the kindergarten activity unit is our primary problem. While solving the utilization rate of the active unit, it is also necessary to consider the way of attending the child and the behavioral interaction. Designed with children as the center, grasping the psychological characteristics of children's “his play”, and increasing the multi-level field space to achieve the purpose of entertaining and learning, creating multiple spaces for children's games and communication. It satisfies the characteristics of children's psychological changes in different sensitive periods, stimulates children's imagination, improves the adaptability to the environment, and provides a favorable and interesting learning environment for young children.

C. Solution Strategy

A complete activity unit consists of an active part (activity room), a sleeping part (bedroom) and an auxiliary part (toilet, cloakroom).

- The activity room is an activity place for children to carry out various teaching and games. The activity room is the main space of the activity unit, and its function is to meet the needs of children's activities and learning;
- The relationship between the bedroom and the activity room is closely related, sleep for young children, it is a necessary condition for physical and mental health. When reviewing specifications and cases, the bedroom can be mixed with the activity room or set independently.
- In addition to solving the physiological needs of children's toilets, the bathroom also has the function of cultivating children's good hygiene habits and living ability.
- The cloakroom is an auxiliary space for the activity unit and should be closely related to the activity room and the bathroom.

The basic mode of kindergartens in China is a class as a complete teaching unit. It is called a single-group activity unit from the life, teaching, and management of children. [4] Its characteristics are conducive to the targeted education according to different age characteristics. China is suitable to teach and educate teachers in a fixed class in the same mode according to the "class", emphasizing health isolation and avoiding cross-infection. Each class is self-contained; each unit has strong independence, which is not conducive to the development of children's personality. In the case of such a tight area for children, after explored two solutions for the combination of space and integration space; forming a complete activity unit with two classes as a module, hope to solve the problem of land use, so as to improve the utilization of activity units. The rate can meet the child's psychological and physiological needs for the activity unit.

1) Shared space: In the combined space, try to use the activity room, bedroom, bathroom, and cloakroom separately. By analyzing the advantages and disadvantages of the combined space, then choose a program with high applicability and high feasibility. 1. The activity room and the activity room are used as the main space of the activity unit. Although the shared activity room can save a large space, the 60 classes of two classes at the same time are not conducive to the teacher management, and the interference between the classes is large; obviously combined The activity room is not working. 2, combined with the bedroom, assuming that 60 people rest in a small room, the density of space is high, children are easy to get infected with each other, so it is not feasible. 3. When the toilet is used together, the children will not appear at the same time when using the toilet. At the same time, 60 people can go to the toilet. If the two classes need to be used at the same time, they can also be used in the wrong peak; it will not cause much interference; at the same time, the toilet can also be effective. Save a part of the area. 4, the combination of the coat storage room this way can reduce the area is small, so the combined use is of little significance. Through the above analysis, it is more feasible to compare the two toilets with the toilet.

2) Integration space: In the integration space, try to integrate the spaces by using the stacked bed (as shown in "Fig. 6"), the interlayer (as shown in "Fig. 7") and the stepped interlayer (as shown in "Fig. 8").

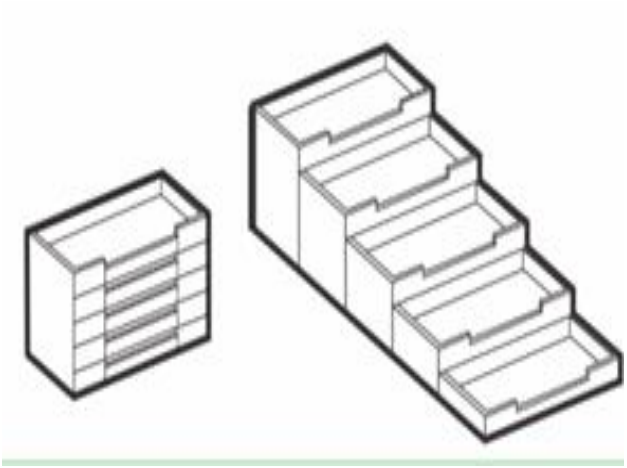

Fig. 6. Stacked bed.

a. Image source: painted by the author.

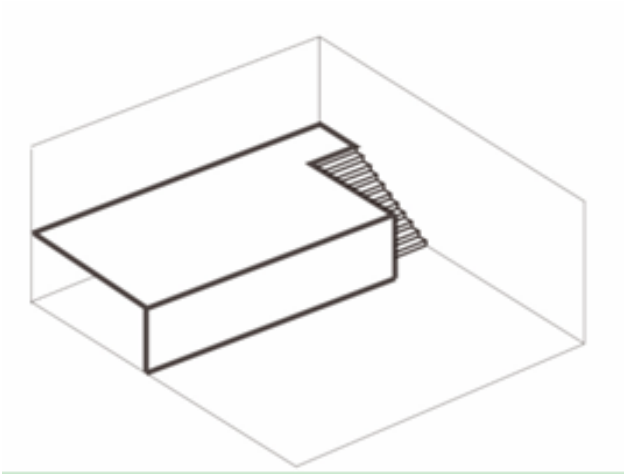

Fig. 7. Mezzanine.

a. Image source: painted by the author.

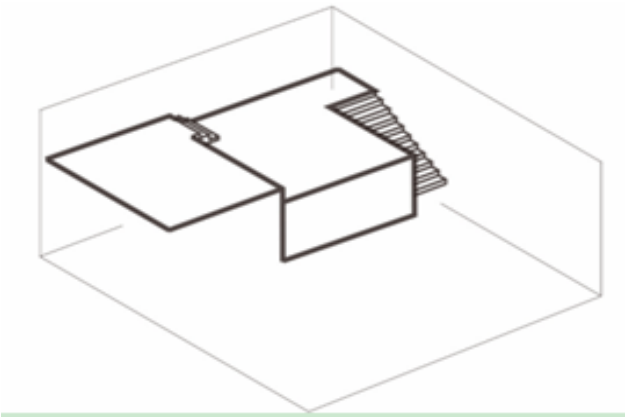

Fig. 8. Stepped interlayer.

a. Image source: painted by the author.

The method of stacking beds is to integrate the activity room and the bedroom. The stacking bed refers to a set of beds with 3 to 5 beds stacked together. When it is a bedroom state-stacked bed, it can be used for 3 Up to 5 children are used at the same time (as shown in "Fig. 9"). When it is in the active class game state, the original 3 to 5 beds only need to become the footprint of a bed (as shown in "Fig. 10"). The method of stacking beds can save space to a certain extent, and it is also the method for saving the area of most kindergartens at present; however, the stacking bed is generally placed on the wall and the activity room originally occupies the space of the storage room; whenever it is switched to the dormitory state When you need a teacher, you can increase your teacher's troubles. And the toddler who sleeps to the top needs to step on the bed of the bottom child to reach his sleeper. To reach the bed by pedaling other children's beds, it is easy to cause unhygienic bacteria in other children's beds.

Fig. 9. Sleeping conditions.

a. Image source: painted by the author.

Fig. 10. Active status.

a. Image source: painted by the author.

Since the indoor activity unit in the current construction scheme has a height of 3.9 meters, try to solve the problem of the dormitory by means of a sandwich when the height of the floor is relatively easy, and integrate the bedroom and the bathroom in the mezzanine space; The height of the floor can meet the problem of children's nap, but the height of the floor is not suitable for the toilet or activity class.

Since the interlayer is not so flexible in height, put forward the idea of stepped interlayer in the way of the mezzanine. The stepped interlayer refers to the requirement of two layers of height to adapt to different spaces, and the distribution of layer height is more Flexible (as shown in "Fig. 11", "Fig. 12" and "Fig. 13").

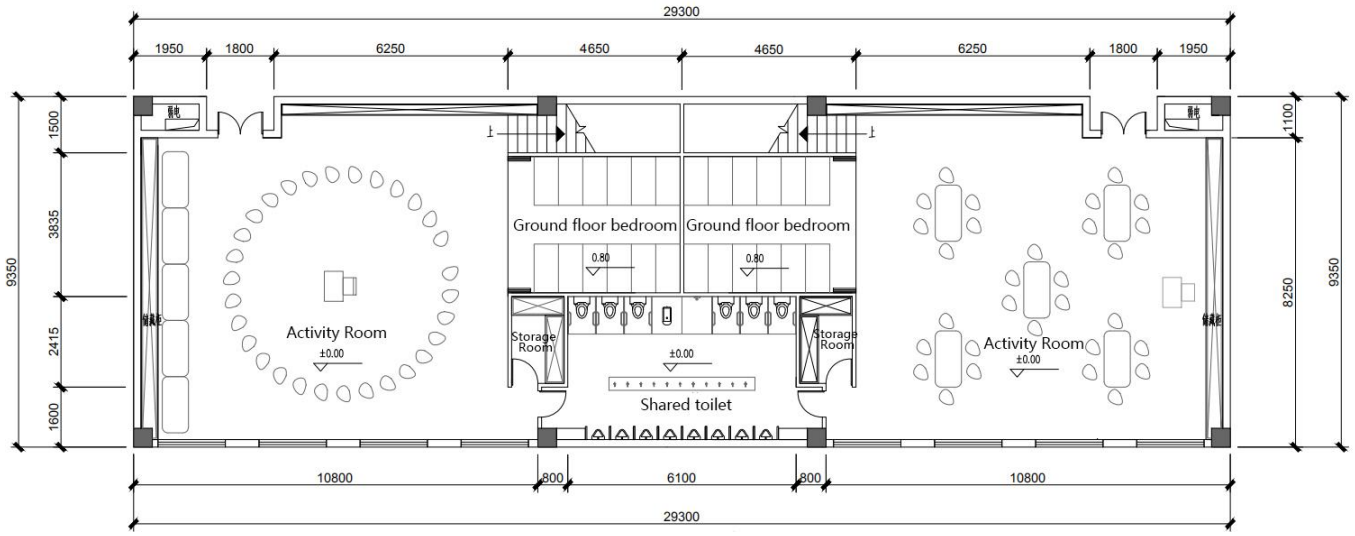

Fig. 11. Kindergarten first floor plan.

a. Image source: painted by the author.

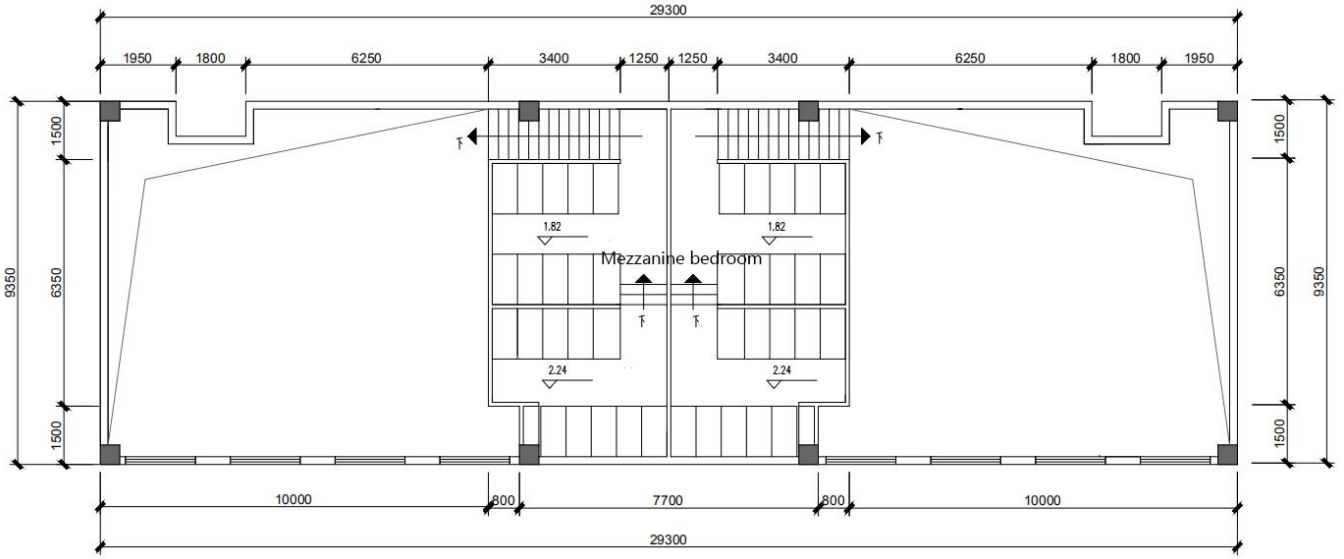

Fig. 12. Kindergarten mezzanine floor plan.

a. Image source: painted by the author.

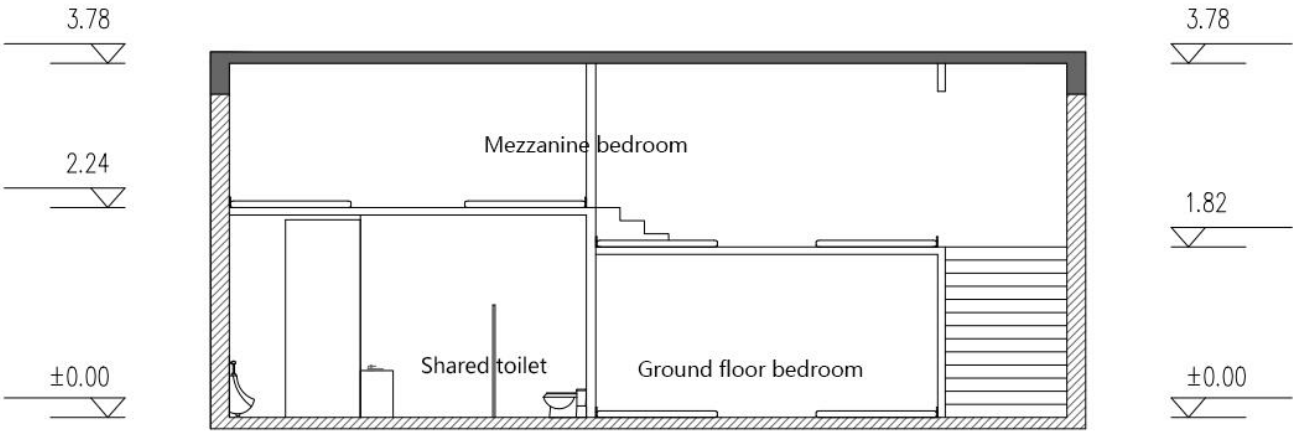

Fig. 13. 2-2 section.

a. Image source: painted by the author.

In the integration space, three ways of bed, sandwich, and stepped interlayer were tried; in contrast, a stepped interlayer was used to integrate the bedroom and the bathroom.

3) Provide a flexible space for children to provide a variety of space: The interior space can be divided by flexible partition walls and furniture. There is no permanent fixed partition wall. The spatial layout, form and function, scale and so on can respond to different space requirements with a variable attitude. At the same time, flexible furniture is available for teachers and toddlers to switch between different classes. In this design, the child's chair is designed into an eggshell shape to facilitate the movement of the child (as shown in "Fig. 14"); all desks in the classroom are in the form of roller skating for the convenience of teachers and children to move.

Fig. 14. Egg shaped chair.

a. Image source: painted by the author.

D. Program Deduction

Based on the above-proposed solution strategy to demonstrate the process of its process, the first step is to set up two classes in the original activity unit and add a shared bathroom (as shown in "Fig. 15").

Fig. 15. Roller table.

a. Image source: painted by the author.

In the second step, a stepped interlayer is added to integrate the bedroom, bathroom and coat storage, and the height difference is rationally utilized. The stepped mezzanine is a sleeping room upstairs, and there are two different heights downstairs - the higher space is set for the bathroom to facilitate the entrance and exit of the teacher and the child, and the lower space is set for the small space or bedroom space for children to play (as shown in "Fig. 17"). The third step treats the stepped interlayer as a box that reinforces the shape of the box and reduces its volume in the moving unit (as shown in "Fig. 18").

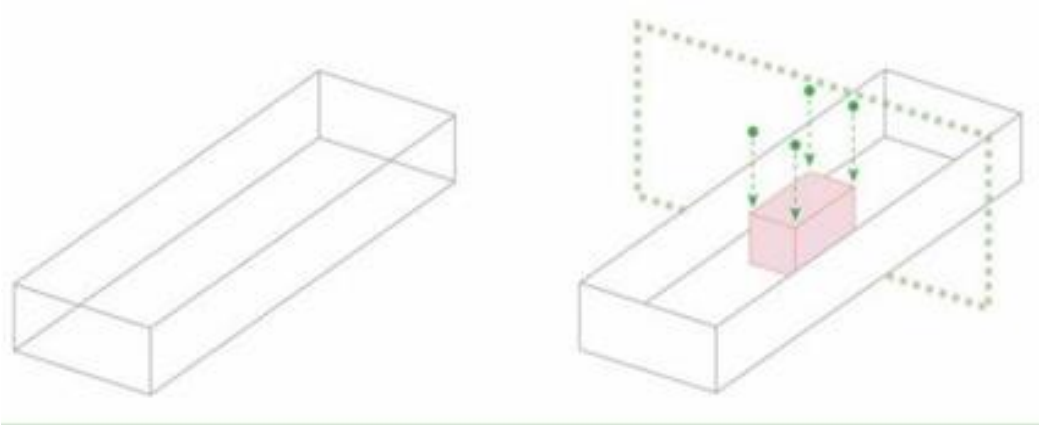

Fig. 16. Add a shared toilet.

a. Image source: painted by the author.

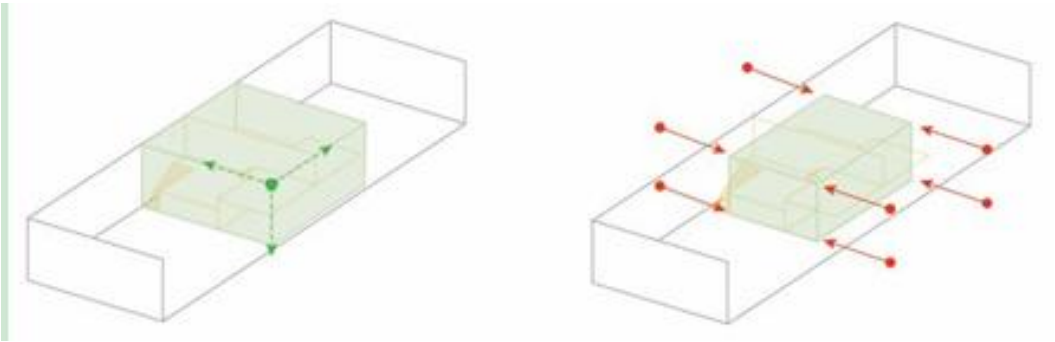

Fig. 17. Integration space.

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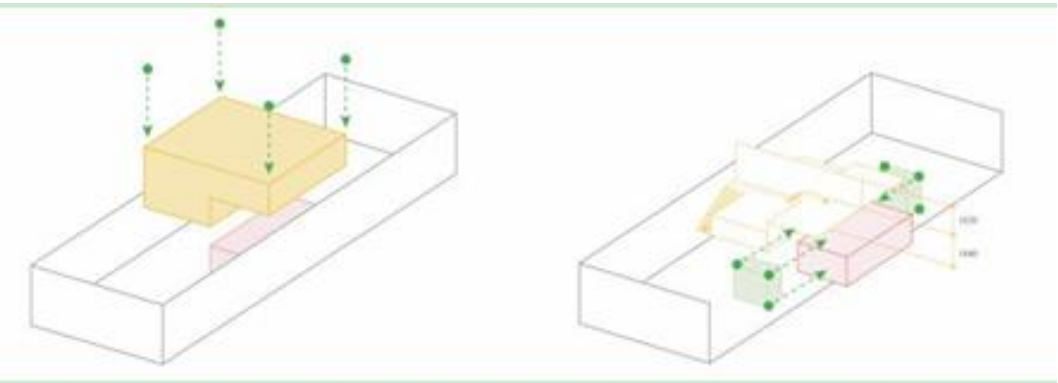

Fig. 18. Enhanced box shape.

a. Image source: painted by the author.

Step 4: Add different shapes and colors to the texture of the surface of the box to enhance the interest of the shape to attract the attention of the child (as shown in "Fig. 19", "Fig. 20").

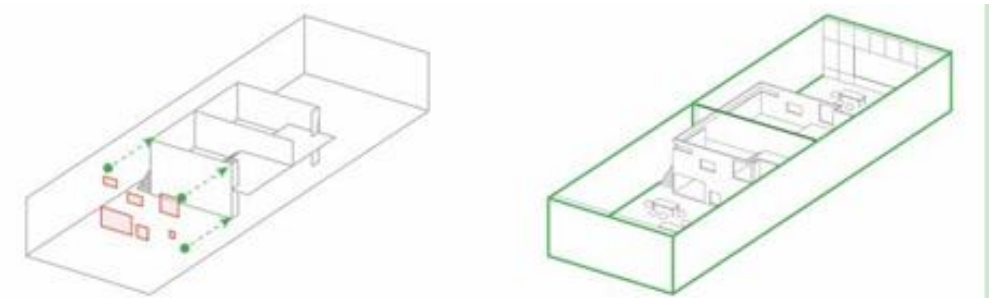

Fig. 19. Add different shapes and colors.

[a] Image source: painted by the author.

Fig. 20. Indoor perspective.

[a] Image source: painted by the author.

IV. Problem-oriented Design Strategy

A. Integration Space and Sharing Part of the Space

According to the above, when the kindergarten land is tight and the number of children is gradually increasing, the problem of low space utilization of the activity unit proposes an integration space and a solution strategy for the partial space. The activity unit serves as an interactive space for independent learning and living in each class of the kindergarten, including an activity room, a bedroom, a bathroom, and a cloakroom. In the unit space, the activity room and bedroom are called service spaces, and the rest are called service spaces. In order to divide and reorganize each function space according to different needs, to create a completely functional space, the service space should be as much as possible. Separate from the overall space, increasing the integrity and flexibility of the event space. Separate the service space from the activity room and bedroom, divide and integrate the service space, so that it can meet the needs of children's life and rest, and meet the space requirements of group teaching and diversified activities.

The activity room and the bedroom occupy a large part of the area and function of the activity unit as the service space, but the service space is also an indispensable part of the activity unit. Currently, in the case of severe real problems, two classes are used to share part of the service space. The practice can effectively save a part of the area, and at the same time, the children's class life will basically not affect.

B. Using Vertical Space to Create Multi-level Domain Space

In the case of the height of the floor, in the face of the problem of land use, the vertical space can be properly utilized, the mezzanine space can be set, and a multi-level vertical system can be created. The mezzanine space is a domain space of privacy and semi-private nature. The bottom layer can be used as a place for children's activities and games, and the second floor can be used as a bedroom. In the above case, the concept of a stepped interlayer is mentioned. A part of the lower space of the stepped interlayer can form a space that conforms to the small-scale privacy of the child, another part can be used as a shared toilet, and the second floor can be used as a child bedroom. The relatively low floor height as a bedroom will not give the child a sense of oppression. The interval between the various spaces continues, not only enriching the level of space, but also living the atmosphere of space; at the same time, it greatly improves the utilization of space, creates a spatial form of various attributes, and makes the spatial form and spatial layout more colorful.

The stepped interlayer not only improves the utilization of the space. At the same time, it changes the height of the

indoor part to form a domain space suitable for children's activities, and the scale of the space is more suitable for the use of children. The reduced part allows a part of the space to be defined so that it has a strong sense of envelopment and increases the privacy of the space, providing a strong sense of communication space for young children; and the high part of the space has strong publicity and provides for young children. A public-community space of communication; such an approach creates a multi-level domain space that gives young children a different experience in the process of communication.

C. Space Is Fully Flexible and Provides a Variety of Possible Diversity Spaces

The comprehensive space layout replaces the previously closed activity space with a large space without partition walls and strives to create a highly flexible active unit space environment [5]. The centralized teaching public area and the regional activity area share a large space, and space is divided according to the changing sensitive period of the child, for example: through flexible furniture, a translucent division inside the space, a low partition, etc. Space is divided. There is continuity between the various spaces, which can be separated and merged. The multi-level flexible segmentation of the space not only makes the space more transparent and transparent but also takes into account the privacy requirements of different activities.

Taking the activity room as a whole, the children choose various types of activities independently, and the collective public areas are open and large spaces, which is convenient for children to organize a large number of activities and improve the space for large-scale exchanges. In addition, the group area activity room is divided into furniture to form their respective regional activity areas, and a small number of children's activities are carried out in the form of small groups.

V. CONCLUSION

With the development of the economy, parents pay more and more attention to the basic education of young children in China. Kindergarten construction has become an essential part of city development. In the construction, it is necessary to comprehensively consider various factors, not only to meet land use planning, municipal construction and education. In order to meet the actual needs of the needs, it is also necessary to consider the behavioral characteristics and psychological needs of the children who are mainly used. From the problem, the design respects the actual requirements and the characteristics of the children and designs the kindergarten activity unit that is conducive to the healthy growth of children.

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