COMTEMPORARY KINDERGARTEN DESIGN
"BASED ON MONTESSORI EDUCATIONAL THEORY IN KUNMING, CHINA"

Haimingrong Zou

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Architecture

Department of Architecture School of Architecture and Design ASSUMPTION UNIVERSITY 2016
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Haimingrong Zou
ID: 543-8325

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Thesis Approved:

Date Assoc. Prof. Pralong Phirananda, DEAN

Date A. On-la-or Homsette, Chairperson

Date A. Suriyong Suriyachat, Thesis Advisor
COMTEMPORARY KINDERGARTEN DESIGN

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Abstract:

Kindergarten, as an important transition carrier from family to the society, which is a place for preschool education to carry out and it plays an important role in contemporary preschool education. In recent years, the concept of Montessori educational system draws a widely public attention in China. It is a preschool educational theory which is based on the child psychology, physiology characteristic and serves the same function as Quality Education. Montessori Educational theory becomes the focus topic of the preschool education of the Educational Ministry in China. How to covert and apply the Montessori Education Theory and idea into Kindergarten design will be the main purpose of this thesis.

In the concept of Montessori education, there are expounds about children's natural development, sensitive period education, sensory education. For kindergarten design, the concept is mainly focus and emphasizes the “Environment Education”. We should provide a prepared environment for children by creating a suitable and adapted Indoor and Outdoor environment. A kindergarten which has more usable function space with rational child scale, suitable color design and sustainable design.

Key Words: Contemporary Kindergarten design, Montessori Education Theory, Environmental Education
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Chapter 1: Thesis Introduction

Ch.1.1 - Background of Interest.

Infants are important for the nation future development because they are the future hope for the whole nation. The education for infantile children is the important fundamental of nation's education quality development. Regarding the Chinese Education Development Plan, it is important to give a suitable and excellent education for infantile children. One of the greatest infantile educationalist, Montessori, believed that learning ability from infancy to three years old is as much as an adult learns for 60 years. From the research, infantile brain and nervous system can develop very fast, and it is very important to develop and stimulate the child's potential talent during this period. However, in the past, Chinese infantile education developments are more focused on 'Intelligence Quotient' (IQ) development and pay less attention to the importance of infantile psychological and behavior education.

In relation to this focus, most of the Chinese kindergarten designs have many disadvantages and inappropriate approaches. Kindergartens are the second home for pre-school children, and they are the important places for learning and living skill developments. The recent Chinese pre-school educational policy also clearly point out that the basic principle of kindergarten environmental design must concentrate on the infantile psychological and behavior development.

Maria Montessori is one of the most popular and greatest pre-school educator around the world. Her unique infantile education theory and concept have a profound effect on the contemporary infantile education. Montessori thought that infantile education is important for children development in term of 'Psychology' and 'Society'. Psychology helps develop the natural personality growth; Society helps the infantile children to prepare for living adaptability. Since 1990s, the "Montessori education concept" has become more popular in Chinese kindergarten education development system. However, the core idea and concept of Montessori educational theory doesn't have any direct relation to the basic architectural and environmental design, and most of kindergarten designs in China don't have an effective educational environment.

Therefore, this thesis aims to convert this Montessori educational concept into kindergarten design principles and apply them to an effective architectural design for
infantile education that reflects relevant and meaningful issues.

Ch.1.2 - Issue of Interest

There are several issues in relation to Montessori educational concept:

- **Children Centered**, the design must focus on one issue which is children are the target user and they are the center.

- **Prepared Environment**, to improve the quality of education and have a better associate the Montessori Education, the environment and space of architecture play an important role.

- **Montessori Education Theory**, in order to create a kindergarten which the space can have an efficient associate with the education. Therefore, to analysis and learn how to translate the theory into architecture design is very important.

- **Communal Sharing space (Future)**, in the future, the kindergarten will be more communalization. A good kindergarten should has a relation with the surrounded social community.

- **Environmental Awareness (Future)**, the Montessori Education Focus more on child logical thinking and Practical Life Skill, but the on Kindergarten in the future should also improve the Kids environmental awareness. As a prepared environment, the building itself should has some interaction with the children and teach them somehow.

Ch.1.3 - Objective of Proposal

- To create environment that served children by understanding their needs and behaviors.

- To create a new kindergarten design with a well prepared environment by studying the Montessori theory and combine with the basic design principles of kindergarten in various aspects.

- To improve children’s social sense by creating an interactive and sharing communal
space between the kindergarten and community with safety design factors.

- Activate the interactive value of the transition and circulation space in the kindergarten.

- To improve the children's environmental awareness by
  - Creating strong connection between indoor and outdoor green space.
  - Providing green farming space for children.
  - Integrating sustainable design.
  - Creating the kindergarten to be a green area of the city.

Ch.1.4 - Hypothesis of Proposal

The new kindergarten design can solve the current problems and fit the need of future development by interpreting the Montessori's education theory into new design strategy for architectural design, which can provide an interesting and motivating childhood environment to develop a better growth for children.

Ch.1.5 Thesis Statement

The proposal of this new and unique kindergarten community can support the preschool's education system at Kunming to improve a better development for children and a better learning environment quality of kindergarten, which will develop more attention and concern from the society to the kindergarten.
Chapter 2. Literature Review

2.1 Theory Study based on Montessori Education Theory

In order to learn and have a thorough understanding of the Montessori Education Theory, I did some research about what are the core ideas of Montessori education theory, how did other kindergarten apply the Education into architecture design. Moreover, because the Montessori education emphasis on the learning environment and the priority of the children. In order to know the basic requirement and design for the space of kindergarten, and what the relation between the space, learning environment and children.

2.1.1 Based on Montessori Education Theory

Based on the study of Montessori education theory, to understand about the basic system of her education theory and how it works and why it works. I read the DR.MONTERSSORI'S OWN HANDBOOK and conclude the core idea of her education theory.

DR.MONTERSSORI'S OWN HANDBOOK: "THE BASICS OF HER SYSTEMS, HOW IT WORKS AND WHY IT WORKS." By Maria Montessori

She said the Sensory function through which, receiving sensations from the environment and a continual exercise of observation, comparison and judgment. And in this way, the child gradually comes to be acquainted with his environment and to develop their intelligence¹.

Montessori recognized an interrelationship between mental and physical powers in mankind and categorized three types of activity:

- The exercises of practical life.

- The exercises of sensory training.
- The didactic exercises.

In Montessori educational theory, a prepared environment is very important for children's development. She proposed 6 factors about the Educational environment as below:

- Freedom Space. The role of teacher is assistance with the development of children's psychological and intelligence. And they can overserve the children's behavior in an open and freedom space. She thought that the nature and essence of children only will show and expose in a freedom and opened environment.

- Structure and rule. The environment of the kindergarten should reflect the outside world. (Social, Community environment)

- Reality and Nature

- Aesthetic atmosphere.

- Montessori teaching tools

- Living as a group. (Mixed age education.)

2.1.2 Based on Contemporary kindergarten design

RESEARCH ON INDOOR ACTIVITY SPACE ADAPTIBILITY DESIGN OF KINDERGARTEN IN URBAN COMMUNITIES. By Xiaochen H. (Master degree thesis in Dalian University of Technology)
The research and study method of the kindergarten design should base on the child’s perspective, to understand and know the psychological behavior of Preschool Children. By:

- Communicate and interview with the children directly by using the chart and diagram to study.

- By using Painting class to understand the children’s perception in terms of the spatial environment.

- Don’t perceive the children’s space with an adult’s perspective.

- There is no obvious difference of the children’s impressive toward to the indoor and outdoor space. But their interest is more prefer the Outdoor Space due to the natural factors, Activity field and Playground.

Through the survey of the children’s perception of the space. By let the children in different ages to choose the picture of their kindergarten in order to know their focus space and function area.²

<table>
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<th>Frequently be chosen photo</th>
<th>The most priority photo</th>
<th>Impression on Interior space</th>
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<td>RUNWAY</td>
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<tr>
<td>Playground (more freedom)</td>
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<td>Garden (more nature)</td>
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Table 1. Summary of children’s perception of the space (Draw by author)

1. Children’s interest more prefer the outdoor space, because the nature, activity field, playground facility.

2. The perception to the indoor space is from the living habitat.

3. The perspective eye level of children (1m above the ground) will be most impression.(the flower, small table, but no high tree.)

4. The grade 3 children has more precise of the perception of space. They more care about the Natural factors (sun, plants, animal). The Freedom activity space (Playground, runway).

²Huang, Xiaochen Research on Indoor Activity Space Adaptability Design Of Kindergarten in Urban Communities, (Dalian, Dalian University of Technology, 2011)
The colorful impact (runway, plants, facade)

KINDERGARTEN ARCHITECTURE- "SPACE FOR THE IMAGINATION" by MARK DUDEK

In chapter 4 - "Defining quality: Characteristics space within the kindergarten environment". In the kindergarten, environmental and aesthetic factors, like light, atmosphere and color, many aspects which can be enhanced by architecture.

In Chapter 2,-"A selective history: Aspects of children's culture and architecture for children." He summarized that European nursery schools were integrated into urban environment. Being both physically close to residential quarters and encouraging the involvement of parents and others from the wider community.

He think a kindergarten should also participate with the society to improve their kids' social ability somehow.

In the House of Childhood is all freedom, freedom to be able to perform ordinary tasks by themselves. All furniture in the House of Childhood is at height and scale of children.

---

CHILDREN SPACE by MARK DUDEK

This is a book about children, for children. This is a framework, a forum about the children's psychological behavior, senility and views that interpret from the adult voices.

"TALKING AND LISTENING TO CHILDREN" by ALISON CLARK

A methodology framework named Mosaic approach for listening to young people about the important details of their daily lives.
- A Sense of Place. Children's experience of place
- Constructing meanings: place use. Children define the space.
- Objects
- Activities
- Routines. Children also added meanings to spaces by the personal routines.
- Access
- Constructing meanings: place feelings and values
- Social spaces
- Private spaces
- Individual landmarks

"PLACE MAKING AND CHANGE IN LEARNING ENVIRONMENT" by BRUCE A JILK

Bruce argued that schools have become internalized ghettos of childhood, cut off from the communities they are supposed to serve.

"This is consistent with today's desire for the school to be the center of community. Because both students and public share the use of some places, A third, shared zone in between the other two is envisioned."4

- Learning Process.
  - Integration between subjects.
  - Provide individual, small group and large group learning.
  - Allowing learning process in multiple settings: outdoors, elderly care center, homes and Internet.
  - Integrate learners of different ages.
  - Involve students in managing their learning, teaching them to take responsibility to plan, organize and maintain their environment.
  - Involve teachers working together and being trained in new teaching methods.

THE SCHOOL BUILDING AS THE THIRD TEACHER by ELEANOR NICHOLSON

She describes a more enlightened approach to school design. She explains how important the environment is in complementing the education. There are criteria which were developed by the National Middle School Association in relation to the architectural aspects as followed:

1. The building must be fun and an exciting place to be, filled with color and light.
2. Space for files, activity space for advisory groups to meet, involving all faculty and staff.
3. Flexible organizational structures
4. Programmed that foster health, well-being and safety: comprehensive guidance services.\(^5\)

Gernot Minke (2014) "Building with Bamboo: Design and Technology of Sustainable Architecture"

\(^5\) Mark Dudek, Children’s Spaces, Jordan Hill, Burlington, Architectural Press 2005. Chapter 4, page 44
This book bamboo and architectural elements in collaboration with modern materials. It takes a modern approach to Bamboo construction design; showing how the innovation of eco-friendly or ‘old’ materials in collaboration with model material such as steel or concrete. This is quite good when one is designing for rural community since it allows ideas for enhancement of existing buildings. The book transforms the line between vernacular and urban into a connected practice. Overall the knowledge of bamboo is one which is quite useful into vernacular design. It shows the multiple uses of this material, not only in architecture; but also methods of cooking and water filtration.

It shows how old techniques can be resurrected through modern advances proving them to be just as ideal as they were at the time they were being used. The construction detail of bamboo in this book shows specific diagrams of connections and foundations along with insulation and other structural elements. This is quite helpful in understanding the construction process and how to apply it in different areas of the world.
2.2 Montessori Education Theory and Concept

2.2.1 Montessori Education Concept

She claimed that Self-motivation of children is the most efficient ways for learning. The Montessori Classroom is designed to capture the unique ability of children to develop their own capabilities. Preparing the environment and providing activity, functions to guide and stimulate children do it themselves.

![Figure 1. The Mechanism of Pre-School Children’s Psychological Development](image)

This diagram shows that the child start to learn and know the outside environment start 3 years old which means that this 3-7 years old is very important to grow the kid’s psychological development.
The principle of Multi - Sensory Education.

Self- Motivation, Active studying by providing different Didactic materials and in certain environment

Sensory education plays an important role in Montessori education. The intention is to develop infantile children concentration, judging, comparison ability. To make their sensory more sensitive and accurate.

2.2.2 6 Core Points of Montessori Education Theory

- Child Centered Education
In Montessori education, Child is the center. The role of teacher is just the observer. They will help the child when they need help.

Figure 2. The principle of Multi - Sensory Education. (Draw by author)

Figure 3. Child Centered Education
(Draw by author)
• Importance in Sensitive Period Education
  5 sensory training (Sight, Hearing, Smell, Touch, Taste) are the core education of Montessori. The infantile children will learn through the 5 sensory, they experience then they learn and perceive the environment.

• Active learning
  To stimulate the child learn by themselves so that they can really learn it and they can decide to learn more interesting things that they prefer. The teacher as an observer doesn't force the children to learn what they are not interested.

• Mixed Age Education
  Mixed age education can build up the kid's social awareness and experience. The younger kids can learn faster with older kids

• Various Didactic Materials
  By providing various didactic material for the kids to create a better sensory training and perceiving

• Prepared Environment.
Children are able to learn efficiently within a prepared environment which architecture could play an assistance role in Montessori education.

2.2.3 5 Major Aspects of Montessori Education Curriculum

To have a better understanding of the Montessori education system, I did some research about the Montessori education curriculum so that to know that what the children should learn and what class they have. Therefore, the design of architecture and space can have a better association for the education and children.

- **Practical Life Exercise**
  - Environmental awareness
  - Good work habits
  - Responsibility
  - Concentration
  - Attention
  - Independence
  - Order and positive learning.

- **Sensorial Training**
  A child will be able to perceive sizes, shapes, colors, sounds, textures, odors etc.

- **Montessori Language**
  Child learn utilizes all the senses to help them read and write experience with proper
Montessori Mathematics
Hands-on experience in learning mathematical concepts.

Cultural Artistic subject
- Nature study
  Explore and understand their environment.
- Botany and Zoology
  Study of plants and animals.
- Geography
  To launch the child's exploration of the world's physical environment.
- History
  Understand the present and past.

Through the research of the curriculum of the Montessori education, I know that the Montessori education kindergarten focus more on the children's practical skill, self-characteristic growing, social awareness and environmental life awareness.
2.2.4 The 6 Design Principle Based on the Theory

After the research and study of the Montessori education theory, I analysis and translate the core idea of the theory in to architecture design criteria as follow.

- **Freedom**
  Keys of modified open plan facility.
  - Visibility between each area.
  - Partial enclosures privacy for the child.
  - Partial apart by encloses of circulation
  - Minimum
  - Clear visual interaction and connection to outdoor space.
  - 14 m² minimum space for each kid.

- **Order and Didactic Material**
  - An irregular shape create interesting space.
  - Space can be defined by
    - Floor level changes
    - Ceiling height

![Figure 4. Freedom principle](Draw by author)
- Niches
  - Fixed or movable partitions.

![Diagram](image.png)

Figure 5. Rational order of space principle. (Draw by author)

- **Nature**
  Life garden is another important aspect of the Montessori Method.
  - A separate nature study area apart from playground.
  - Should be easy to approach.
  - Visual connection between indoor activity spaces.
  - Children should be able to grow a plant by themselves.

![Diagram](image.png)

Figure 6. Natural principle (Draw by author)

- **Aesthetic and Atmosphere**
  - Natural & Artificial light
    The natural light is very important for the interior space for the children. A good natural light will create a warm and calm environment for the children.
  - Color decoration
    Different color will create a different atmosphere for the environment and also will make the children has different perception of the environment which will directly affect the psychology of the infantile children. Orange and warm color will create a space which can stimulate the children learning. Blue color will be calmer for the children.
- Material apply
  Material also will create a different atmosphere environment for the children. Wood material will create a warm and calm space which is more eco-friendly.

- Space based on Children proportion
  All the design of the space must follow the children proportion.

- Community Life
  - Shared facilities can be design to enhance Mixed-Age Interaction.
  - Size of activity space.
  - Involve parent and social interaction with the kids by provide a safe connection.

Figure 7. Social community
(Draw by author)
• Related issues
  1. Playground or Gym
     “Multi-purpose-motor-activities space”
     A space for the child who can’t picked up by parents sooner.

2.3 Case Study and problem analysis based on the principle

2.3.1 Current problem of the kindergarten in Kunming

• Not enough space.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Land Use</th>
<th>Building Space</th>
<th>Sqm/ Kld</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Class:</td>
<td>4085 sqm.</td>
<td>2700 sqm.</td>
<td>15 sqm</td>
</tr>
<tr>
<td>9 Class:</td>
<td>5866 sqm.</td>
<td>3780 sqm.</td>
<td>14 sqm.</td>
</tr>
<tr>
<td>12 Class:</td>
<td>6645 sqm.</td>
<td>4860sqm.</td>
<td>13 sqm.</td>
</tr>
</tbody>
</table>

Table 9. Law of the minimum space for kindergarten
(Draw by author)
• Simple and boring activity unit

• Simple and boring Outdoor Activity space

• Lack of Special Function room
  - No individual painting room, Artistic room, craft ship room,
  - Can't meet the need of various education.

• Lack of interaction space
  - Lack of the interaction between each class.
  - Enclosure and individual space.

• Negative Atmosphere and Aesthetic
  - Color Pollution.
    Color design is not rational and create a negative effect on children.

Figure 10 Current kindergarten problem in Kunming
(Photo taken by author.)
- Not enough natural light and poor design on artificial light.
- The Concrete material doesn’t create a kind and lovely environment.
- Form is for high school but not for a kindergarten.

- Unsafe issues.
  - Some safety detail is irrational.
  - Vegetation safety issue.

2.3.2 Case Study based on the principle

**C.O Kindergarten and Nursery**

Location: Hiroshima, Japan
Site Area: 1050.59sqm
Surface area: 595.33sqm
Building area: 940.60sqm

Figure 12. Plan of C.O Kindergarten. (Edited by author)
Coffee shop at the entrance of the kindergarten in front of the courtyard. The parents are able to seat in the coffee shop to wait for their kids. On the other hand, the parents can observe their children.

The kitchen beside the corridor with transparent glass window which children are able to see through the interior.

Playground locate along with the hallway and corridor which can maximum the use of the transition space.

Figure 13 C.O Kindergarten (photo from the internet edited by author)
Fuji Montessori Kindergarten
Architect: Tezuka Architects
Client: Education foundation Minnaohiroba Fuji Kindergarten
Site area: 4791sq.m
Building area: 1419sq.m
Number of students: 620
Number of Classes: 19

Fuji Kindergarten is the best example based on The Montessori education theory. The oval shape roof is the running path. Interior class room is one unit without any wall to separate the room so that the children can see through what other group is doing and make more interaction. On the other hand, the teacher can observe all the children from any point. The giant tree through the roof to ground will be the playground for the children and they can learn from the nature at the same time.

Figure 14. Plan of Fuji Kindergarten
(Edited by author)

Figure 15. Photo of Fuji Kindergarten
(Photo from Archdaily.com)
Chapter 3: Contextual Proposition in Kunming, China

3.1 District Selection

Kunming is the capital city of Yunnan province in China.

KunMing Urban Area,
Area: 4,615 km$^2$
Population: 4,575,000
Urban Density: 990 ppl /km$^2$

<table>
<thead>
<tr>
<th>Urban District</th>
<th>Population</th>
<th>Area (km$^2$)</th>
<th>Density (/km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panlong District</td>
<td>809,881</td>
<td>340</td>
<td>2,382.002</td>
</tr>
<tr>
<td>Wehui District</td>
<td>855,521</td>
<td>398</td>
<td>2,149.550</td>
</tr>
<tr>
<td>Guandu District</td>
<td>863,371</td>
<td>652</td>
<td>1,365.961</td>
</tr>
<tr>
<td>Xishan District</td>
<td>753,813</td>
<td>791</td>
<td>952.987</td>
</tr>
</tbody>
</table>

Figure 17. The population statistic of Kunming
(Table from Wikipedia.com)
The advantages of XiShan District are as follow:

- Residential development district
- Surrounded by a lake and many green space. This district has less traffic pollution and air pollution.
- Convenient Transportation.
- Need more Kindergarten in this area due to the high speed development of the residential building.
- This district has the main tourist visit point and it's the cultural center.
3.2 Site Selection and Site Analysis

3.2.1 Principle of kindergarten location

- The site must be away from the main road.
- The maximum site service radius is 500m.
- There shouldn't have any high-rise building close to the south of the site.
- The site should be close to the green space.
- The site must be located in a safe area.
- The site should have a convenient access.
- The site need to be near to the public transportation (subway, bus station.)
- The site must avoid the traffic influence (traffic jam)

Figure 19. Principle of Kindergarten location. (Drawn by author.)
3.2.2 Sites Comparison

3 suitable site comparison by scoring in 13 related issues to get the most suitable site.

![Figure 20: Site comparison (Drawn by author)]

The total score of site 1 and site 3 is only 1 point difference. However, to compare the highlight issues with green color are more important and priority to be concerned. Therefore the total score of the highlight issues of site 1 is much more than site 3.

As a result, Site 1 is the selected site for the kindergarten in terms of the advantages as follow,

- The size is suitable for the kindergarten and it has possible potential for future development.
- The site is located in a safe, quite, green, clean, environmental friendly community residential area.
3.2.3 Site Analysis

3.2.3.1 Location

The Site is located on the DianChi Lake Sub-District, Xishan District, Kunming City, Yunnan Province, China.

The location of site is on the intersection of Xin Ti Road and Ti Yuan Road.

The distance from the main road (HongTa East Road) to the site is 1.1km.

The distance from the site to the HubinRoad is 980m.

The site is located in the center of the high class residential area and is very near to the main road (Hongta). The Xinti road beside the site is minor road which will has less traffic and pollution. A row of the giant trees on west side will create a green barrier from the road which the kindergarten will has less negative influence from the road and weather.
3.2.3.2 Surrounding context

- **Residential Area**
  There are 3 Large Residential Community surround the site.

- **Educational Institution**
  - One Primary School is located 400m away from the site.
  - Two Kindergarten is 3 km away from the site.
  - One Sports training base is near the site.

- **Public Space**
  - One Yunnan Nationality Museum is 1.4km away from the site
  - One Yunnan Nationality Park
  - One Golf Center
  - A Waterfront Recreation Park is 900m From the site.

Figure 23. Site surrounding. (drawn by author)

3.2.3.3 Circulation and Traffic

Figure 24. Circulation and traffic. (Drawn by author)
Advantage

- Only less car passed through the TiYuan Road.
- There is no vehicle air pollution and traffic jam on both side of road
- Safe Condition Car way and Pedestrian beside the site
- Two Bus Stations are 100m away from the site.

3.2.3.4 Site Dimension & Infrastructure

- The Total area of site is 10,830 m².
- The both Road along the site are fully planted trees with a safe pedestrian.
- The bike line is along the pedestrian.
- Traffic signal light and urban security monitor are installed at the in
- There is no Car parking
3.2.3.5 Climate Analysis

The climate of Kunming is very comfortable. As the name of “spring city”, the four seasons in Kunming is like spring. It won’t be too cold or too hot the whole year. The back of the site is empty which will has a strong wind comes from Southwestern. Thanks to this climate advantage, Passive design of the kindergarten will be applied.

To create a sustainable and low-cost energy green Kindergarten.

- The wind is mainly from Southwestern and East.
- The south side will has more sunlight in one day.
Average Temperatures Graph for Kunming, China

Figure 28. Average temperature graph. (Weatherforecast.com)

Average Rainfall Graph for Kunming, China

Figure 29. Average rainfall graph. (Weatherforecast.com)
The average temperature during spring to summer is 17 - 20°C.

The average temperature during autumn to winter is 15 - 8°C.

These three diagram show the weather condition through the whole year in Kunming. The more important is the average temperature is Kunming. During the summer, it'll not be too hot. Conversely, it will not be too cold in winter. Which means we don't need HVAC system in Kunming normally. A new low-cost energy active and passive design should be considered.
3.2.3.6 User Analysis

- The District DianChi District that the site located area is 22.5 Km²
- The total residential population in this district are 120,000
- The Kindergarten target user will be family in DianChi District and the three residential community near the site.
- The roughly population in these three residential area is 8,500
- Target Age Group is 3 - 6 years old children.
- This area is more high class residence.
3.3 Building Regulation & Law

Building Regulation

- FAR: ≤ 1.5
- BD: ≤ 45%
- Green Coverage Ratio: ≥ 30%
- Height: ≤ 24m

- Storey: ≤ 3
- Setback (under 24m): 6m from boundary line
- Main Entrance can’t open to the Main road.

Building Interval

- Insolation Standard: 3 hrs/day (groundfloor window)
- No Living room facing West
- Permeability Rate ≥ 10%, Site Size

Kindergarten Enrollment Regulation

<table>
<thead>
<tr>
<th>Residential Population (&lt;10,000)</th>
<th>No. of Class</th>
<th>General Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Building Area</td>
</tr>
<tr>
<td>≤ 0.5</td>
<td>6</td>
<td>1600-2500</td>
</tr>
<tr>
<td>≤ 0.5-0.8</td>
<td>9</td>
<td>2000-4600</td>
</tr>
<tr>
<td>≤ 0.8-1.0</td>
<td>12</td>
<td>3200-4900</td>
</tr>
<tr>
<td>≥ 1.0-1.5</td>
<td>16</td>
<td>7000-7600</td>
</tr>
</tbody>
</table>

- Grade 3-4 years old: 20-25 students
- Grade 4-5 years old: 25-30 students
- Grade 5-6 years old: 30-35 students

Figure 32. Building interval regulation. (Drawn by author.)

Figure 33. Kindergarten enrollment regulation (Drawn by author.)
Chapter 4: Potential Design Response

4.1 Design scope

Figure 34. Design scope and research outline (Drawn by author.)
4.1 Kindergarten organization Structure

The organization structure system in 12 classes one-day care Kindergarten chart.

The Total number of kids is 360 with 12 classes. Each class has 3 teacher and one Childcare assisted teacher. Because the ratio of teacher and child is 1:7. Due to some of the family will send their kid to kindergarten at 4 years old, the number of kids in grade 2 and 3 in 30 and 35.
Figure 37. Children's proportion
4.3 Programming Analysis

4.3.1 Circulation Space design analysis (30%)

The transit space is an important area which can cause the interaction between kids in different grade. To enlarge the size of transition space will be one of the design strategy. There are some design strategy of transition space design.

- Increasing the size of stair and corridor space.

The staircase will be able to sit, play, read or watching other group’s activity.

- Hallway Space Form

The hole on the wall of hallway will add More secret and interesting space for kids.

Figure 38. Circulation space. (Children space, Mark Duek)
• **Hallway Private space**
  
The children always need some private space. Hallway as a circulation space could create more interaction secret space for children.

![Diagram of Hallway Private space](image)

**Figure 39. Private Space (Children space, Mark Duek)**

Children more like the space which is more private which they can hide inside, and the maximum straight hall way should not exceed 15m, otherwise, children will get bored. So place some private hidden space or activity space at the corner will increase the value of circulation space.

![Diagram showing Maximum walking distance](image)

**Figure 40. Maximum walking distance. (Drawn by author)**
### 4.3.2 Kids Living Room

<table>
<thead>
<tr>
<th>AREA</th>
<th>FUNCTION</th>
<th>FURNITURE &amp; Equipment</th>
<th>NO.OF</th>
<th>AREA</th>
<th>TABULATION CHART</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIDS LIVING ROOM (12 ROOMS)</td>
<td>ACTIVITY AREA</td>
<td>Desk</td>
<td>30 KIDS</td>
<td>105.110 m²</td>
<td>Desk 700</td>
</tr>
<tr>
<td></td>
<td>DESK &amp; SEAT</td>
<td></td>
<td></td>
<td></td>
<td>Chair 260-310</td>
</tr>
<tr>
<td>SLEEPING AREA</td>
<td>BED</td>
<td>30 KIDS</td>
<td>30</td>
<td>60.65 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30-45 m²</td>
<td></td>
</tr>
<tr>
<td>STORE SPACE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESTROOM</td>
<td>Male</td>
<td>Sink</td>
<td>4</td>
<td>12 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>Sink</td>
<td>1</td>
<td>12 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toilet</td>
<td></td>
<td>6 m²</td>
<td></td>
</tr>
</tbody>
</table>

Area per kids (30 students): 5.3-5.6 m²  
Total area: 265 m²  
Total Area in 12 rooms: 3060 m²

Table 41. Kids living unit program. (Drawn by author)
### 4.3.3 Communal Activity Area

<table>
<thead>
<tr>
<th>AREA</th>
<th>FUNCTION</th>
<th>NO. OF USER</th>
<th>UNIT</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNAL ACTIVITY</td>
<td>SPECIAL ACTIVITY ROOM</td>
<td>30 days/</td>
<td>9</td>
<td>770 m²</td>
</tr>
<tr>
<td>AREA</td>
<td>ArtCraft Room</td>
<td>2</td>
<td>140 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensory Training Room</td>
<td>1</td>
<td>90 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Science Exploration Room</td>
<td>1</td>
<td>70 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Toy Block Game Room</td>
<td>1</td>
<td>70 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical Training Room</td>
<td>2</td>
<td>180 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Martial Dancing Room</td>
<td>2</td>
<td>240 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MULTIFUNCTION SPACE</td>
<td>Gardening Space Performed Space Media Room</td>
<td>100 kids</td>
<td>600 kids</td>
</tr>
<tr>
<td></td>
<td>COFFEE LOUNGE</td>
<td>40 ppl/time</td>
<td>1</td>
<td>160 m²</td>
</tr>
</tbody>
</table>

**Total area:** 1330 m²

Table 42. Communal activity program table. (Drawn by author)
### 4.3.4 Office Area

<table>
<thead>
<tr>
<th>AREA</th>
<th>FUNCTION</th>
<th>NO. OF USER</th>
<th>UNIT</th>
<th>AREA</th>
<th>TABULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Area</td>
<td>HeadMaster’s Office</td>
<td>2</td>
<td>2</td>
<td>40 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Administration Office</td>
<td>12</td>
<td>1</td>
<td>60 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher’s Office</td>
<td>52</td>
<td>1</td>
<td>260 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meeting Room</td>
<td>14</td>
<td>2</td>
<td>120 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lunch Room</td>
<td>1</td>
<td>1</td>
<td>80 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training Tools Prepare</td>
<td>1</td>
<td>1</td>
<td>50 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WC</td>
<td>1</td>
<td>1</td>
<td>40 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Healthy Care Room</td>
<td>3</td>
<td>1</td>
<td>100 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Security Room</td>
<td>4</td>
<td>1</td>
<td>30 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staff Living Room</td>
<td>24</td>
<td>6</td>
<td>260 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>1</td>
<td>1</td>
<td>20 m²</td>
<td></td>
</tr>
</tbody>
</table>

**Total area:** 1,060 m²

Table 43: Office area program table. (Drawn by author)
### 4.3.5 Supply Area

<table>
<thead>
<tr>
<th>AREA</th>
<th>FUNCTION</th>
<th>NO. OF</th>
<th>AREA</th>
<th>TABULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPPLY AREA</td>
<td>Kitchen (processing &amp; store)</td>
<td>6</td>
<td>170 m²</td>
<td>Stove food processing: 15 m²</td>
</tr>
<tr>
<td></td>
<td>Boiler room &amp; Disinfection rooms</td>
<td>1</td>
<td>20 m²</td>
<td>Stove food Storage: 20 m²</td>
</tr>
<tr>
<td></td>
<td>Locker Room</td>
<td>12</td>
<td>70 m²</td>
<td>Vegetable Storage: 15 m²</td>
</tr>
<tr>
<td></td>
<td>Laundry Room</td>
<td>4</td>
<td>20 m²</td>
<td>Cold Storage: 10 m²</td>
</tr>
<tr>
<td></td>
<td>M&amp;E Room</td>
<td>2</td>
<td>40 m²</td>
<td>Pantry: 20 m²</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>1</td>
<td>20 m²</td>
<td>Washing &amp; Disinfection: 15 m²</td>
</tr>
<tr>
<td></td>
<td>Parking Lots</td>
<td>75</td>
<td>1128 m²</td>
<td>Parking Lots: 1.5 cars/100 m²</td>
</tr>
</tbody>
</table>

Total area:

75 × 12.5 = 940 m²
940 m² × 20% = 188 m²

Table 44. Supply area program table. (Drawn by author)
4.4 Activities and Space

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am - 4:20 pm</td>
<td>Practical Life, Sensorial, Language, Mathematics and Culture</td>
</tr>
<tr>
<td></td>
<td>Outdoor play, morning snack</td>
</tr>
<tr>
<td></td>
<td>Lunch, nap.</td>
</tr>
<tr>
<td></td>
<td>Music experience, art &amp; craft and swimming, water play, indoor gym, thematic teaching</td>
</tr>
<tr>
<td>2:30 - 3:30 pm</td>
<td>Extra Curricular Activities</td>
</tr>
<tr>
<td></td>
<td>'Swimming</td>
</tr>
<tr>
<td></td>
<td>'Art</td>
</tr>
<tr>
<td></td>
<td>'Piano</td>
</tr>
<tr>
<td></td>
<td>'Gymnastics.</td>
</tr>
</tbody>
</table>

Table 46. Figure of daily activity of different users (Drawn by author)
4.5 Space Summary

4.5.1 Program adjacency matrix analysis

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>Natural Light</th>
<th>Green Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Entrance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-Function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cafe Lounge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hallway&amp;Corridor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Activity RM.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special Activity RM.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor Playground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Garden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dining Rm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy Care Rm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff Living Rm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adminstration office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-Function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Open Space</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 47. Program adjacency matrix analysis. (Drawn by author)

The transition space and green space is an important connection between each program. The kid in each room should have an interaction with the outside nature and green space.
### 4.5.2 Program Summary Table

<table>
<thead>
<tr>
<th>ZONE</th>
<th>FUNCTION</th>
<th>NO.</th>
<th>AREA / m²</th>
<th>ILLUMINATION (LX)</th>
<th>TEMPERATURE (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KIDS LIVING AREA</strong></td>
<td>KIDS LIVING ROOM</td>
<td>360</td>
<td>12</td>
<td>3060</td>
<td>300</td>
</tr>
<tr>
<td><strong>SPECIAL ACTIVITY AREA</strong></td>
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<td>30</td>
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<td>30</td>
<td>1</td>
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<tr>
<td></td>
<td>TECTONIC GAME RM</td>
<td>30</td>
<td>1</td>
<td>70</td>
<td>300</td>
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<tr>
<td></td>
<td>PRACTICAL TRAINING</td>
<td>30</td>
<td>1</td>
<td>80</td>
<td>300</td>
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<td></td>
<td>MUSICAL DANCING</td>
<td>30</td>
<td>1</td>
<td>120</td>
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<td><strong>MULTI-FUNCTION SPACE</strong></td>
<td>Gathering / Performing</td>
<td>100</td>
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<td>250</td>
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<td></td>
<td>Media Room</td>
<td>60</td>
<td>1</td>
<td>150</td>
<td>300</td>
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<td></td>
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<tr>
<td></td>
<td>Headmaster’s Office</td>
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<td>2</td>
<td>40</td>
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<tr>
<td></td>
<td>Administration Office</td>
<td>12</td>
<td>1</td>
<td>60</td>
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<tr>
<td></td>
<td>Teacher’s Office</td>
<td>52</td>
<td>1</td>
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<td></td>
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<td>14</td>
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<td>200</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Lounge Room</td>
<td>20</td>
<td>1</td>
<td>80</td>
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<tr>
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<td>Training Tools Prepare</td>
<td>10</td>
<td>1</td>
<td>50</td>
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<td></td>
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<td>4</td>
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<tr>
<td></td>
<td>Staff Living Room</td>
<td>24</td>
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<td>260</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
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<td>3</td>
<td>80</td>
<td>100</td>
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<td><strong>SUPPLY AREA</strong></td>
<td>Kitchen (Process &amp; Store)</td>
<td>6</td>
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<td>200</td>
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<td>200</td>
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<tr>
<td></td>
<td>Locker Room</td>
<td>12</td>
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<td>70</td>
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<tr>
<td></td>
<td>Laundry Room</td>
<td>4</td>
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<td>20</td>
<td>150</td>
</tr>
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<td></td>
<td>Storage</td>
<td>-</td>
<td>1</td>
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<td>150</td>
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<td>10</td>
<td>150</td>
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<td>1</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>M.O.B Room</td>
<td>-</td>
<td>1</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Generator Room</td>
<td>-</td>
<td>1</td>
<td>30</td>
<td>200</td>
</tr>
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<td></td>
<td>L.P Room</td>
<td>-</td>
<td>1</td>
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<td><strong>OUTDOOR ACTIVITY AREA</strong></td>
<td>Communal Playground</td>
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<td>1</td>
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<td></td>
<td>Amusement Equipment</td>
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<td>1</td>
<td>200</td>
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<tr>
<td></td>
<td>Sand Field/Water Play</td>
<td>2</td>
<td>1</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Green Garden</td>
<td>12</td>
<td>1</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>MultiFunctionCommunity</td>
<td>-</td>
<td>1</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td><strong>PARKING AREA</strong></td>
<td>Teacher/Staff Service</td>
<td>-</td>
<td>1</td>
<td>10lots</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Parents</td>
<td>-</td>
<td>12</td>
<td>12lots</td>
<td>-</td>
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</table>

Total Water Permeability Area (10%): 875

Green Coverage Area (36%): 3900

Total Building Area: 6839

Total Site Area: 10,830

Table 48. Space summary table. (Drawn by author)
4.6 Kindergarten Safety Issues

The kids is a special group. The safety issues are very important in kindergarten design. There are 5 main issues as follow.

1. Outside Fence & Main Entrance Safety

   Fence Height > 2.2m

2. Playground Safety

   Playground Standard
   - Flat
   - Anti-Skidding
   - No barrier
   - Sharpless

   Amusement Equipment Area
   - Sand Pool
   - Amusement Equipment
   - Slide as Part of Building

   Sharpless Edge
   - Material
   - Depth < 0.3m
3. Vegetation Plant Safety

Arbor Tree Shading
Block the view and path
Meadow for soft surface
Green Garden for planting

4. Indoor Safety (Material, Window, Door)

1.2m Soft Material
Gum Doohandle
Open Window > 1.3m
Safe grill > 0.8m
Window height < 0.5m

5. Stair Safety

Timber Step 50
Timber Handrail 70
Timber Step 30
Timber Step 30

Protective handrail
Timber Handrail
4.7 Case Study

1. ShangHai Jiadin Kindergarten

ShangHai Jiadin Kindergarten

- Site Area: 11,000 m²
- Total Floor Area: 8,342 m²
- Structure: Reinforced Concrete Frame Structure (Steel Structure Partly)
- Storey: 2
- No. Classes: 15 classes (3-6 years old)
- Cost: 42 million RMB/210 million Baht

This kindergarten located in Shanghai. The L shape building formed a courtyard beside the river. The main kid living room are face to south side to get more natural light. The kids living room and supply room are separated by teacher office room.

The Passive design is applied in this kindergarten. This kind of roof will bring more natural light to the classroom and the heat will ascend and escape to the top of roof in hot season. Natural ventilation also will be increased because of the roof.
2. Jiading New Town Kindergarten

This kindergarten has an interesting design on the transition space. The long ramp on one side of the building instead of stair case. The child is able to run and play on the ramp. Several green open spaces has been inserted in between each class room on every floor randomly. The children will has more interaction in each different space.

The large skylight roof on the transition part will bring more natural light to the classroom. The large number of the random size of window on the façade create an playful and interesting light effect, and the children are able to sit in side of the window which will be their own secret space.

Figure 51. Plan and section analysis of Jiadin New Town Kindergarten (Drawn by author)
Chapter 5: Building Technology

5.1 Building Structure

The building structure will be the Timber and Steel structure. The Chinese Traditional "Column & Tie" wood skeleton load bearing system.

Figure 52. "Column & Tie" Wood skeleton system (Drawn by author)

Figure 53. Rammed earth wall construction detail

"Rammed Earth" Protection of external environment system.

The wall will use rammed earth. This wall doesn't take the load but can help the building passive design. The heat from sun light will be absorbed and the thermal will remain inside. So that during the winter season, the interior will be warm but cooler during summer. This material can get from the site and its cheap and more natural.
5.2 Building System

Because the climate in Kunming will not be too hot or too cold, HVAC system will not be applied in. The main strategy to control the building interior temperature be the passive design which is natural ventilation and rammed earth wall. The green roof will be applied.

5.2.1 Micro-Climate Design

![Figure54. Increasing natural light by building (draw by author)](image)

Natural light is important for the growth of kids. The kids living and activity room should be located on south and southeastern side to get the maximum natural light. The supply room could be located north or northwestern side to prevent the negative weather effect. The building on south side lower than north side will bring more natural light to north side and the building on south side can use slope roof to bring the sunlight into courtyard.

![Figure55. Natural light & ventilation by Inner courtyard and skylight (draw by author)](image)

By using the transition space (open & semi open space) to control the interior micro-climate. The inner courtyard or garden inside of kindergarten will provide a green, comfortable and interesting living environment. On the other hand, it will control the building interior micro-climate by increasing the natural ventilation, natural light.

Beside those active design, the building itself also has passive design to control the interior micron-climate. The skylight on the south side roof and the opened south façade bring more natural light. The plant on the roof top also will block more sunlight and bring more natural light. The interior cross ventilation will increase the interior natural ventilation.
Chapter 6: Design Schematics

6.1 Zoning & Circulation

Figure 58. Zoning and circulation diagram (drawn by author)

There are three basic zoning in kindergarten which are as in the diagram above,

- **Private Zoning:** Kids living area, Special activity area
- **Semi-Public/Private area zoning:** Outdoor space (playground, sand field)
- **Public zoning:** Office and Service area

Figure 59. Transit space diagram (Drawn by author)
The more important area for the modern kindergarten is the semi-private zone. It is a zoning to separate the public and private. Somehow, it should build up a connection between the kids and kids, kids and parents.

As mentioned earlier, in Montessori kindergarten education theory, the more important issues are the interaction between kids and kids in different group age. In the new kindergarten design, I focus more on the communal circulation space (corridor, walkway, path, hallway, and courtyard.). The transit space should provide more interaction possibility between children so that they can learn more from each other.

6.2 Concept development.
6.2.1 Conceptual zoning

This kindergarten design is based on the Montessori educational theory. Translate the theory into architectural environmental education principle. With the concept of traditional Chinese landscape garden and village landscape Break the traditional one building’s kindergarten into several unit (Cluster) which create more sense of social community. Insert the important core element – Courtyard in each unit. The courtyard will provide more natural space for interior so that the children can observe the changing of nature and learn from the nature. On the other hand, the children can watch the activity of other group in different courtyard and do more interaction.

Figure 60. Inserting of courtyard concept. (Drawn by author)

Bring the garden into the building, inner and outer courtyard will be the transition space.
Figure 61. 3 typical types of kindergarten zoning layout. (Drawn by author)

To merge the courtyard into the three different types of kindergarten and analysis the pros/cons of the type, I found out that all the types are actually limited the kids in a box, even though there are a lot of courtyard surrounded.

To reconsider about the size of the site, I decide to break down the private zoning into several individual units and connect by a corridor and green garden.

Cluster
Transit space
Green Space
Irregular

Figure 62. Cluster type zoning layout. (Drawn by author)

To break down all the kids living and special area into individual units somehow to create a sense of the community. And insert the green courtyard and garden in between each unit so that maximize the interaction between children and kindergarten. To keep the patio type of kindergarten, put a central courtyard for communal gathering of the children in different age groups.
6.2.2 Conceptual diagram development

There are 3 different levels in the kids which are age 3 to 6 years old when they grow up.

- Know nature
- Know social
- Know themselves (self-characteristic create)

So I try to convert these route into three conceptual keywords:

Social

Cluster
Transit space

Nature

Organic
Green Space
Courtyard

Creative

Irregular Shape

Figure 63. Three levels in age 3-6 (Drawn by author)

Figure 64. Three key words. (Drawn by author)
- **Nature**
  Bring the green space and courtyard into the kindergarten and create a more organic architecture space so that the children can learn from the nature and the building.

- **Socialized**
  As in Montessori theory, the interaction between children is very important. Therefore, transit space and cluster units can create more interaction possibility.

- **Creativity**
  The building should stimulate children’s creativity and curiosity. As in Montessori theory, an irregular space can create a more interesting and curiosity of children. I combine the traditional house and modern regular square house to get an irregular polygon unit for each kids' living room. Moreover, compare the rigid square unit with a polygon unit, a polygon unit can create more different angle of the view so that it can stimulate the curiosity of children.

![Figure 65. Types of irregular form of units. (Drawn by author)](image)
Based on these keywords and the conceptual zoning diagram, I come up with a conceptual diagram of the formulation of the kindergarten’s layout with all the functions and concepts.

The dynamic and organic arranging of the transit space and the individual unit is a spirit from the traditional Chinese landscape garden.
Chapter 7: Design Summary

7.1 Layout plan

Through the site analysis, the class units are located on the east and south side so that each unit will receive more natural light. The office and supply area located on the west which will block more negative influence from the west side. Even though the road is on east side, but there are less traffic influence and the green belt will block the influence. A strong wind from north side will increase the ventilation in the center courtyard and the circulation space.
Figure 69. Circulation Diagram

KIDS CIRCULATION

PARENTS & SERVICE CIRCULATION

TEACHER CIRCULATION

VEHICLE & FIRE CIRCULATION

7.2 Plan

Figure 70. Ground Floor Plan
Due to the enough size of the site, I break all activity units into each single unit with only two floors. Each age group has four units. As the concept, all of the units are connected by a large circulation hall, the children will have more interaction when they are walking in the hall. The younger children will learn more from the older group which is the one of the core concept of Montessori education theory. A center multi-function hall separates the center courtyard into several space which all the children can gather and do more interaction.
7.3 Elevation

Figure 72. Elevation South

Figure 73. Elevation East

Figure 74. Elevation North

Figure 75. Elevation North
7.5 Building System Design

To install a glass roof ceiling on the roof top and connect each units in each age group. To protect the kids from raining day and also create an interesting space for the kids that they could see the raining through the glass ceiling. On the other hand, this device will collect the rain water and dew water, at the winter season, it will also collect the thermal heat to warm up the interior space.
Water Collector System -
Due to Kunming is a city which is lack of water, especially during dry season. To design a water collector roof duct device in order to collector the raining water, and also the dew water during the night. At the same time architecture perform as an educator for the children.

Thermal Control and Collector System -
Because the weather in Kunming will not be too hot or too cold, so that there is less using of AC. However, during the winter season, it will still be cold for children somedays. The glass roof shelter perform as a greenhouse producer to collector the thermal to the heat storage then supply to the kid’s living unit and corridor.
7.6 Perspective

Figure 82. Entrance Bird View Perspective

Figure 83. Entrance Perspective
Figure 84. Kindergarten Bird View Perspective 1

Figure 85. Kindergarten Bird View Perspective 2
Figure 86. Outdoor playground Perspective 1

Figure 87. Outdoor playground Perspective 2
Figure 88. Animal Observing Zone Perspective

Figure 89. Library Perspective
Figure 90. Multifunction Hall Perspective

Figure 91. Multifunction Hall Perspective 2
Figure 92. Exhibition Hall Perspective 1

Figure 92. Exhibition Hall Perspective 2
Figure 93. Special Activity Room Perspective

Figure 94. Kids Living Room Perspective
Figure 95. Kids Living Room Perspective 2

Figure 96. Kids Living Room Perspective 3
Figure 99. Model 1

Figure 100. Model 2
Figure 103. Section Model 3

Figure 104. Section Model 4
Chapter 8: Thesis Conclusion

Through the research and study of Montessori Education Theory and translate it into architecture design method, this project give a new design of modern kindergarten based on the Montessori education theory and create a prepared environment for the kids. Even though there are still some design deficiencies, but it improves and helps more understanding of the design of kindergarten’s space, environment function. In general, this project start with the interaction space in between the transit, outdoor and class unit to create more possibility for the interaction between the kids in different age groups. Moreover, break the class unit into several individual cluster and surrounded by the green open space will build up strong connection and interaction between kids and nature, so that the kids can learn more from the nature. In the design process, considered the infantile kids’ proportion and psychological characteristic, and based on the understanding of infantile sensitive period, natural development and sensory training in Montessori education theory. A rational design of the kindergarten space proportion, function zoning, and educational zoning. To provide a health, comfortable and stimulating learning and living environment for the children.

This project applied a lot of Montessori educational theory, but still has some deficiencies in terms of the design method and eco-system design method. For example, the diverse architectural language has been merged together should has a stronger statement and reason. And because the lack of the knowledge of building sustainable and eco-system, can’t apply it well and integrate into the design process. But still, a rational function zoning and open space design give a more ecological architecture.

In conclude, in the design process of this project, I got more knowledge and understanding about the Montessori education theory. I know how important the architectural environmental space for the kids with an effective and rational design. In the future practical design, I’ll not only focus on the function design but also to think more about the meaning of the space related to the nature of design. For kindergarten, the building should satisfy the need of each function but also need to show the "Environmental education".
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