“There is too little attention being given on ensuring a high level of quality in preschools for the most vulnerable children. We urgently need more investment in children's education, otherwise an important opportunity to reduce their disadvantage will be lost.”

Manos Antoninis,
Director of the Global Education Monitoring Report
UNESCO
Adriana Martínez Tozqui
3rd year Engineering student

Luis Enrique Hernández Jaramillo
5th year Architecture student

Carol Aranssa Castañeda González
5th year Architecture student

José Juan Rodríguez Grave
5th year Architecture student

Luz Brenda Matadamas Santaella
5th year Architecture student
Introduction
Objectives
Strategies
Project Highlights
Conclusions

Presentation Overview
Location: Mexico City, Xochimilco, México
Climate Zone: mixed-humid (4a; ASHRAE)
Wetland of international importance (RAMSAR)

World Agricultural Heritage Systems by the FAO

Cultural and Natural Heritage of Humanity by the UNESCO

**Xochimilco and Chinampa system**
Cultural and Natural Heritage of Humanity by the UNESCO
120 miles
of contaminated water canals
Relationship with nature is broken
How can we reconnect with nature?
and involve children in the process?
Water trail School
Agricultural producers
12,000 people
Income: 200 USD/month  Lower class
| 1 | Observe and interact with nature |
| 2 | Capture and store energy. |
| 3 | Obtain a yield without affecting future generations |
| 4 | Design self-regulation systems & accept feedback. |
| 5 | Use & value natural services and resources. |
| 6 | Produce no waste. |
| 7 | Design from patterns to details. |
| 8 | Integrate rather than segregate |
| 9 | Use small and slow solutions |
| 10 | Use and value diversity. |
| 11 | Use the edges and value the marginal. |
| 12 | Creatively Use and Respond to Change |

**Permaculture principles**
Give a new perspective for children to observe nature, as well as the treetops thanks to the Mexican milpa crops located all over the project.

Provide energy for the building and supply excess into the community by installation of PV systems and generating through games for children.

Move towards sustainability by creating habits in the new generations to guarantee a resilient future.

Control daylight shades manually observing the differences between north-oriented openings, and south oriented light shelves.

Highlight the historical importance of vernacular architecture made of earth, using the constructive technique called bahareque.

Compost organic waste and reuse and recycle inorganic waste valuing natural sources while using waste disposal as a last resort.

Design buildings according to climate parameters so that the entire building functions as an integrated system.

Integrate segregated communities through public space as well as relating to the natural environment in order to create more resilient communities.

Replicate the project in other sites near the waterways to jointly purify the lake water and work as a cleaning network and ecosystem services provider.

Provide energy, water, and food to serve as an emergent collection center in case of natural disasters and pandemic.

Allow the community to interact with the lake through converting residual spaces into natural-urban landscape.

Create comfort microclimates by integrating the waterscape and replacing impervious pavements with permeable surfaces.

---

**GOALS**

**Main goals**

According to 12 principles and permaculture and the 9 contests
Design guidelines
Lack of public space
Kindergarten
Lot Size: 25,907.80 ft²
Building Size: 13,850 ft²
Design from patterns to details.
Public space
Lot Size: 33,508 ft2
CLEAN
Clean 30 liters per minute of lake water
Biological filtration

HARVEST
1,250 gallon Underground Cistern
Irrigate Edible Landscape
Produce energy
Energy permanent
165,645 kBtu electricity

Capture and store energy using natural services and resources without affecting future generations.

**CAPTURE**
26 Rooftop PV Panels
20,400 kWh/year
14,000 SF Allowable Roof Area

**REDIRECT**
Turgo impulse wheel
5,110 kWh/year
196 gpm water flow

**PLAY**
5,110 kWh/year
Intermittent energy when needed
Observe and interact with nature obtaining a yield. Without affecting future generations. Use & value natural services and resources.

**CULTIVATE**

Relationship with neighborhood festivities
5, 283 sq ft

**REPLICATE**

Replicability at their homes
5, 023 sq ft

**Landscape**
permanent
5 tons of food per year
Annual Cycle
Mexican Milpa
Agroecology

Observe and interact with nature obtaining a yield, without affecting future generations. Use & value natural services and resources.
Observe and interact with nature obtaining a yield without affecting future generations. Use & value natural services and resources.
Observe and interact with nature obtaining a yield without affecting future generations. Use & value natural services and resources.

**Flowering and plant growth**

Polination
Observe and interact with nature obtaining a yield without affecting future generations. Use & value natural services and resources.

Water harvesting
13,850 ft² caption surface
290K gal/year
Observe and interact with nature obtaining a yield without affecting future generations. Use & value natural services and resources.

**Milpa and Cempasuchitl**

Link with neighborhood festivities
Observe and interact with nature obtaining a yield without affecting future generations. Use & value natural services and resources.
Ecosystem based design
Accessibility
walkability
no carbon transportation (bike, canoe)
Public spaces around water
Water approach
Wind
Cold season
Wind
Hot season
Sun radiation
Capture radiation in the roof
Blocking radiation in public spaces
Building’s access plaza

Use the edges and value the marginal
Flexible Classrooms

Observe and interact with nature
Playroom and playground

Observe and interact with nature
Habitable roof

Observe and interact with nature
Observe and interact with nature

Kitchenette & Orchards
Building performance
Wind

Prevailing winds: 2 m/s

Design from patterns to details.
Wind simulation
Natural Ventilation
+13 changes of air in each classroom

Design from patterns to details.
Energy Recovery Ventilation system
400 cfm
11 changes of air in each classroom

Design from patterns to details.
Use & value natural services and resources

Spatial Daylight Autonomy
sDA300/75%.
LEED v4 BD+C

a) Playroom
b) Auditorium
c) Classroom 1
d) Classroom 2
e) Classroom 3
f) Mechanical room
g) Kitchenette
h) Compostable Toilets
i) Administration
j) Nursery
k) Psychology
Interactive movable shades

Three modes
Annual Sunlight Exposure
ASE1000, 250
LEED v4 BD+C

Use & value natural services and resources
Glare

DGP = 0.27 average
Imperceptible glare
Artificial lighting
LED technology. Whole building’s LPD: 0.38 W/SqFt
2.5% less than ASHRAE guidelines
Artificial lighting
Schedules & 3 types of dimmers. Occupancy sensor
dimmers in corridors (Up to 50%).
Assess the importance of vernacular architecture

Bahareque system
33.33 ft² · Fh/Btu
Construction system

Asses the importance of vernacular architecture

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<th>U-value</th>
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<td>U-value</td>
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</tr>
<tr>
<td>Standard floor</td>
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</table>
A completely sealed system to avoid heat transfer

**Heat transfer**

maximum $Q= 3.46$ MMBtu/year
Integrate rather than segregate.

Local Suppliers
2 miles radius

Salcedo
Building Materials
15 min

“HEXCELSUKX”
Glass custom cut
7 min

“Maderas del lago”
Timber shop
6 min

“Honeysuckle”
Plant Nursery
5 min
Global warming potential
23 901 lbCO2eq

Capture and store energy.

- Ceilings: 13%
- Doors: 6%
- Floors: 54%
- Structure: 27%
- Walls: 6%
Capture and store energy.

Global warming potential 23 901 lbCO2eq
Energy Usage Intensity

Energy Source: 572,166 kBtu
Energy SITE: 181,640 kBtu

Capture and store energy.
Hydropower = 6,390 kBtu
Photovoltaics = 255,501 kBtu
Playing = 249 kBtu
Demolition and excavation  
New Building Structure  
Building Envelope  
Building Equipment and Appliances  
Landscaping and water management systems  
Photovoltaics  
Professional fees

Project Cost  
$25 per sqft  
40% cheaper than conventional construction
Integrated Performance

Creatively Use and Respond to Change
kids

parents

school community

neighbors

Interactivity

Interior buildings

Waterways and landscape

energy

take care

Operations & Maintenance Cost

Observe Nature, and make small changes to have huge impact
Electric energy
$149,600 USD

Stormwater
$960 USD

Co₂ capture
32 ton

Food production
5 ton/year

System Outputs
Yearly

Design from patterns to details.
Design from patterns to details.

Replicability
Replicability
8 potential sites

Design from patterns to details.
WATER TRAIL SCHOOL

A KINDERGARTEN + A PUBLIC SPACE INTERVENTION

José Juan Rodríguez Grave
Luz Matadamas Santaella
Adriana Martínez Toxqui
Luis Enrique Hernández Jaramillo
Carol Castañeda González

Universidad Nacional Autónoma de México (NAM)
Education Building