

DESIGNING A GREEN MIDDLE SCHOOL AS A 3-DIMENSIONAL TEXTBOOK

A Thesis

Submitted to the

Faculty of Miami University

in partial fulfillment of

the requirements for the degree of

Master of Architecture

by

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Miami University

Oxford, Ohio

2023

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# 1- ABSTRACT

‘Train up a child in the way he should go and when he is old, he will not depart from it.’

Proverbs 22:6

# ABSTRACT

The Teaching Green Building (TGB) initiative is gaining traction as a method to include the users of a building in conversations about environmental issues by means of the building's architectural design. If built environment, natural, and cultural architecture can be used as instructional tools, educational environments can be more effective. Architects design these buildings to achieve high levels of environmental performance and to encourage inhabitants to engage in the environmental narrative of the structure as well as its day-to-day operations. "The surrounding nature as a passive area" with "the building's surrounding natural areas" may be used to teach environmental concerns, ecology, and sustainability. The question of "how the Green Building School encourages students to be aware of their environment and to understand the application of the concept of green in their school?" has been widely debated in educational and sustainable design, with scholars such as "Nurhayatu Nufut Alimin" and "Laura Cole" arguing when students are placed in an environment, their behavior, mind, and choices are influenced by the environment. However, these publications do not sufficiently address how we might teach sustainability to children by involving them in sustainable design and school design, including sustainable curriculum and school curriculum. In my thesis, I will present research and design to showcase how sustainable features can be used as an educational tool to help students gain a sense of sustainability and built systems around them, using a combination of green school design and educational goals. To a certain extent, I am looking for ideas and structures that guarantee the learning and participation of students in all areas related to the initial middle school curriculum (Biology, geometry, technology and so on), 4 C's skills (communicating, creativity, critical thinking and collaborating) and sustainability. In particular, I am interested in how sustainable features, architecture and education can be combined to reinforce all areas of children's development and learning by creating a well-designed environment.

School buildings may provide an opportunity for students to engage with themselves, their communities, and their environment. Children can relate their learning to their world, be proud of where they live, and as a result become real and practical learning experiences, concerned and participatory citizens. The purpose of this thesis is to explore this main question:

- How a green building school can act as a 3D textbook and teaching tool for students giving them a comprehensive understanding of not only the school's curriculum, but also the ideals of sustainable design for nature and humans? Even though there are instances of teaching green school building both in the United States and elsewhere, they do not support all aspects of education and also the amount of contribution of students in sustainable structures and projects are really low. In conclusion, this study provides fresh light on the previously recognized problem of lack of sufficient techniques and sustainable education to children by carefully evaluating new curriculum and new educational environments.

Keywords: green school, three-dimensional textbook, sustainability, environmental education, students.

“Each one of us matters, has a role to play, and makes a difference.  
Each one of us must take responsibility for our own lives, and above  
all, show respect and love for living things around us, especially each  
other.”

**Jane Goodall**

# 2- PROJECT DESCRIPTION

# PROJECT DESCRIPTION

## 2-1 Why is a sustainable future important?

For a long time, we have used the limited resources of the earth. In the process, we have damaged our lifestyles and livelihoods. Numerous factors have influenced the growth of this decline, such as large population, increase in harmful human activities, decrease in natural resources, etc. In such a situation, we must look for better ways.

The goal of sustainability is the use of renewable resources and nature protection. The idea behind sustainability is to reduce the effects of current and future human abuse in order to continue living effectively. The most important challenge we now face is educating people about issues and understanding the importance of saving our planet. In order to be able to use the resources and pass them on to the next generations, we must quickly adapt to a more sustainable lifestyle, so it is essential for a sustainable future. While adapting is difficult for adults, one of the most promising ways to make a difference is to influence the school of thought of younger generations who have not yet discovered their ideals and principles about life. This approach, in my opinion, may be beneficial on a local scale and in relation to individual activities, as well as on a larger scale and in relation to government and major operations. Children are clearly the next generation of society, and they will engage in both major and small-scale activities. As a result, when we instill the proper values and habits in children, the negative environmental impacts of all actions, great and little, will be lessened. We observed that one of them had established a sustainable and environmentally friendly product line, as Alimin<sup>1</sup> stated in his article on the future of pupils attending a green school.

## 2-2 The need for a Sustainable Middle School?

Environmental education has been a feature of American education since the 1970s. Given the system's age, as well as rising consumerism and environmental degradation, I've come to the opinion that its influence has been insufficient, and that additional study and actions are needed to establish the proper education and habits in society. On the other hand, it is obvious that teaching youngsters good habits is more successful than teaching adults. What we need to achieve out of this summit, according to the Dalai Lama, is to work with children, as he mentioned during the Earth Summit in Brazil. We need to instill in them a sense of reverence for the environment<sup>2</sup>. As a result, I devised the concept of creating a green school that would have a bigger influence on ensuring a sustainable future. In reality, my ambition is to create a three-dimensional book that depicts a green school. The qualities and technology of sustainability are taught to students (as the new generation), parents, instructors, and staff at this school, both actively and passively (as the old generation). To put it another way, I believe that, in addition to the positive environmental effects, this school prepares students for college and career, as well as introduces them to the innovative and systems thinking skills they will need to engage in sustainable behaviors and practices. I hope that this stunning aim has far-reaching consequences for the educational system, professionals who deal with children, and the learning spaces in which children play. In my opinion, we should maximize the amount of money spent on schools and educational facilities so that they can better assist every child in learning and education. Many principles may be learned through our surroundings. However, as architects, we must be able to make it as educational, entertaining, and useful as feasible.

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<sup>1</sup> Alimin et al, 2021

<sup>2</sup> Taylor, 1993, p: 170

### **2-3 What makes a school a green school?**

To be classified as a three-dimensional textbook, not only the building but also the educational institution must be capable of providing effective sustainability instruction. My Green School contains two components that are directly connected to educating kids about sustainability in order to achieve this aim. The first element is that the structure is created and utilized as an instructional tool for kids and school employees to learn about sustainable practices. The building's second component of my green school is that it should employ an environmental education and sustainable education curriculum so that children may understand significant and fundamental sustainable concerns.

### **2-4 Why we need Teaching Green Buildings (TGB)?**

The notion of merging architecture with environmental education in the field of school architecture results in a school building that is variously referred to as a "teaching instrument" or "3-dimensional textbook" for environmental challenges<sup>3</sup>. Because there isn't a more specific name for these kinds of structures, we're going to refer to them as "Teaching Green Buildings" for the rest of this article. Teaching Green Building projects must incorporate curriculum, both hidden and explicit, and convey a meaningful tale about how people connect to the natural environment in which they live<sup>4</sup>. These buildings have the potential to expand our understanding of green buildings beyond a perspective that is centered on green technologies. They can also propose that green buildings can be vehicles to visualize sustainability, draft new behavioral norms, and suggest increasingly thoughtful ways of using the earth's resources in our day-to-day lives.

Buildings that have been constructed with the intention of bolstering environmental education have made it possible for social science research programs to begin investigating how such structures function in order to broaden the participation of the general public and the educational opportunities available to them<sup>5</sup>. Before delving further into the future of ecologically educative architecture, it is important to examine the reasons such structures are a worthwhile endeavor despite the possibility of increased costs associated with their construction. Consider the following two constraints on education about environmentally friendly construction practices: 1) Even in areas where green buildings do exist, users are not often involved in the environmental narrative of the building they use on a day-to-day basis. This is despite the fact that there are presently very few inroads for the public to interact with green building concerns. The Teaching Green Building is a persuasive solution that may be implemented in response to any of these difficulties.

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<sup>3</sup> Nair & Fielding, 2005; Taylor, 1993; United States Green Building Council, 2008

<sup>4</sup> Orr, 2004

<sup>5</sup> SeiboldBultmann, 2007

# 3- PROBLEMS

“Sustainable development will not just be a subject in the classroom: it will be in its bricks and mortar and the way the school uses, and even generates, its own power. Our students won’t just be told about sustainable development, they will see and work within it: a living, learning place in which to explore what a sustainable lifestyle means.”



# PROBLEMS

Education is widely acknowledged as a critical component in raising awareness and understanding of environmental challenges. Given the UN Sustainable Development Goals for 2030, the Action Plan for Planet Earth, People, and Welfare cannot be realized without understanding the critical relationship between educational advancement and a sustainable learning environment.

They are mysteriously linked to pupils' ability to transform information into conscious action, allowing them to function as catalysts for future progress. That is why environmentally friendly schools are so vital. We must provide pupils with an organizational culture, curriculum, and physical location, as well as environmental awareness. During their most formative years, students spend the majority of their time in the school building. Schools should be a place for creative thinking, inspiration, and the beginning of establishing a feeling of awareness and responsibility at this time. To achieve this aim, pupils must be educated in a healthy and sustainable environment.

Since a consequence, the demand to create green schools in conjunction with a suitable education system is growing by the day, as the number of green schools with a decent education system is insufficient to satisfy these needs. Unsustainable schools not only do not assist us in achieving these objectives, but they also compound the difficulties and have harmful consequences. This is due to their high energy consumption and a lack of environmental awareness in the school system, which makes it difficult to instill sustainable habits in the next generation and safeguard the environment.

As a promising remedy to numerous environmental and educational problems, green school buildings are acquiring popularity. These institutions employ eco-friendly materials, renewable energy sources, and sustainable architecture to reduce their environmental impact. Moreover, green schools create a healthful and conducive learning environment for students, which has a positive impact on their learning.

Teachers in green schools can use the facilities as a tool and foundation for project-based learning, in which students engage in hands-on, interdisciplinary environmental and sustainability-related initiatives. This type of education improves students' academic performance and instills in them a sense of environmental responsibility. In addition, green schools provide students with a distinct opportunity to engage with curricula in areas such as the environment, technology, and mathematics, and can be used as a tool for interactive instruction in all subjects.

In addition to educational benefits, green institutions offer substantial environmental benefits. They can reduce their carbon footprint and conserve natural resources by employing sustainable designs, eco-friendly materials, and renewable energy sources. In addition, they assist government authorities in resolving environmental issues such as air quality, wastewater management, water consumption, and recycling. Therefore, green colleges can contribute to global efforts to combat climate change and safeguard the environment.

Due to the high cost of construction and a lack of funding, governments have been sluggish to adopt green schools despite all of these benefits and advantages. However, research indicates that the initial investment required to establish a green school will be repaid over time. This is due to the fact that green schools can substantially reduce operating expenses, including energy and water expenditures. Moreover, by fostering a wholesome and secure learning environment, green schools can help reduce healthcare costs.

However, research indicates that a substantial number of green schools have labored with curriculum and architectural design. Some green institutions, for instance, have failed to effectively incorporate environmental and sustainability topics into their curricula. Others have encountered building issues, such as inefficient heating and cooling systems, which have increased energy consumption and operating expenses. Therefore, it is necessary to evaluate these structures, identify their defects, and develop strategies for their improvement.

In a nutshell, green schools are a novel approach to environmental and educational problems. They provide a healthful and conducive learning environment and can reduce school buildings' carbon footprint. However, governments must acknowledge the long-term advantages of green schools and provide funding for their construction and maintenance. In addition, efforts should be made to ensure that green schools are effectively designed and implemented to maximize their benefits. By doing so, green schools can contribute to a sustainable future for the planet and create a more conducive environment for student learning.

# 4- LITERATURE REVIEW

# LITERATURE REVIEW

**4-1 Laura Cole**<sup>6</sup> through writing “Green building literacy: a framework for advancing green building education” provide a toolkit of conceptual frameworks for educators who want to educate green buildings as sites where complex interactions between human activities and terrestrial systems take place. She begins by providing a practical definition of "green building literacy" based on the wide concept of environmental literacy (knowledge, skills, emotion, and conduct).

According to Cole, Green building literacy involves a combination of knowledge, impact, and behaviors related to green building design. A starting point for defining areas of "green building knowledge" is to use the criteria used in architecture to define a green building. Such as green infrastructure, sustainable landscapes, energy and atmosphere, water, materials and resources, and water, materials, and resources are only a few examples. She then goes on to explain the fundamentals of green construction and how they link to the next generation of scientific standards. Green building literacy, in my opinion, may allow students to combine scientific and environmental literacy. Teachers play an important role in this respect. Unfortunately, it appears that there are few tools available to assist educators in incorporating green building concepts into the classroom. My objective is to construct and integrate these training tools in order to assist educators in connecting green buildings and teaching one another. These technologies should lead to the design of environments that improve interactions between student activities and the ground system. Students' knowledge, abilities, and conduct are all influenced by green and environmental construction literacy. These sustainability system training resources can serve as a starting point for improving students' talents and understanding.

Cole objective is to foster green building literacy among K-12 students through STEM education. According to her, the educational tools generated via this method may be utilized as a beginning point for curriculum creation in a range of formal and informal settings to expedite green building education. She developed educational tools for connecting green buildings and science education through a multi-step process. An interdisciplinary literature review yielded a series of frameworks that were improved through two focus groups with science and environmental educators and built environment professionals. To develop this provisional framework for green building literacy (GBL), her guiding question is: what are the core qualities of a green building literate citizen? She used a simplified and qualitative Delphi technique to create, present, and revise the frameworks presented here. The Delphi method is a process used to arrive at a group opinion or decision by surveying a panel of experts. The three broad themes addressed by experts were summarized below:

Theme 1: framing green building literacy

The Table 1 “affective dimensions” category was split into two sub-themes as a result of this discussion.

Theme 2: green building knowledge categories

Discussion around the specific Table 2 categories comprised the major portion of sessions. Theme 3: implementation within schools

A central theme in the Educator focus group was the ways in which frameworks for GBL can be useful to educators and curriculum developers. They, all, agreed, that alignment between GBL and science standards is a critical missing piece for promoting the adoption of green building education in K-12 classrooms.

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<sup>6</sup> Cole, 2019

The focus of this article is more on how to design a green building to have the highest and best potential in terms of green. While I'm going to look at building elements and the effective features of being green based on my site, I also want to look at how these elements are more effective in the child education system. I want to create an environment that creates a pleasant learning experience in relation to the purpose of the project. As a result, the initiative is divided into two main objectives. The first is about building a structure with sustainable characteristics, while the second is about creating an educational environment that can help children's learning process. The Categories that would be beneficial for me through the process of design:

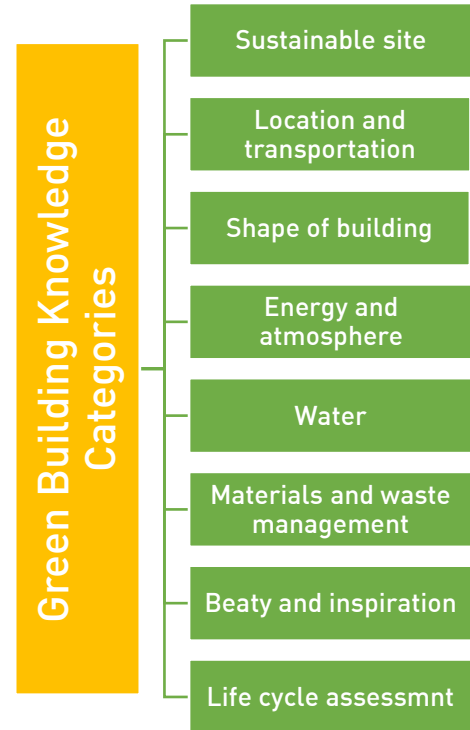


Fig. 4.1 – Cole, 2019

**4-2 Nurhayatu Nufut Alimin<sup>7</sup>**'s question in “Establishing sustainable habits of students in Green School Bali through green interior design” is how the Green Building School encourages students to be aware of their environment and to understand the application of the concept of green in their school. He concludes that when a student is placed in an environment, his behavior, mind, and choices are influenced by the environment. He analyzed that habits can be formed by following patterns, behaviors, and experiences planned to become an inevitable habit. After reviewing the school, it was found that the school was equipped with sustainable materials such as bamboo, solar and biogas as electricity, recycling animal waste into manure, windmills as air conditioning, and organic gardening for students. Encourages them to establish green concepts in their minds. He states that in this school, students are accustomed to interacting directly with nature. They experience planting, processing, and reprocessing activities. On the other hand, students are encouraged to continue these habits, even if they graduate from the school. In addition, he proved the success and effectiveness of habit theory by examining the fate of several students who graduated from this school. For example, one of those students discovered a type of cactus that is widely harvested, and launched a line of local wallets made of cactus bio-leather. Alimin used a qualitative method in which the method of data collection is obtained through field observations, interviews using the recording and documentation of everything that is encountered with the camera in the field. This article deals with both sustainability and training, and the techniques it offers can help me design. The techniques studied in Bali school to establish the habit of sustainability and teaching the necessary points such as agriculture and its supply to the people are effective points in designing a sustainable school for me.

<sup>7</sup> Alimin et al, 2021



Fig. 4.2. - Exhibition hall in Green School  
Alimin et al, 2021Bali



Fig. 4.3 - Green sign/instruction to Green School Bali  
Alimin et al, 2021Bali



Fig. 4.4 - Garden, recycling laboratories, and recycled product of Green School Bali  
Alimin et al, 2021Bali

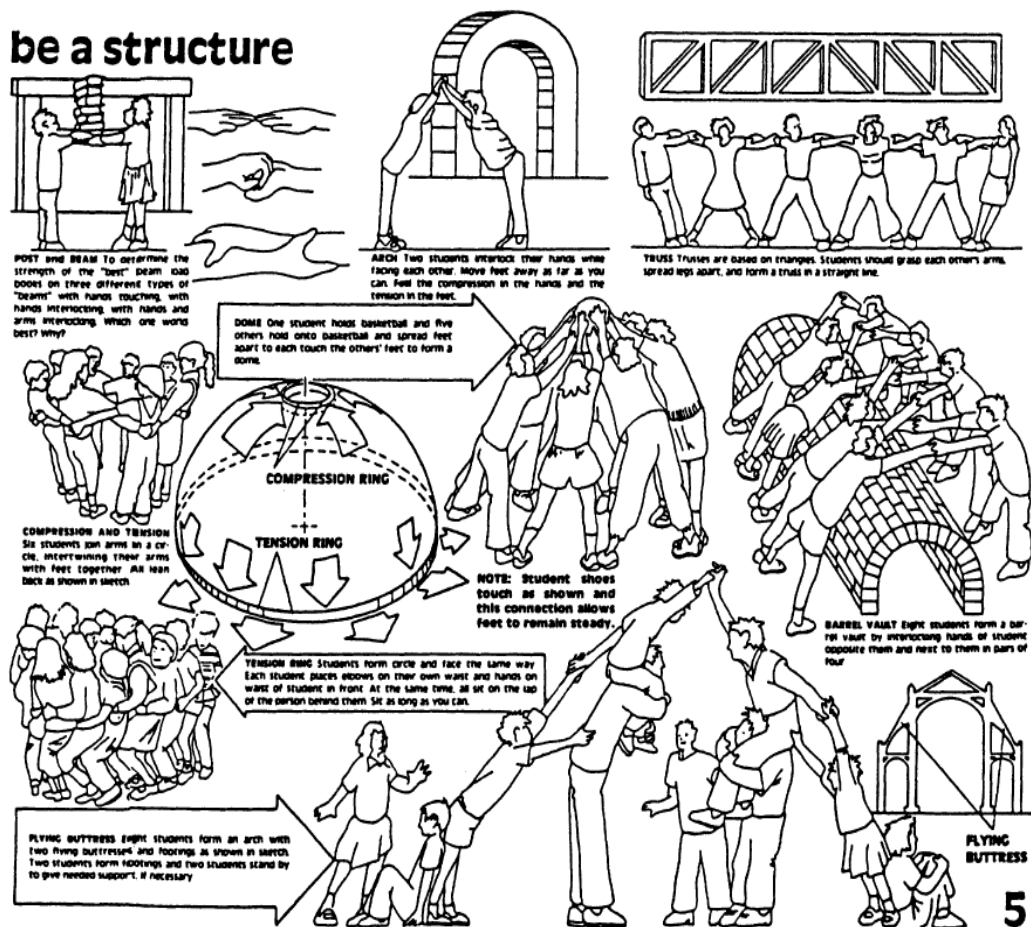
**4-3 Ann Taylor<sup>8</sup>** architecture is a vital issue in building a greater understanding of our built environment, which is not generally taught in most schools. She claims that architecture allows pupils to have a deeper understanding of their communities and the greater globe.

Taylor provides a unique method of instruction, as most curricula are provided in book form. She vividly delivers the curriculum in the form of posters and booklets that can be simply put on any classroom wall. By studying architecture and reforming the classroom, she hopes to merge art, math, physics, social studies, and other subjects. The teacher's responsibility is to function as an educator by displaying the posters and explaining to the pupils the ideas and actions shown in each poster. Activities should take the form of "practical experiences of learning applied architecture," as described by the author. The curriculum's main goal is to assist students become more familiar with architecture, visual and spatial thinking, working in

<sup>8</sup> Taylor, A., Vlastos, G., & Harden, N, 1987

comparable architectural approaches, and appreciating the quality of their personal surroundings. Some are general, such as architectural structure, while others are unique, such as the school's entrance design. Color and texture, excellent graphic design, landscape design, and urban planning are just a few examples of additional topics. Diagrams and assignment forms are included on certain posters, which will be printed and handed to pupils. Furthermore, they are hands-on learning activities that allow students to actively engage in their education. Students are encouraged to participate in both solo and group activities in this program.

Many directions appear to lack sufficient explanations or information that teachers may easily use and comprehend for their pupils. Teaching new sciences, in my opinion, need professors with relevant expertise and training. It is essential to evaluate instruction before implementing this curriculum for teachers with no prior experience. In overall, I believe Taylor's educational method is a novel and successful approach. Taylor has concentrated on space architecture, visual and spatial thinking, and the quality of one's own surroundings. My ambition is to include environmental concerns and sustainability into the educational system. Designing educational posters with the guidance of educational and architectural specialists may be an excellent design and concept for simultaneously educating and disseminating information to students and instructors.



Illustrations from *Architecture and Children: Learning by Design* by A. Taylor, G. Vlastos, and N. Harden.

Fig. 4.5 – Learning by design  
Taylor, A., Vlastos, G., & Harden, N, 1987  
19



**4-4 Steven A. Marable<sup>9</sup>**, the purpose of “Green Schools – The Implementation and Practices of Environmental Education in LEED and Used Green Ribbon Public Schools in Virginia”, which is written by Steven A. Marable, is to review the environmental education curriculum used in green schools. According to the author, no particular guidelines for implementing environmental education in green schools or schools that employ buildings as instructional instruments for students exist at the moment. To further understand what standard curriculum may be employed, the researcher studied green schools in the Commonwealth of Virginia. These findings assist me in developing a building system for teaching environmental protection approaches to students and instructors using effective teaching methods. Multiple-choice survey questions were used to obtain quantitative data in this investigation.

Extraordinary solutions have been offered as a result of the interviews, and it has also been established which ideas have been more effective and which need to be better examined and implemented. This knowledge will enable me to better understand the flaws in this problem and concentrate my efforts on resolving them. One participant, for example, commented, "We have a fantastic horticulture program that teaches sustainable agriculture and has been quite effective." Another person mentioned that they planned to recycle paper, metal, and plastic, as well as compost leaves and grass clippings. However, paper recycling was the only program they really executed. So I think I have to find solutions that not only improve the architectural design of the building in this regard and have the facilities and tools for recycling and composting, but the building itself can teach this as an educational tool, and Upgrade.

One of the questions raised in this research is what common methods and strategies are used to implement environmental education? The result is the use of an outdoor garden space in the school, the use of renewable energy such as wind and solar energy, recycling programs, environmental clubs, and community service projects. All of this data is grouped into tables and can be a good resource for a green school space for my design.

**4-5 Laura Cole<sup>10</sup>**, believes that the 3D textbook approach to TGBs integrates learning experiences in a variety of environmental contexts. The design of green school buildings and environmental education centers is simply tied to this three-dimensional textbook approach. According to him, universities are using the concept of a "living laboratory" in educational facilities. A three-dimensional textbook, like the Science Museum method, entails the engagement of a topic specialist who is generating an educational experience, he claims. A building, like a textbook, can be allocated to a course and coordinated with formal education. The 3D textbook method and the formal lessons that may be taught using green building have a significant association in terms of green building knowledge. Cole claims that the criteria used in architecture to identify green building are a good starting point for establishing the domains of "green building expertise" in this study. In the discipline of architecture, these are some of the criteria:

- Green infrastructure
- Sustainable scenery
- Water
- Energy and atmosphere
- Materials and resources,

And in the field of green building training includes the following:

- Beauty and inspiration
- Internal environmental quality

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<sup>9</sup> Marable, 2015

<sup>10</sup> Cole, 2018



- Economic effects
- Healthy and local food systems

These categories can help me organize the titles of the chapters and are a good guide on how to categorize information in the field of architecture and education.

**4-6 Laura Cole<sup>11</sup>** investigates the topic of utilizing school design to educate and promote environmental education in this essay. She offers a foundation for learning about green building models (TGB). This model can help me understand how to improve the interaction between a school building, its occupants, and other educational activities in order to promote environmental education and sustainability at the school. She states that one of the most common techniques to teaching environmental concerns in green schools is to add signage that conveys information about the building's environmental attributes, such as recycling. Despite the importance of tools, he points out that this type of training is passive and lonely, with little chance for conversation or action. I also feel that particular instructional tools that students may interact with in an indirect and required manner should be developed. Because the vast majority of students are capable of obliviously passing dormant educational materials. One of Laura's goals in this piece is to expand the choices for how to use a facility for education by including space for social contact, conversation, and physical activity. She accomplished this by conducting a study of several schools that have previously used TGB features.

The TGB paradigm in this study includes formal to informal involvement, passive to active interaction, and individual to group participation.

She examines formal and informal relationships while emphasizing the link between physical aspects and the educational curriculum. She observed that in an ideal world, schools and the Green Building of Education provide significant chances for students to participate in feature care and performance monitoring. Some of the choices mentioned in this article that could aid me in design include garden or environmental awareness groups, water recycling systems, solar panels, energy feedback monitors that provide real-time energy information, and play structures made from recycled materials (which can serve as a reminder of awareness be environmental).

She's proposed methods for turning passive involvement into active engagement. According to her, advanced technologies such as automatic thermostats, lighting, and window controls reduce touch with the structure. As a consequence of this discussion, I feel I should attempt to design all architectural processes related to sustainability and the environment in such a way that students may manually modify them, such as how and when to use windows for heating and cooling system optimization. This meeting serves as an educational opportunity.

**4-7 Reem Okasha and Madi Ahmed Mohammad<sup>12</sup>** describe various K-12 Green Schools that are purposefully constructed to use school structures as a 3D textbook for environmental teaching in another article (EE). This essay's purpose is to assess the approaches and strategies for establishing green schools as teaching resources using case analysis, which is comparable to my research. In these conditions, geographical locations, climate, green efforts, and activities are all explored.

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<sup>11</sup> Cole, 2012

<sup>12</sup> Okasha , Ahmed Mohamed, 2020

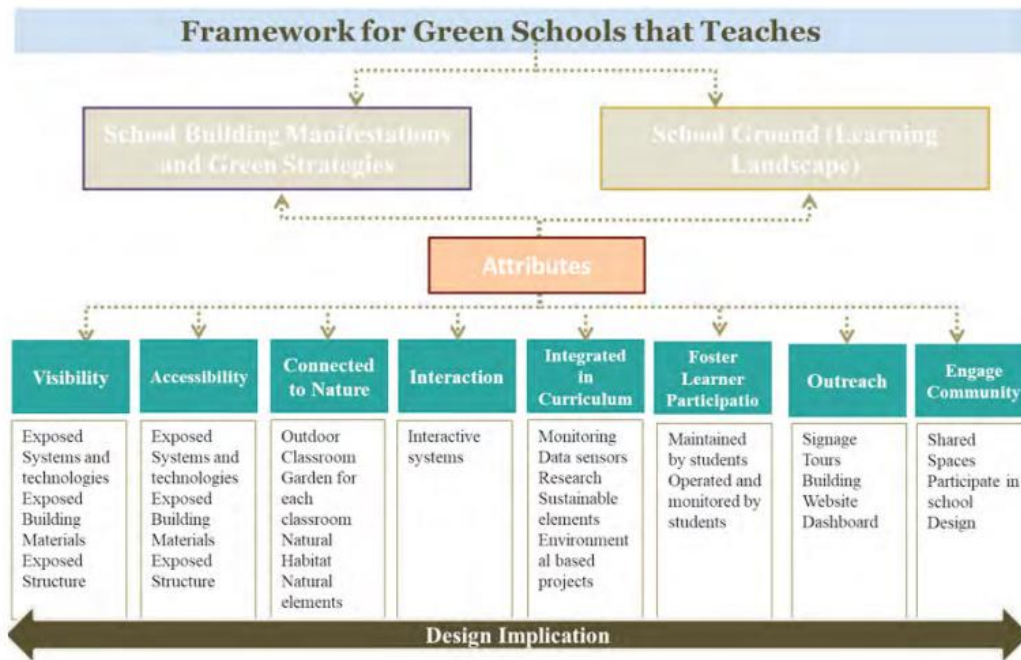


Fig. 4.6 – Proposed framework for green school that teach  
Okasha, Ahmed Mohamed, 2020

# 5- PRECEDENTS



Fig. 5.1 – Keller Center - Harris School of Public Policy  
<https://www.aia.org/showcases/6280257-keller-center--harris-school-of-public-po>

# PRECEDENTS

The combination of sustainable school design, culture and curriculum in line with sustainable methods and methods, provides the ground for the school to use its facilities and potential as an educational tool. When new teaching principles, facilities, and techniques are incorporated into the learning environment, it transforms its environment into an educational tool. Architects, according to Anne Taylor, must examine various aspects of design in order to create a comprehensive and healthy learning environment without depending exclusively on a numerical program, even though size and cost are vital factors to consider. Rather, it's a more complex program that caters to the users, communities, and environmental demands<sup>13</sup>. Previous studies have been intended to help examine the various techniques, methods, and features used to integrate sustainability into school architecture to enhance educational facilities. Case studies first examine the possibilities of sustainability and then the educational possibilities for students to provide ideas for the final design for this dissertation.

## **5-1 Keller Center - Harris School of Public Policy<sup>14</sup>**

Architect: Farr Associates (Design Lead & Architect of Record) Woodhouse Tinucci Architects (Collaborating Architect, Interior Designer)

Location: Chicago, Illinois

Year: 2016

In this university, a central atrium is carved in the building and performs various program functions. The university has a complete section (Civic Participation Office) dedicated to better communication between the campus, its resources and future projects with the community. This is a very interesting idea for me. In order to enhance the school education system, building architecture and sustainability tools, I can also consider a center for interactions and transfer of experiences between students, teachers, architects and sustainability experts. Other aspects of sustainability in the building include the optimal use of rainwater and its collection in a 15,000 gallon tank for toilet flushing and drip irrigation. In addition, rainwater is used to supply waterfalls among rocks and plants, and eventually penetrates highly permeable sandy soils in rainforests. All of these installations are exposed to the students to demonstrate their functionality.

This technique brought to my mind the idea that I can use tap water and rainwater not only for the main purpose of the building but also for decorative purposes. For example, to design a waterfall or small waterfalls in combination with small turbines that can be for students and show them how to use water energy. Daylight is essential. Lighting without glare. This complex has a large set of nested skylights on the green roof that bring light from above to the basement levels and allow everyone on all floors to enjoy natural light. Creative use of skylights can show students how practical and creative the use of natural light can be. For example, I could design galleries in combination with skylights with stained glass and show students how uplifting the use of natural light can be. Properly sized skylights with fixed solar shading provide passive thermal gains. Programmable interior curtains fall at night to reduce heat loss.

It appears that the architect's purpose in designing this structure was to create a green and sustainable structure. But my objective is to create a structure that is not only sustainable, but also serves as an instructional tool by displaying the aspects and potential of sustainability. By investigating this structure, I

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<sup>13</sup> Taylor & Enggass, 2009

<sup>14</sup> <https://www.aia.org/showcases/6280257-keller-center---harris-school-of-public-po>



was able to discover numerous strategies that may be used as instructional aids. Rainwater collection in gallons and utilization in waterfalls, for example, is clearly evident. The designer, on the other hand, has demonstrated proper lighting by raising the ceilings and opening the building to let more natural light in.



Fig. 5.2 – Raising the ceilings and opening up the building to incorporate more natural light  
<https://www.aia.org/showcases/6280257-keller-center---harris-school-of-public-po>



Rain Gardens

Cistern Overflow into Rain Gardens

15,000 Gallon Cistern

**M4 Design for Water**

Fig. 5.3 – Collect rainwater to irrigate the waterfalls in the region  
<https://www.aia.org/showcases/6280257-keller-center---harris-school-of-public-po>





Fig. 5.4 – Chicago Charter School with Principles of Sustainability and Wellness

[https://www.archdaily.com/788158/studio-gang-designs-a-chicago-charter-school-with-principles-of-sustainability-and-wellness?ad\\_medium\\_gallery](https://www.archdaily.com/788158/studio-gang-designs-a-chicago-charter-school-with-principles-of-sustainability-and-wellness?ad_medium_gallery)

## 5-2 Chicago Charter School with Principles of Sustainability and Wellness<sup>15</sup>

Architects: Studio Gang

Location: Chicago, United States

Area: 6000.0 m<sup>2</sup>

Project Year: 2016

The purpose of designing this school is to raise the innate curiosity of children, and the mentality of sustainability in students. It shows the transformation of the school as a place that enhances the sense of sustainability and well-being in students by celebrating the innate curiosity of children, natural environmental processes and the work of making positive changes. In order to improve the quality of the educational system in children, a set of indoor and outdoor educational environments has been designed around a central courtyard. Students and teachers from different grassroots levels are placed in collaborative environments that contribute to the school-based research-based approach to learning. The different areas of the school are considered "neighborhoods" and are connected by an amazing path that unites the school's indoor and outdoor environments, practical laboratories and training stations. In other words, they have improved the quality of education by increasing opportunities for interaction and participation between students.

In terms of sustainability through the use of solar energy, greenhouses, seasonal gardens, storm water management, natural ventilation and geothermal systems, the school reduces its energy load and improves the definition of health for its students. Although the designer's goal was to bring about positive change, a sense of sustainability in the students, this process is not clearly seen in the shape of the building. In other words, I think that if all these technologies and sustainability processes were visible in the collection as educational tools, it would have a greater impact on this process. One of the sections designed as a sustainable educational tool at the school is an urban farm that not only allows students to participate in agriculture, food preparation and animal care, but also offers food products. In other words, this process helps to develop patience, self-confidence, empathy, an open mind to new and healthy foods, and an interest in becoming a better global and local citizen.

What makes this project attractive to me is the design of an urban farm that provides animal feed. In my opinion, designing a space for farming for children using sustainability education tools can have positive effects on promoting sustainability habits in students. Another technique used at the school to help raise students' awareness of sustainability techniques is the use of photovoltaic panels to collect sunlight. In terms of design considerations, how the building is located for optimal access to sunlight for training rooms and outdoor greenhouses, as well as how to maximize the collection of solar energy, are important aspects that I must pay close attention to in design. To create a green design that is both sustainable and successful. This project has provided me with a wealth of new and innovative ideas and solutions that have proven to be quite useful in developing new concepts. This structure, in my opinion, might do the job of water management better. Rainwater and building water can be very efficient for purposes such as sanitation and irrigation, which is what I want to include in the design.

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<sup>15</sup> [https://www.archdaily.com/788158/studio-gang-designs-a-chicago-charter-school-with-principles-of-sustainability-and-wellness?ad\\_medium=gallery](https://www.archdaily.com/788158/studio-gang-designs-a-chicago-charter-school-with-principles-of-sustainability-and-wellness?ad_medium=gallery)





Fig. 5.5 – Sidwell Friends School  
<https://www.aiatopen.org/node/140>

### 5-3 Sidwell Friends School<sup>16</sup>

Project Owner: Sidwell Friends School  
Location: Washington D.C. United States  
Project Type: Education – K-12 School  
Year: 2006

Sidwell Friends School is a day school for pre-K through 12th-grade students. In terms of the educational system, one of the most important features of this school that caught my attention is the arrangement of students' curriculum with a focus on the environment. To this end, the school's teachers have access to environmental and sustainability training, landscape systems, and project construction at all levels, and many of them have designed lessons based on this opportunity. In my opinion, this kind of educational system is very necessary to design a green school in the form of a three-dimensional book. To this end, I use the Delphi method to achieve an education system that is not only suitable for elementary school students but also focuses on the environment as well as sustainability issues.

One intriguing aspect of this project in terms of sustainability is the thorough analysis of the location. The project team carefully examined the project site and found that the campus is located on top of two watersheds that have significant environmental values. Also, good sources of water supply were collected. This solution was provided with a detailed analysis of the site plan. As a result, it's a good example for me of how I should analyze my project site layout to find its sustainable potential for use.

One technique that can be considered as a good educational sustainable instrument for students is a wetland between the new and old wings of the Middle School that treats wastewater from the kitchen and bathrooms and serves as a living laboratory where students can learn about biology, ecology, and chemistry. The treated water is then reused in the toilets and cooling towers.

The second educational sustainable instrument for students is growing vegetables and herbs for the cafeteria on the green roofs. Excess water from the green roof flows to the courtyard's pond and rain garden while filters and swales in the landscape purify rainwater falling on the site. These are amazing ideas for garden design that I want to consider in school. I want to allow students to learn how to manage the wastewater and how to use that optimally and how to return water to nature. This idea can be very similar to my question that how can the qualities of green schools become teaching instruments that will help students acquire a consciousness of sustainability, the complexity of life, and constructed systems around us as a result of the combination of green school design and educational goals?

The utilization of solar panels in open spaces, where kids may watch and learn about them, is another teaching tool in terms of sustainability

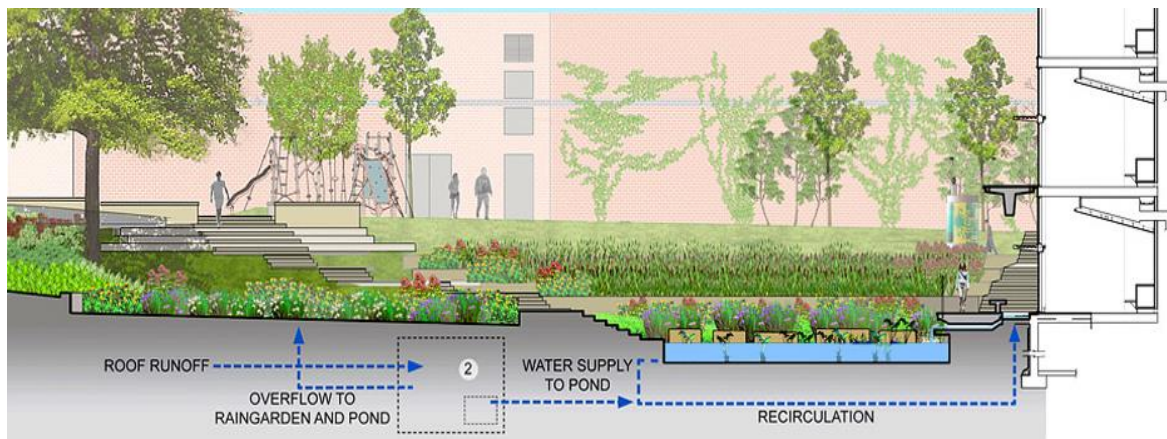


Fig. 5.6 – More than 80 natural species are represented in this rendered built wetland.

<https://www.aiatopen.org/node/140>

<sup>16</sup><https://www.aiatopen.org/node/140>



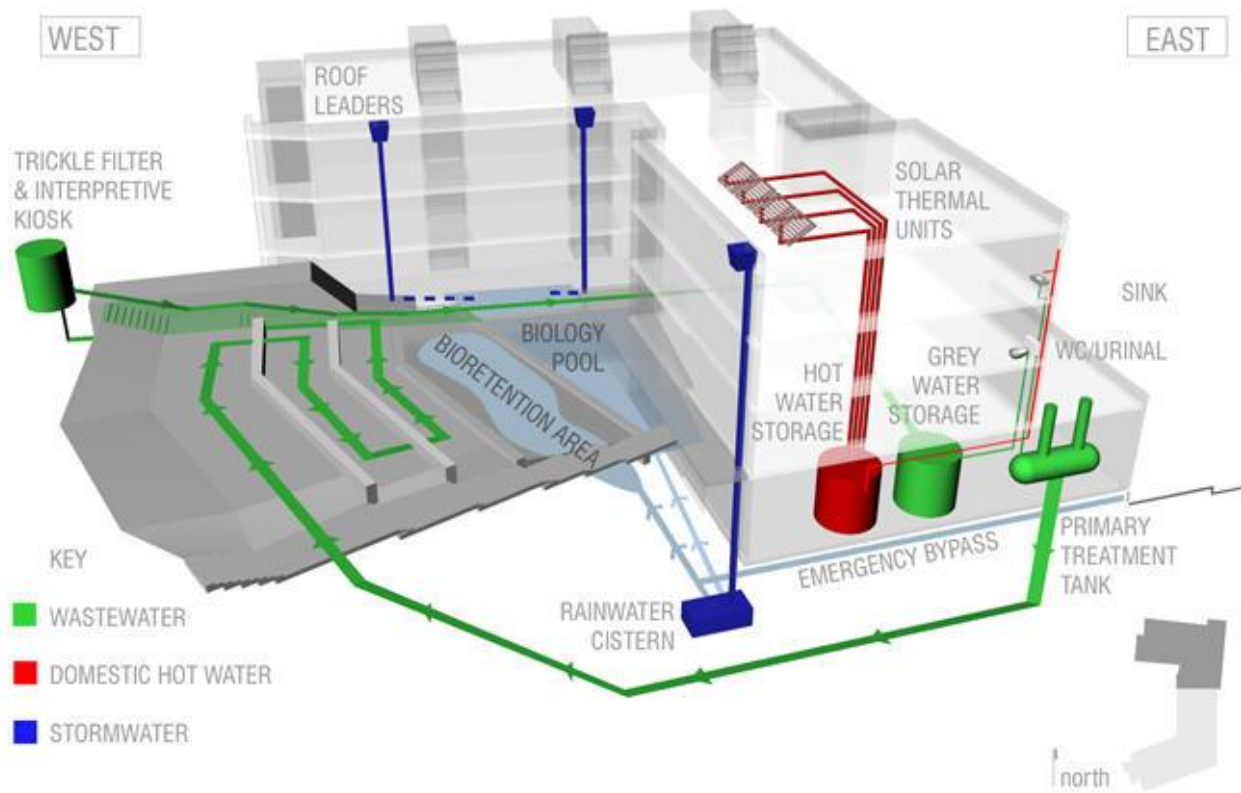


Fig. 5.7 – This schematic describes the building's wastewater, storm water, and domestic hot water systems  
AIA Cote Top Ten, 2007



Fig. 5.8 – EGROW Elementary School  
<https://big.dk/projects-wes1>

The design of WeGrow aims to eliminate segregation, which is common in traditional school settings and emphasizes the necessity of involving children in an interactive environment. The interior, envisioned as a child's school world has a field of ultra-elliptical items that work together to create a dense and logical learning environment that is also free and flowing. BIG created modular classrooms, tree huts, and a vertical farm to encourage a collaborative, inclusive learning environment.

Designing dynamic and adaptable settings, in my opinion, is extremely beneficial to students' learning. Small classrooms, the requirement to sit for lengthy periods of time, and traditional teaching methods limit the appeal of school and education to youngsters. In this design approach, children may choose how to utilize the spaces and can interpret them in whatever way they like.

Another fascinating architectural idea is to employ barriers and shelves that are elevated to the child's level, allowing natural light to reach the building's depths. Three separate levels of shelves for each age group are periodically curved to create varied activity spaces and provide a sense of comfort, safety, and community for instructors and kids. Furthermore, this technology allows the teachers to have a comprehensive view of the space at all times. These concepts are, in general, quite efficient and novel, and they enable me to create an environment in which students are not only excited to come, but also have more learning capacity.



Fig. 5.9 – EGROW Elementary School  
<https://big.dk/#projects-wes1>

# 6- METHODOLOGY

# METHODOLOGY

The most important elements I have highlighted in the design of the Green School as a three-dimensional textbook are sustainable instruments for successful teaching, environmental education, and the integration of sustainable subjects with education. I have found various strategies that assisted me develop my study and find concepts in order to construct these concepts and move my thesis topic from one theory to another. Some of these techniques were more applicable than others. Others require communication and counsel.

In this thesis, I employed several data collection methods to gather data for the design of a green middle school. The data collection methods included literature review, analyzing case studies, site analysis, reviewing and viewing existing videos and animations of sustainable and green designs and Delphi.

The literature review involved reviewing previous studies and research related to green school design and sustainable education. This helped me to identify existing knowledge gaps and potential areas of improvement in green school design. Additionally, analyzing case studies helped me to understand how similar projects were implemented in different contexts and the factors that contributed to their success or failure.

The site analysis involved assessing the selected site and its surroundings to identify its strengths, weaknesses, opportunities, and threats. This helped me to develop a design that was sensitive to the local context and the environment. For the site analysis, I also considered factors such as the climate, accessibility to public transportation, and natural features to reach to a better design of the green middle school.

Watching videos and animations also helped me visualize how design concepts work in real-world applications and gain a better understanding of how design decisions impact the functionality and aesthetics of a building. Additionally, by viewing existing designs, I could learn from the successes and failures of other designers and incorporate those lessons into my project.

Delphi was another data collection method employed in this architectural methodology. Delphi is a research method that involves collecting data from a panel of experts through a series of questionnaires. In this study, I collected data from experts in both architecture and professors in education, and community members about their experiences and perspectives on sustainable education, green school design, and the proposed project. This helped me to ensure that the design of the green middle school was informed by diverse perspectives.

Once the data was collected, I used thematic analysis to analyze the data. Thematic analysis involves identifying themes, patterns, and connections in the data. I used the collected data to develop strategies to promote social interaction, outdoor time, and reduce isolation in my design. Additionally, the analysis of the data helped me to identify specific flexible spaces that sought to educate students about sustainability and enhance their 4 C's skills, including a large central stair for group studying and learning, a recycling studio and innovation space, galleries to show student's work, a greenhouse and educational kitchen, outdoor educational spaces, a roof garden, and a landscape including rainwater tanks, a few numbers of the educational turbine, symbolic structure in the entrance showing collecting the rainwater.



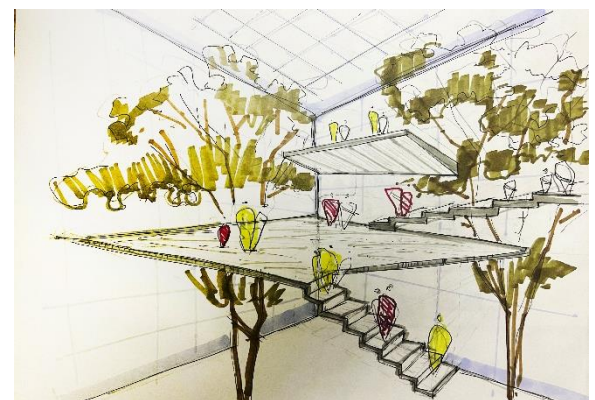
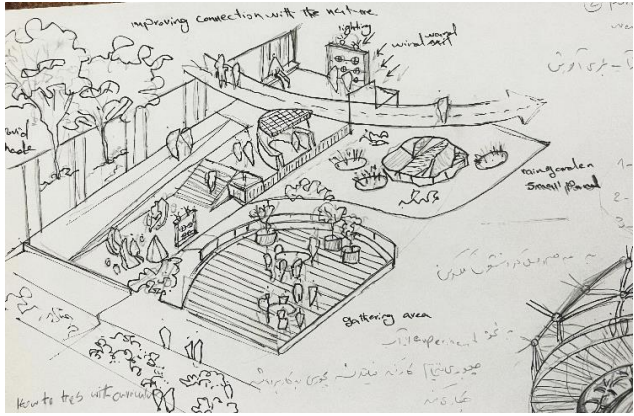


Fig. 6.1 – Sketches of initial ideas  
Architect



# 7- PROGRAM

# PROGRAM

This thesis details a study that demonstrates how a combination of environmentally friendly school construction and educational goals aid the environment in the future. This thesis intends to equip students with sustainable learning tools that help them acquire a sense of sustainability, environmental friendliness, and comprehension of the systems that surround them. School is a location where students are educated in order to prepare them for their future. In order to protect resources and develop a sustainable future, I believe that children's education needs to change. Education and sustainability are the foundations for a long-term environmental and economic future. A key difficulty in enhancing children's feelings of responsibility for their environment and future is the necessity to teach understanding and respect for the world and its resources. As a result of today's civilization, children are growing increasingly estranged from nature. Most children nowadays have little direct contact with open spaces and nature, which has a negative influence on their health and the range of their experiences.

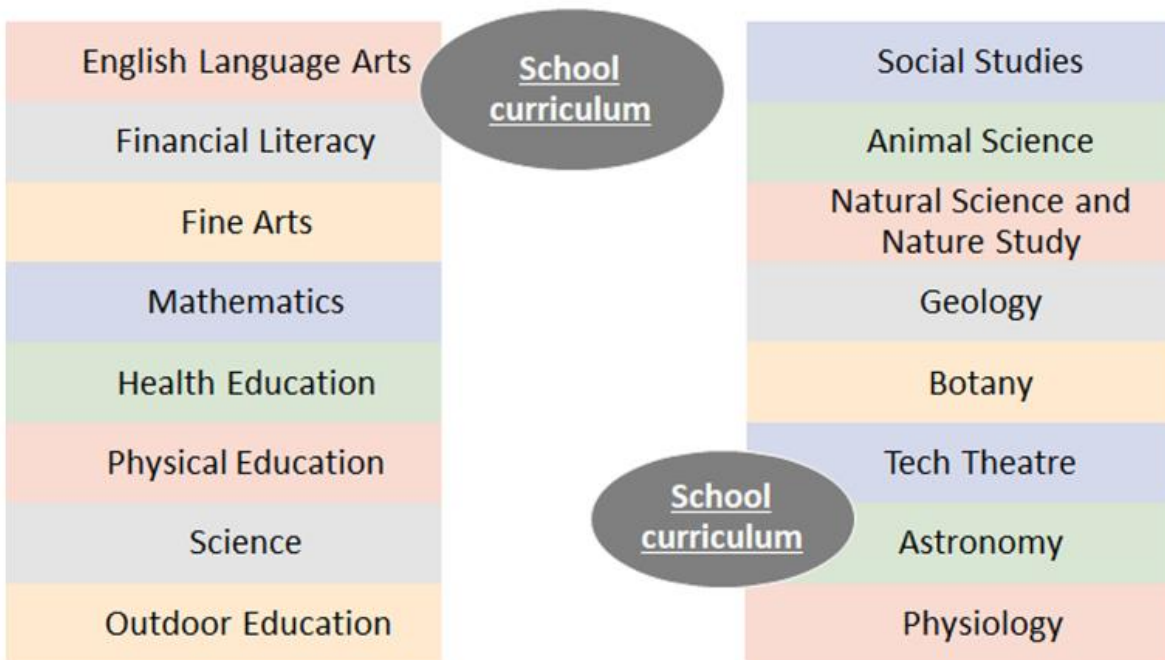
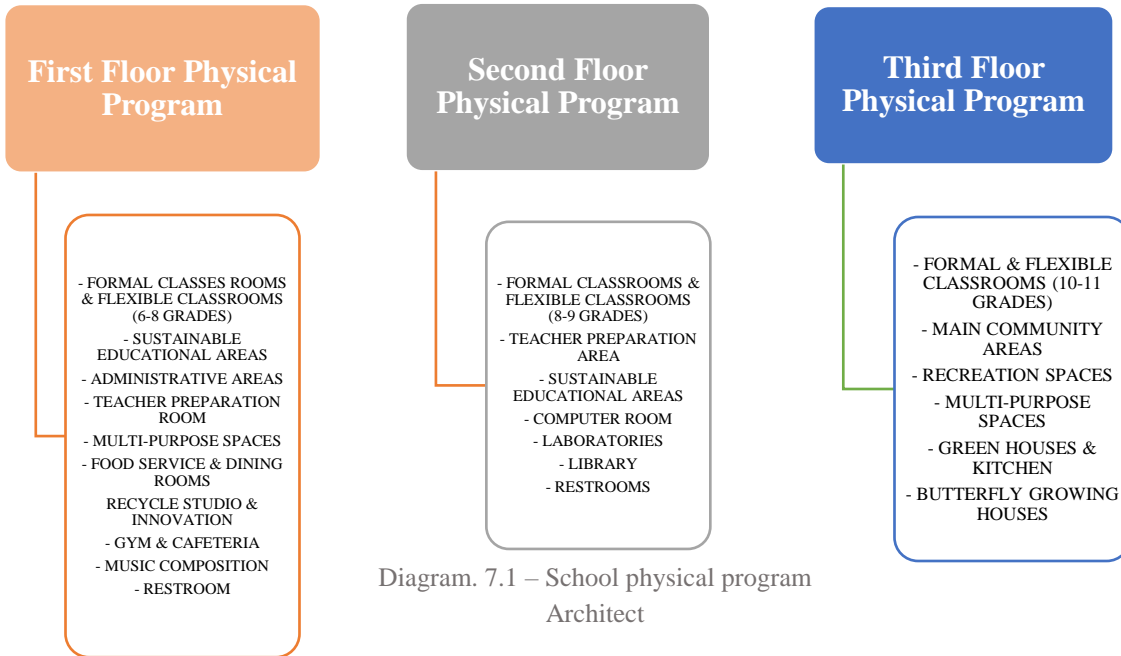
As a result, I feel that increasing children's exposure to the outdoors benefits not just their health but also their creative talents. As a result, it is clear that schools have a particular role to play in these changes.

The first step is to figure out how the spaces of a school can promote instructional and sustainability goals. Within the framework of sustainability criteria and special curriculum, a green school can improve the process of interaction between teachers and students, as well as the environment, in the form of a three-dimensional textbook, and create spaces where students can learn, explore, and play safely and freely. The following are the goals I looked into for this school's design:

1. A school that inspires pupils by emphasizing the value of the natural environment.
2. A school that is designed around children's needs and concerns.
2. In addition to teaching places, including areas that are fun and meaningful.
3. Creating outdoor play environments that are safe, engaging, and instructional.

When designing for middle school students, keep in mind that children have different perspectives on the world than adults. Furthermore, the architectural requirements and desires of children vary. As a result, in order to achieve efficient design, spaces must be adaptable and versatile.

## 7-1 School and building program



7-2 Design theory process

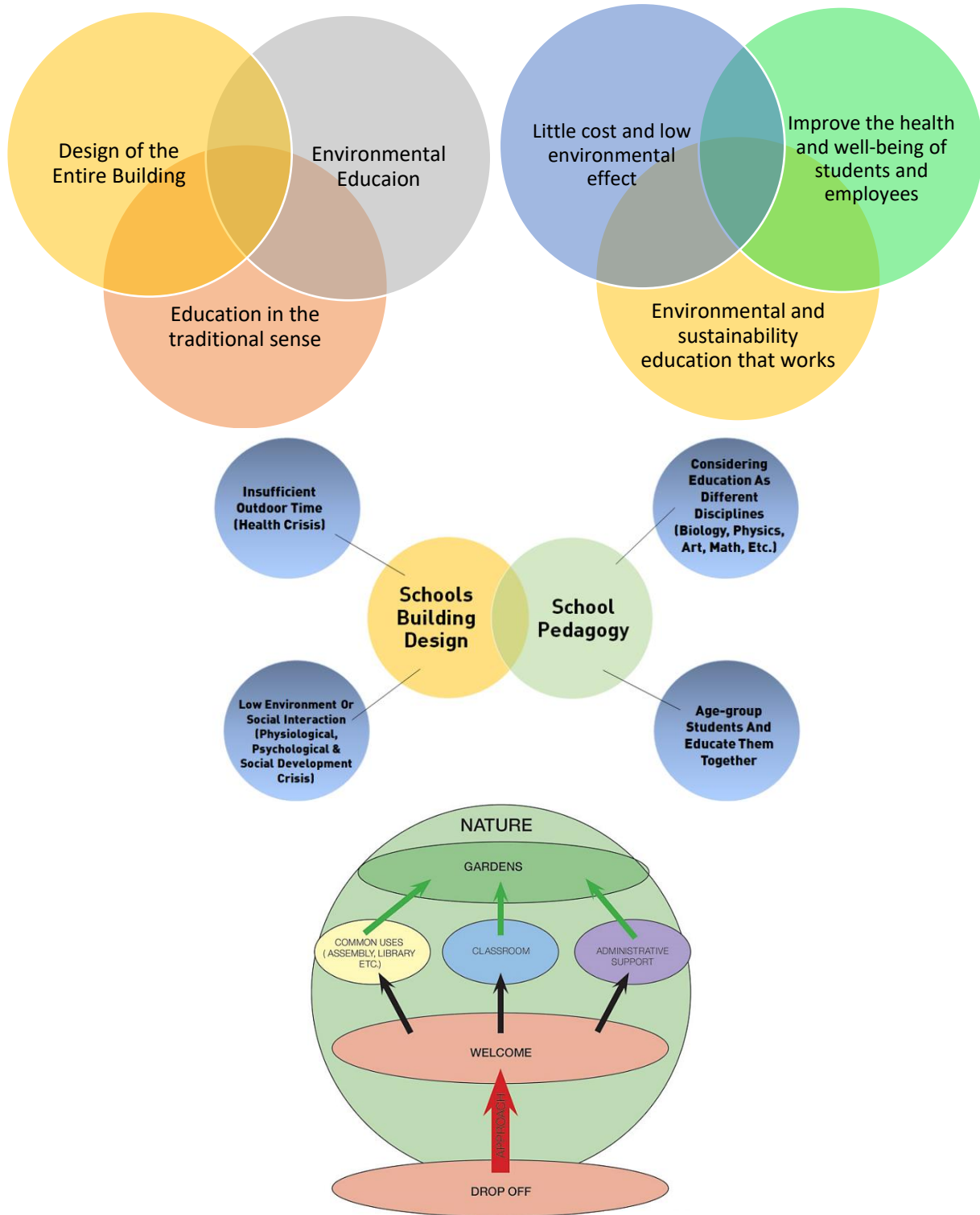


Diagram. 7.3 – Design theory process

Architect

### 7-3 learning spaces

What are the best places for children to study and how do they learn?

Teachers in this school help students learn by acting as facilitators. Interdisciplinary, project-based learning. Individual duties are undervalued in favor of collaborative projects. Learning is an active, creative process, not a passive one.

- The following are the key goals for the proposed school's design:
- Construct an expressionist school to excite and educate pupils about the marvels of the environment.
- Create a child-friendly environment.
- Create surroundings that are meaningful and pleasurable.
- Provide a safe, exciting, and sensory environment for nature-based play.

**INDOORS** ↔ **OUTDOORS**  
**STRUCTURED** ↔ **UNSTRUCTURED**  
**FORMAL** ↔ **INFORMAL**

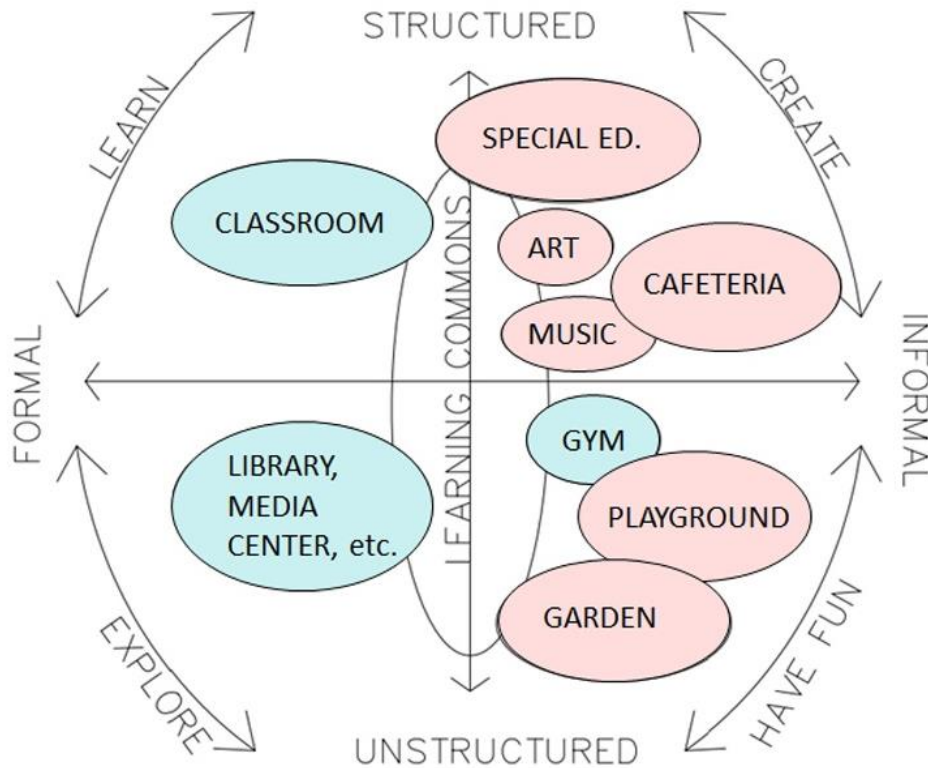


Diagram. 7.4 – Learning Space Diagram  
Architect

# 8-CONTEXT

# CONTEXT

Cincinnati, Ohio, established in 1788, is home to the site and has a long and storied history as an economic and cultural hub. There are a variety of single-family houses and multi-unit apartment buildings in the Lumford Pl. area, which was created as a residential neighborhood in the early 20th century.

The area is part of Cincinnati's Pleasant Ridge neighborhood, which is largely residential and has a wide range of home sizes and architectural styles. The area is recognized for its tree-lined avenues and lively community gatherings, giving it a suburban vibe. Location is convenient to both a residential neighborhood and a business district with a variety of dining and shopping options.

## 8-1 Climate and Average Weather Year Round in Cincinnati Ohio, United States

Hot summers and frigid winters characterize Cincinnati's humid subtropical climate. On average, highs in July hover around 29 degrees Celsius (85 degrees Fahrenheit), while lows in January hover around 23 degrees Fahrenheit (-5 degrees Celsius). Rainfall varies from moderate to heavy throughout the year, averaging around 42 inches (106 cm) in the region.

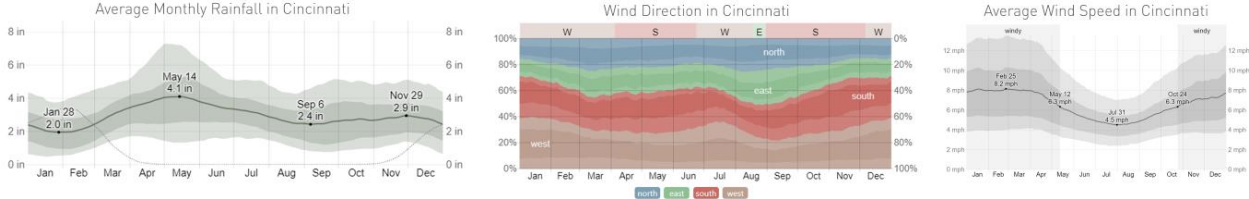


Diagram. 8.1 – Climate and Average Weather Year Round in Cincinnati Ohio, United States  
<https://weatherspark.com/y/15856/Average-Weather-in-Cincinnati-Ohio-United-States-Year-Round>

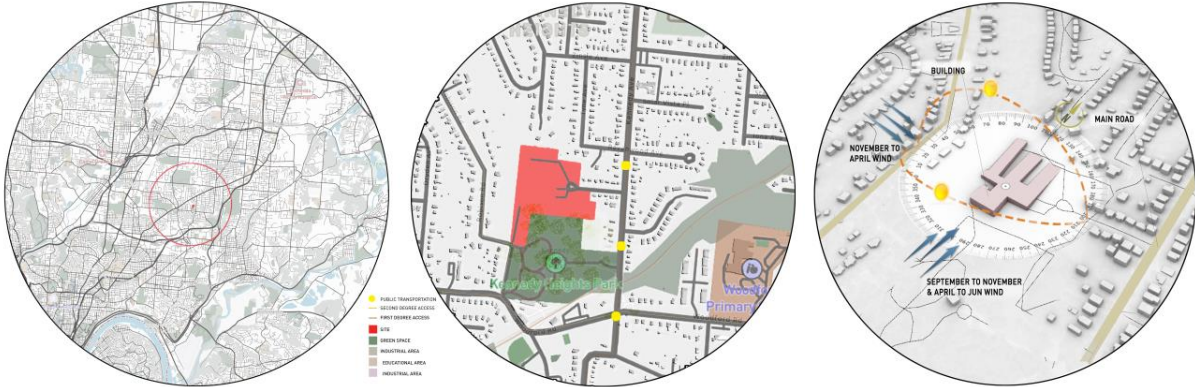
## 8-2 Site analysis

Lumford Pl., a local residential street, provides access to a number of major thoroughfares in the neighborhood. Cincinnati's Montgomery Rd. is a significant north-south road that connects the city's downtown with the city's many neighborhoods and suburbs. The east-west Ridge Rd. also connects to major highways and is a prominent thoroughfare in the region.

The Southwest Ohio Regional Transit Authority (SORTA) operates a number of bus lines that stop by this location, including routes 4, 11, and 51. The roads connect the city center with the surrounding areas of Cincinnati. The location is conveniently placed near a bus stop on Montgomery Rd.







Location: 3500 Lumford Pl, Cincinnati, OH 45213

Fig. 8.2 – Site analysis  
Architect

# 9- DESIGN

# DESIGN

Designing a Teaching Green Building where sustainability is taught to students is essential for several reasons. It helps to create a more sustainable and environmentally friendly learning environment, provides an opportunity for students to learn about sustainability, and prepares students for a future where sustainability is an increasingly important consideration. It can also help students to learn about green careers and technologies, such as renewable energy, sustainable agriculture, and green building design.

The aim of my thesis is to explore how sustainable features can be used as an educational tool to help students gain a sense of sustainability and build systems around them, using a combination of green school design and educational goals.

The question of "How a green building school can act as a 3D textbook and teaching tool for students giving them a comprehensive understanding of not only the school's curriculum, but also the ideals of sustainable design for nature and humans?" has been widely debated in my thesis research and design, and my goal is to find how sustainable features, architecture, and education can be combined to reinforce all areas of student's development and learning by creating a well-designed environment. Additionally, In this thesis, I am looking for ideas and structures that guarantee the learning and participation of students in all areas related to the initial middle school curriculum, 4 C's skills (communicating, creativity, critical thinking, and collaborating), and sustainability.

Current problems in schools include isolating students, insufficient outdoor time, and low environment or social interaction, which can lead to psychological, psychological, and social crises. Isolation can lead to feelings of loneliness, depression, and anxiety, while lack of physical activity can affect cognitive function and academic performance. Low environment or social interaction can affect students' self-esteem, interpersonal skills, and emotional regulation.

To address these problems, I have implemented strategies to promote social interaction, outdoor time, and reduce isolation, such as group studying and learning space, incorporating green spaces, outdoor classrooms, physical activity breaks, and planting. Additionally, by designing classrooms and common areas that encourage social interaction, I have enabled students to develop interpersonal skills and foster a sense of community.

To do this, in terms of improving education design, I focused on devoting more spaces to flexible areas rather than fixed areas to accommodate different types of activities, such as collaborative work, project-based learning, and interdisciplinary teaching. This allows teachers to adapt their teaching methods to meet the changing needs of students and can help students learn in a more engaging and interactive way. Additionally, I cared for the social and emotional needs of students by providing a more open and inclusive learning environment, which can improve 4c's skills. A less restrictive environment can also help students feel more comfortable and less isolated, promoting positive mental health and overall well-being.

## 9-1 Concept of design

The majority of the school day is spent indoors rather than outdoors, according to the climate and school time. I came to the conclusion that in order to create a special and worthwhile learning opportunity regarding sustainability and environmental conservation, I needed to concentrate more on the interior and bring and preserve the natural environment inside the building. Using this concept, I also educate students about various flora and textures while engaging their senses.

In terms of outdoor space, By connecting the building to Kennedy Heights Park and creating an outdoor educational space in the middle of the forest, I am providing students with a unique and immersive learning experience.

Furthermore, by providing this space for educating, the schools staff can collaborate with the park management to organize joint events and activities, such as tree planting, nature walks, and birdwatching, to further promote environmental education and conservation. This approach not only benefits the students but also the local community by fostering a sense of stewardship and appreciation for the natural environment.

To address the aforementioned problem and impart sustainability to the students, I made every effort to preserve the site's trees or thought of another green area and sustainable construction in their place. I've worked to promote youth gathering, socializing, and learning in a variety of locations. Using this idea can help students feel less alone by promoting social interaction. I've also increased the pupils' access to natural regions, which has boosted their physical activity and outdoor learning, which can enhance their mental and physical health.

Fig. 9.1 – Initial concept  
Architect



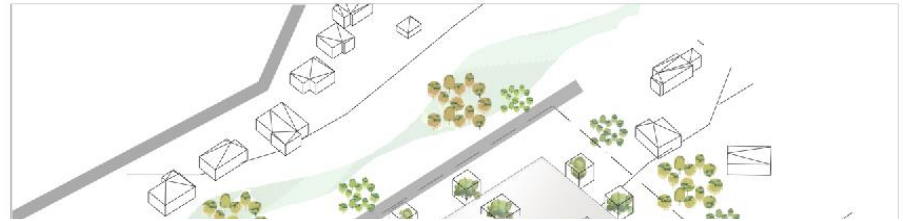
Fig. 9.2 – Complex drawing  
Architect



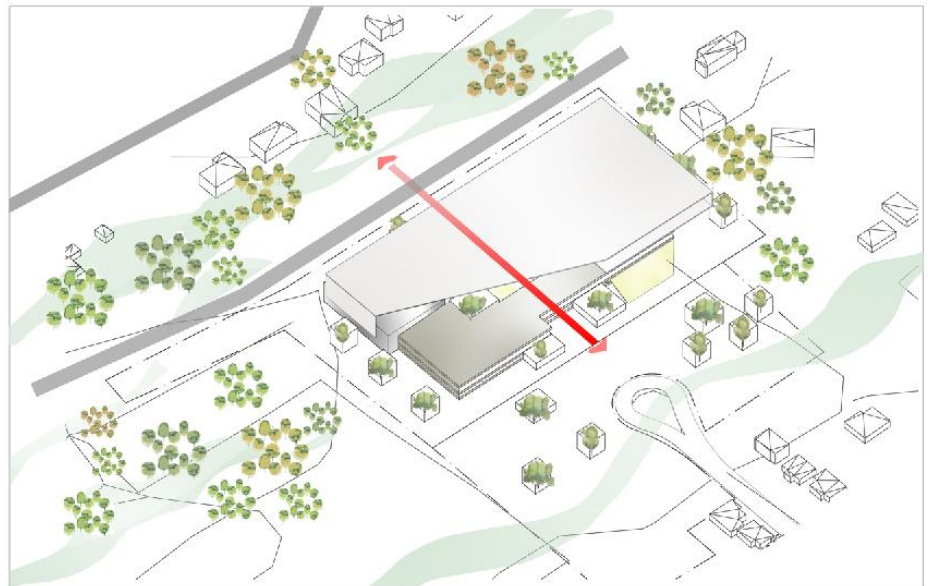
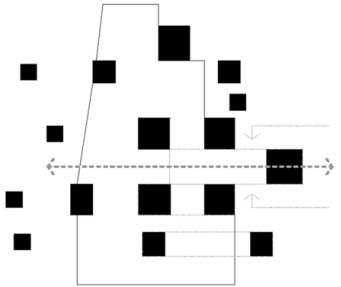
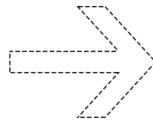
Preserving nature and the trees on a site and involving students in the process, can create a unique and meaningful learning opportunity about sustainability and environmental conservation. It can also help to foster a sense of responsibility and stewardship for the environment in future generations.

Bring nature inside to let students know more about the environment and is a great way to engage students' senses and teach them about different plants and textures.

### UNITY/DIVERSITY

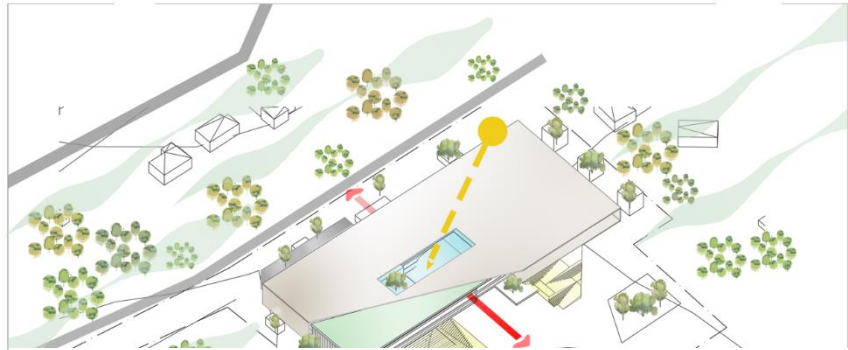


### CLOSED/OPEN





Connecting the building to Kennedy Heights Park, creating territory inside and towards the forest where the outdoor educational space is set up in the middle of the forest to celebrate education with the approach to sustainability.



Creating a roof garden with PV panels and large windows and skylights to improve IAQ and energy efficiency is a unique learning opportunity for students. These methods can improve their well-being, air quality, and energy efficiency.

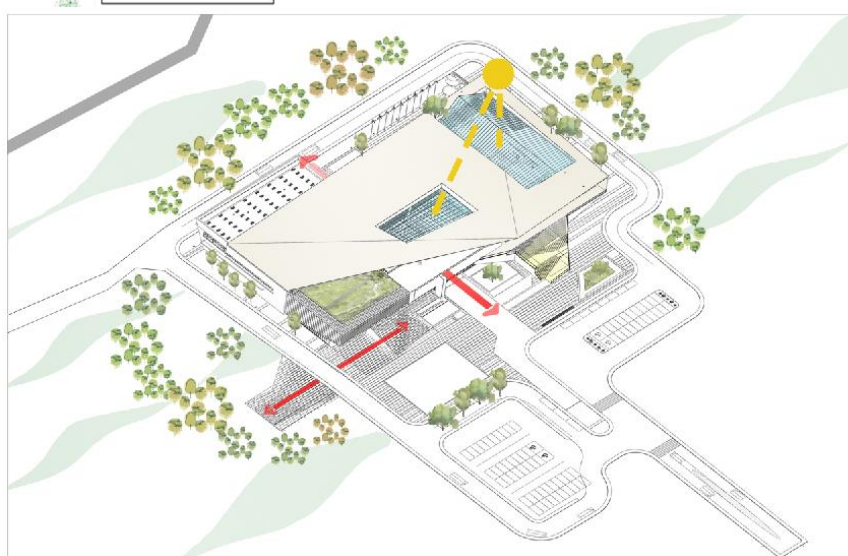


Fig. 9.3 – Concept design process  
Architect

## **9-2 Design Process**

This concept influenced my choice to choose a site that was close to a park and covered with trees. Since Cincinnati has warm, humid summers and very cold, snowy winters and the majority of the school day is spent indoors rather than outdoors, according to the climate and school time, I came to the conclusion that in order to create a special and worthwhile learning opportunity regarding sustainability and environmental conservation, I needed to concentrate more on the interior and bring and preserve the natural environment inside the building. Using this concept, I also educate students about various flora and textures while engaging their senses. In terms of outdoor space, By connecting the building to Kennedy Heights Park and creating an outdoor educational space in the middle of the forest, I am providing students with a unique and immersive learning experience.

Furthermore, by providing this space for educating, the schools staff can collaborate with the park Management to organize joint events and activities, such as tree planting, nature walks, and birdwatching, to further promote environmental education and conservation. This approach not only benefits the students but also the local community by fostering a sense of stewardship and appreciation for the natural environment.

In order to promote these concepts, in addition to the standard school building physical programs like formal classrooms, and sport, I took into consideration a number of particular flexible spaces that seek to both educate students about sustainability and enhance their 4 C's skills. These areas include: large central stair for group studying and learning, recycle studio and innovation, galleries to show students work, greenhouse and educational kitchen, outdoor educational spaces, roof garden, and landscape including rain water tanks, few number of educational turbine, symbolic structure in the entrance showing collecting the rain water.



## Group reading and learning space

Group studying areas provide an opportunity for collaborative learning, which can help students develop communication and teamwork skills. Sharing knowledge and ideas can lead to new perspectives and creative solutions to sustainability challenges. Resource conservation can be promoted by encouraging students to share materials and work together to reduce waste. Social sustainability can be promoted by creating a sense of community and belonging among students. Green IS designed with sustainability in mind, incorporating features like natural lighting, energy-efficient lighting, and sustainable materials.

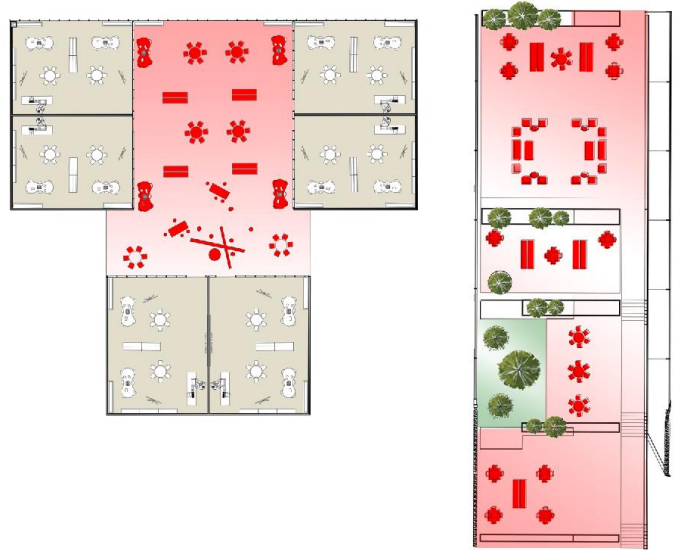


Fig. 9.4 – Group reading and learning space  
Architect

## Innovative and recycle studio

Recycle studios and innovation centers provide hands-on learning opportunities for students to learn about sustainability. They can engage in creative activities like upcycling, participating in innovation projects, and experimenting with new sustainable design concepts. They can also learn about sustainability from a cross-disciplinary perspective and develop a deeper understanding of the interconnectedness of sustainability issues. Additionally, they can teach entrepreneurship skills such as project management, team-building, and communication. Finally, galleries can provide an opportunity for students to showcase their work and share their perspectives on sustainability with a broader audience.

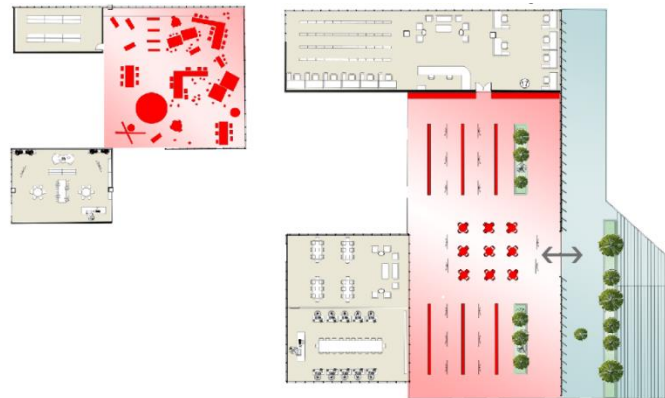


Fig. 9.5 – Innovative and recycle studio  
Architect

## Green house and educational kitchen

Greenhouses provide hands-on learning opportunities for students to learn about sustainability, environmental stewardship, science education, healthy eating, and community engagement. Through growing plants and vegetables using sustainable methods, students can learn about soil health, water conservation, and organic farming techniques. They can also learn about the interconnectedness of ecosystems and the importance of biodiversity. Science education involves conducting experiments and analyzing data to develop critical thinking and problem-solving skills. Healthy eating involves growing their own food to learn about the importance of healthy eating and the benefits of consuming fresh, locally grown produce. Community engagement involves sharing produce with families, friends, and local communities.

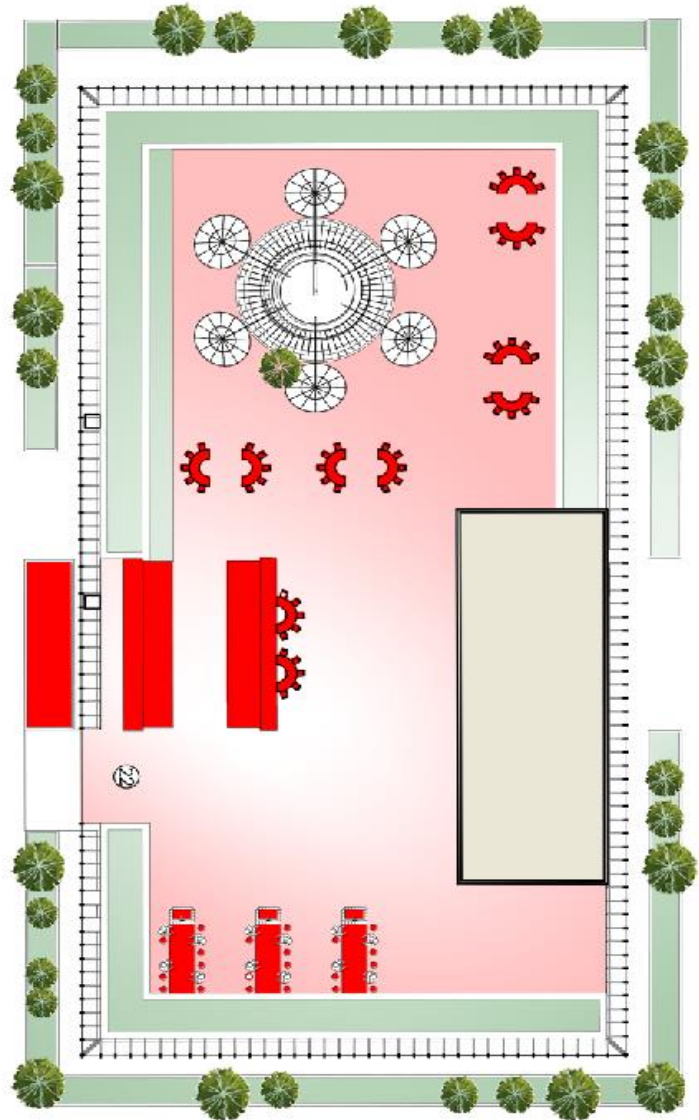


Fig. 9.6 – Green house and educational kitchen

Architect

### 9-3 Final building physical program

The Green Generation Middle School with 300 students has a gross size of 152,842 square feet and a land area of 300,439 square feet. There are three floor layouts for the school. The first floor has a waiting area, administrative space, formal classrooms for grades 6, flexible group reading and learning areas, a recycle studio and innovation space, a dining room and cafeteria, a music room, a space for teacher preparation, and a sports area. The second level has formal classrooms for the seventh grade, a flexible space for group reading and learning, a library, a gallery, an open-concept workshop, labs, a computer lab, a conference room, a large central stair, and fitness room. The third floor houses the green house, the educational kitchen, the small dining area, the pin-up and communication area, the formal classrooms for grades 8, the flexible group reading and learning area, the mix-use space, the roof garden, the PV panels, and the covered outdoor yard. The restrooms, and the mechanical rooms are fixed in all floor plans.

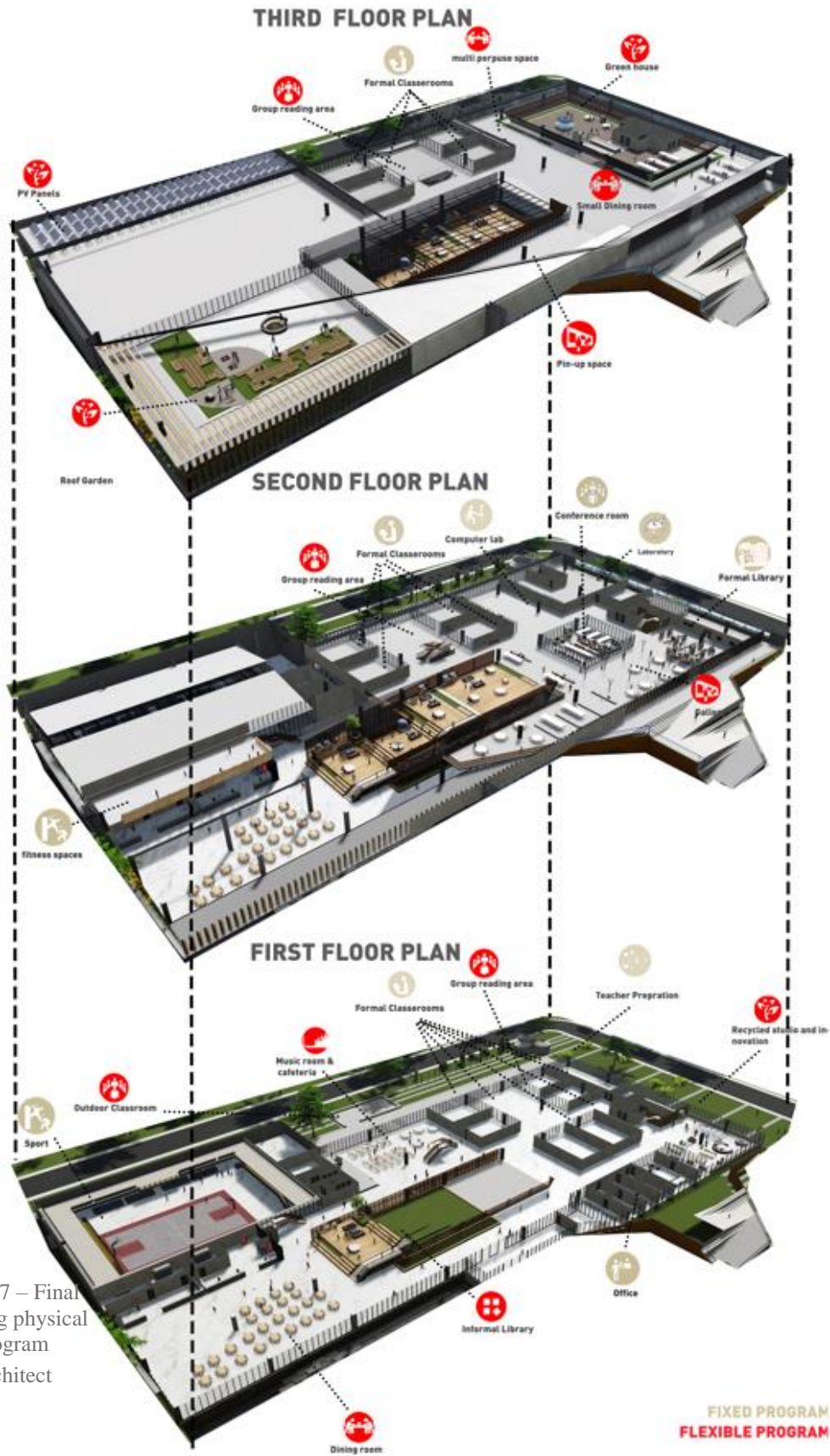


Fig. 9.7 – Final building physical program Architect



## 9-4 Floor plan design

# GROUND FLOOR PLAN

SC: 1/16"=1'-0"

- 1- Formal Classroom  
40'x31'
- 2- Group Studying  
50'x45'
- 3- Teacher Preparation  
69'x28'
- 4- Fitness Room  
30'x96'
- 5- Recycle Studio & Innovation  
45'x63'
- 6- Mechanical & Electrical  
30'x15'
- 7- Office  
125'x36'
- 8- Music Space  
45'x47'
- 9- Gym  
104'x170'
- 10- Waiting area  
45'x47'
- 11- Kitchen  
30'x96'
- 12- Dining Room  
94'x53'
- 13- Art Gallery  
88'x42'
- 14- Conference Room  
150'x45'
- 15- Laboratory  
78'x71'
- 16- Computer Lab  
55'x53'
- 17- Formal Library  
121'x30'
- 18- Workshop  
36'x89'
- 19- Central Gathering Stair  
150'x45'
- 20- Multi-purposed Area  
34'x41'
- 21- Roof Garden  
75'x90'
- 22- Green House  
140'x71'
- 23- Small Dining Room  
27'x67'
- 24- Storage
- 25- Outdoor Classroom  
57'x30'
- 26- Rest Room
- 27- Balcony
- 28- Pin-UP Area



Fig. 9.8 – Ground floor plan design  
Architect

# SECOND FLOOR PLAN

SC: 1/16"=1'-0"

- 1- Formal Classroom  
40'\*31'
- 2- Group Studying  
50'\*45'
- 3- Teacher Preparation  
69'\*28'
- 4- Fitness Room  
30'\*96'
- 5- Recycle Studio & Innovation  
45'\*63'
- 6- Mechanical & Electrical  
30'\*15'
- 7- Office  
125'\*36'
- 8- Music Space  
45'\*47'
- 9- Gym  
104'\*170'
- 10- Waiting area  
45'\*47'
- 11- Kitchen  
30'\*96'
- 12- Dinning Room  
94'\*53'
- 13- Art Gallery  
88'\*42'
- 14- Conference Room  
150'\*45'
- 15- Laboratory  
78'\*71'
- 16- Computer Lab  
55'\*53'
- 17- Formal Library  
121'\*30'
- 18- Workshop  
36'\*89'
- 19- Central Gathering Stair  
150'\*45'
- 20- Multi-purposed Area  
34'\*41'
- 21- Roof Garden  
75'\*90'
- 22- Green House  
140'\*71'
- 23- Small Dinning Room  
27'\*67'
- 24- Storage
- 25- Outdoor Classroom  
57'\*30'
- 26- Rest Room
- 27- Balcony
- 28- Pin-UP Area



Fig. 9.9 – First floor plan design  
Architect



# THIRD FLOOR PLAN

SC: 1/16"=1'-0"

- 1- Formal Classroom  
40'x31'
- 2- Group Studying  
50'x45'
- 3- Teacher Preparation  
69'x28'
- 4- Fitness Room  
30'x96'
- 5- Recycle Studio & Innovation  
45'x63'
- 6- Mechanical & Electrical  
30'x15'
- 7- Office  
125'x36'
- 8- Music Space  
45'x47'
- 9- Gym  
104'x170'
- 10- Waiting area  
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- 11- Kitchen  
30'x96'
- 12- Dining Room  
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- 13- Art Gallery  
88'x42'
- 14- Conference Room  
150'x45'
- 15- Laboratory  
78'x71'
- 16- Computer Lab  
55'x53'
- 17- Formal Library  
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- 22- Green House  
140'x71'
- 23- Small Dining Room  
27'x67'
- 24- Storage
- 25- Outdoor Classroom  
57'x30'
- 26- Rest Room
- 27- Balcony
- 28- Pin-UP Area

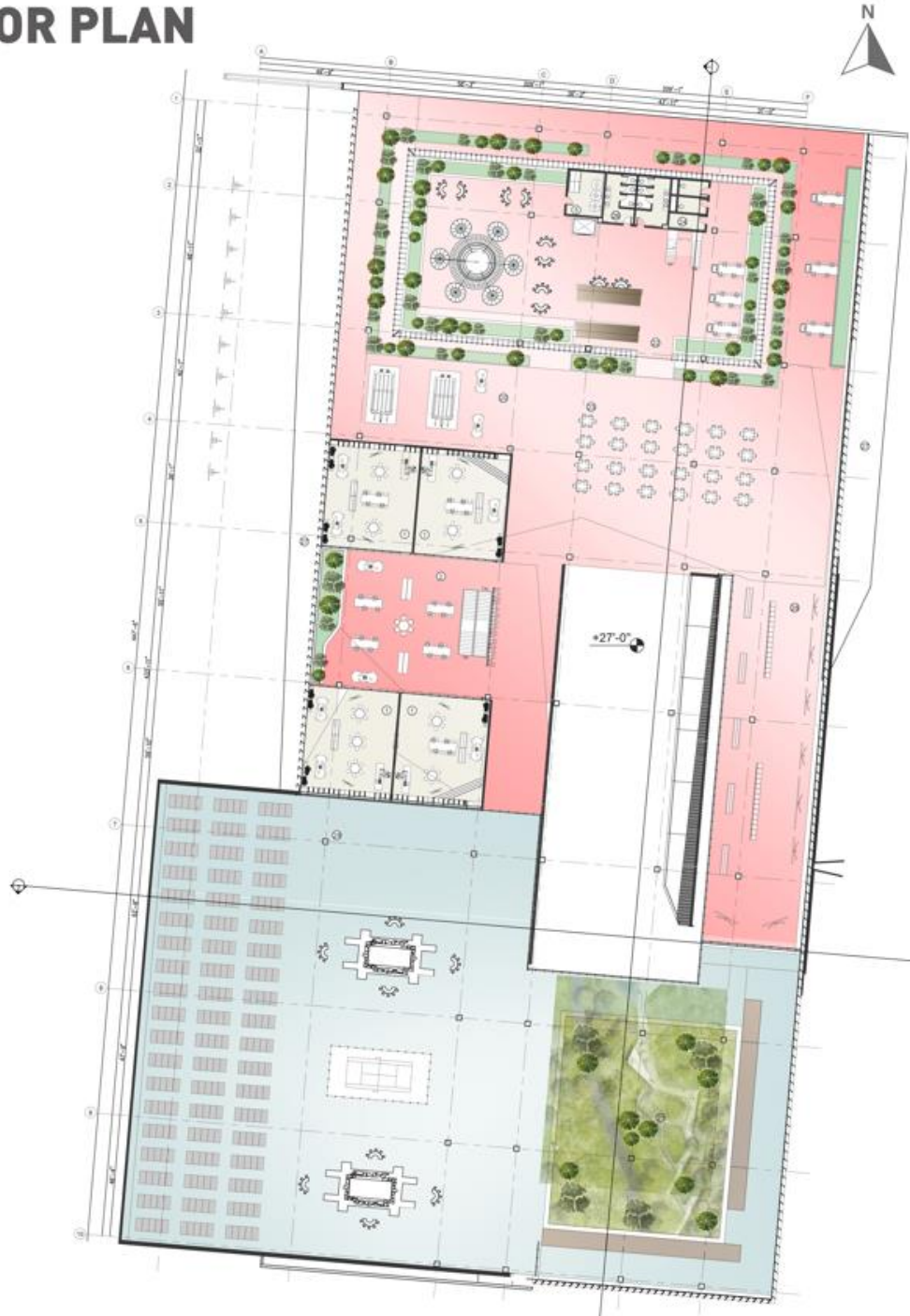


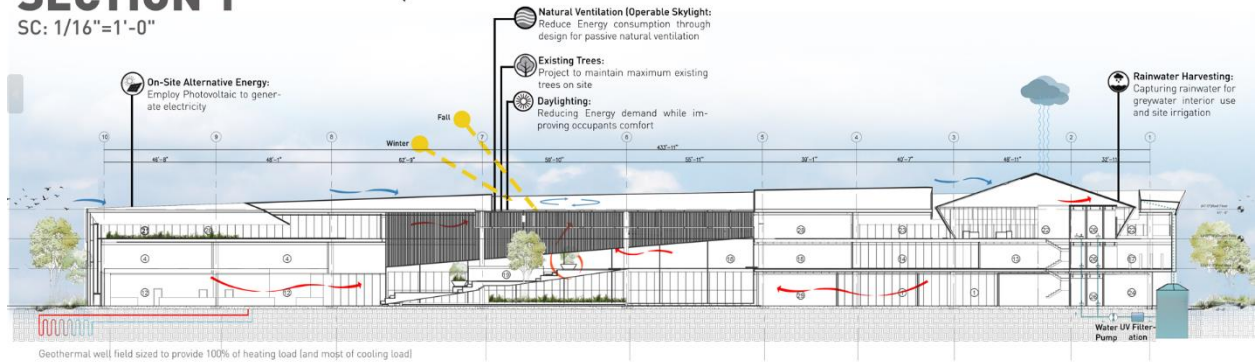
Fig. 9.10 – Second floor plan design  
Architect

## 9-5 Section design and sustainable analysis



### SECTION 1

SC: 1/16"=1'-0"



### SECTION 2

SC: 1/16"=1'-0"

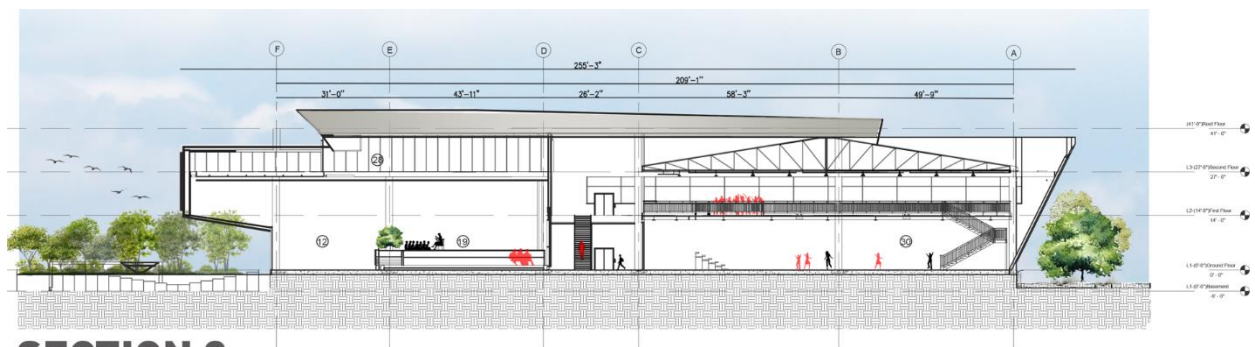
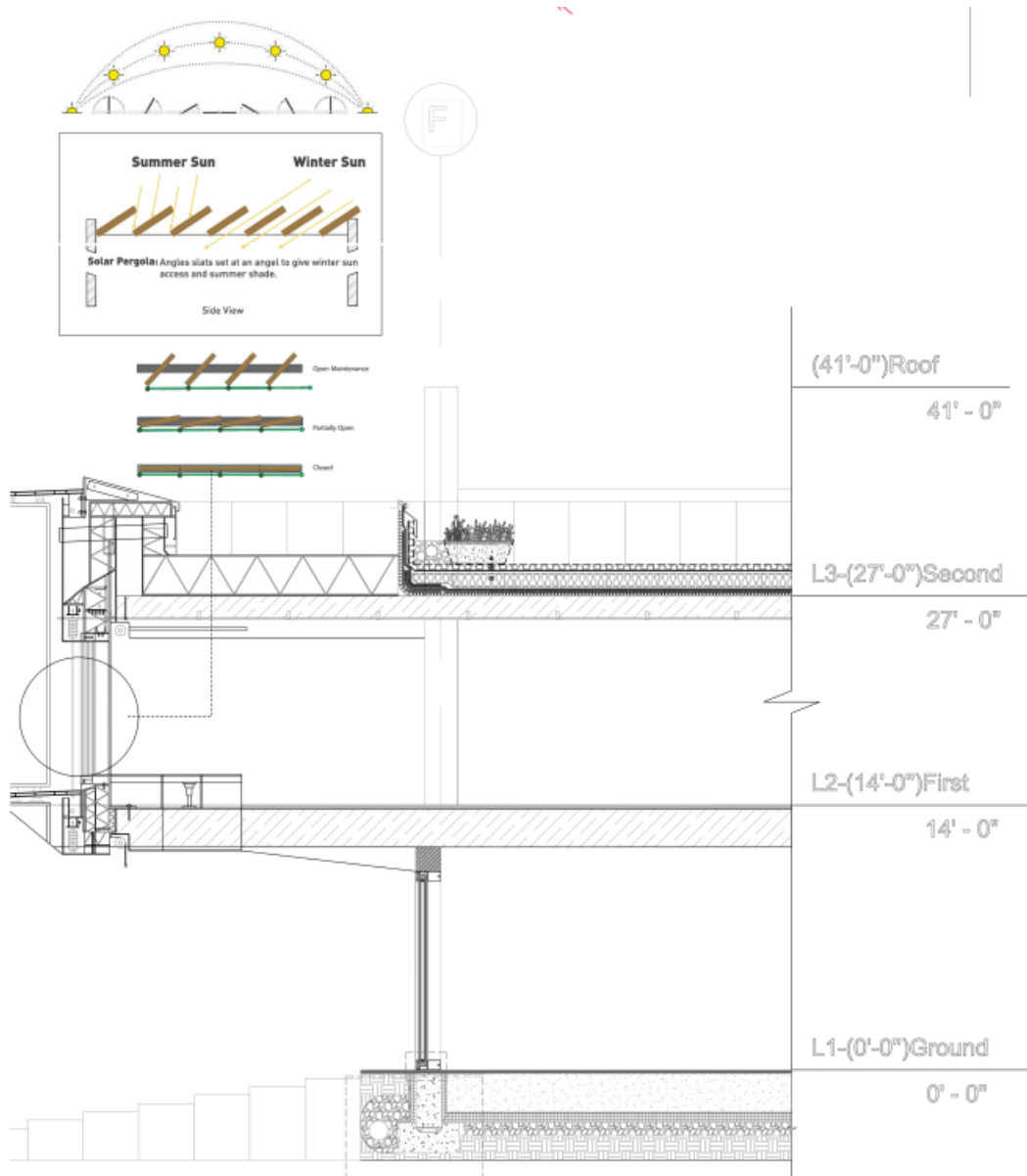


Fig. 9.11 – Section design and sustainable analysis  
Architect

## 9-6 Elevation design and sustainable analysis

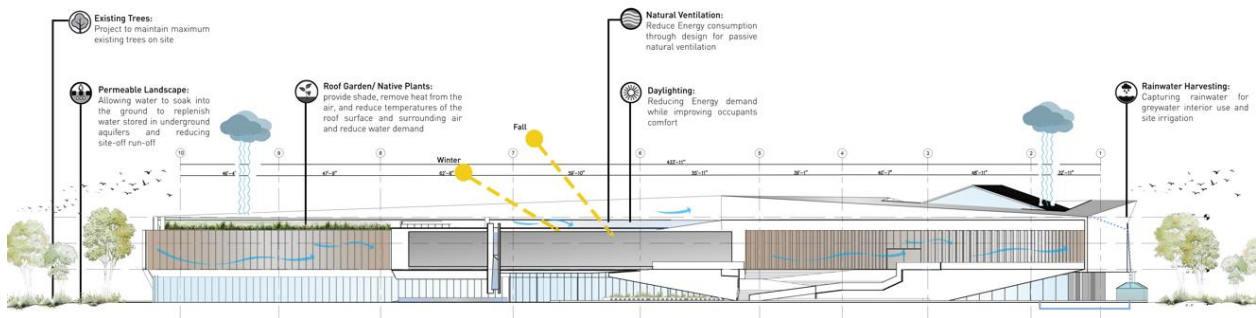
I taught students how to use natural light effectively by incorporating dynamic louvers in the facade to draw in and adjust the light according to the day and season.

By adjusting the position and angle of the louvers, students can learn how to manipulate the direction and intensity of light in a space, and how to balance the need for natural light with the need for privacy and shading. This approach also highlights the importance of considering the orientation and location of a building in relation to the sun, as well as the local climate and weather patterns.



# EAST ELEVATION

SC: 1/16"=1'-0"



# SOUTH ELEVATION

SC: 1/16"=1'-0"

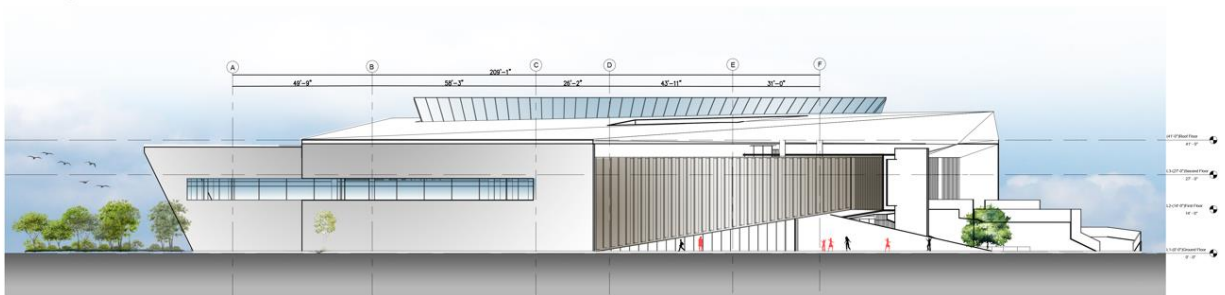


Fig. 9.12 – Elevation design and sustainable analysis  
Architect

## 9-7 Landscape design and sustainable analysis

Students can be inspired to embrace sustainable lifestyles via landscape design by displaying rainwater collection tanks. Students can also learn about the physics and engineering underlying the system and acquire practical experience by helping to setup and maintain the rainwater collecting system. Students are also taught how to produce energy using wind power, taking into account a modest number of turbines and lights on the west side of the property where we have the prevailing wind. Also, this green building school acts as a real-world learning environment where students can explore and experiment with sustainable design concepts. In other words, the opportunity for students to explore the environment and nature has been created by preserving as many of the site's trees as possible, taking into account diverse green spaces with native plants in the landscape of the site, and connecting it with the nearby park. Students can also better understand and become familiar with sustainability and environmental features, investigate vegetation, biodiversity assessment, and field and laboratory tests of school soil features. Besides, I created a spectacular rainwater collection system for a symbolic fountain at the entryway that uses rainwater



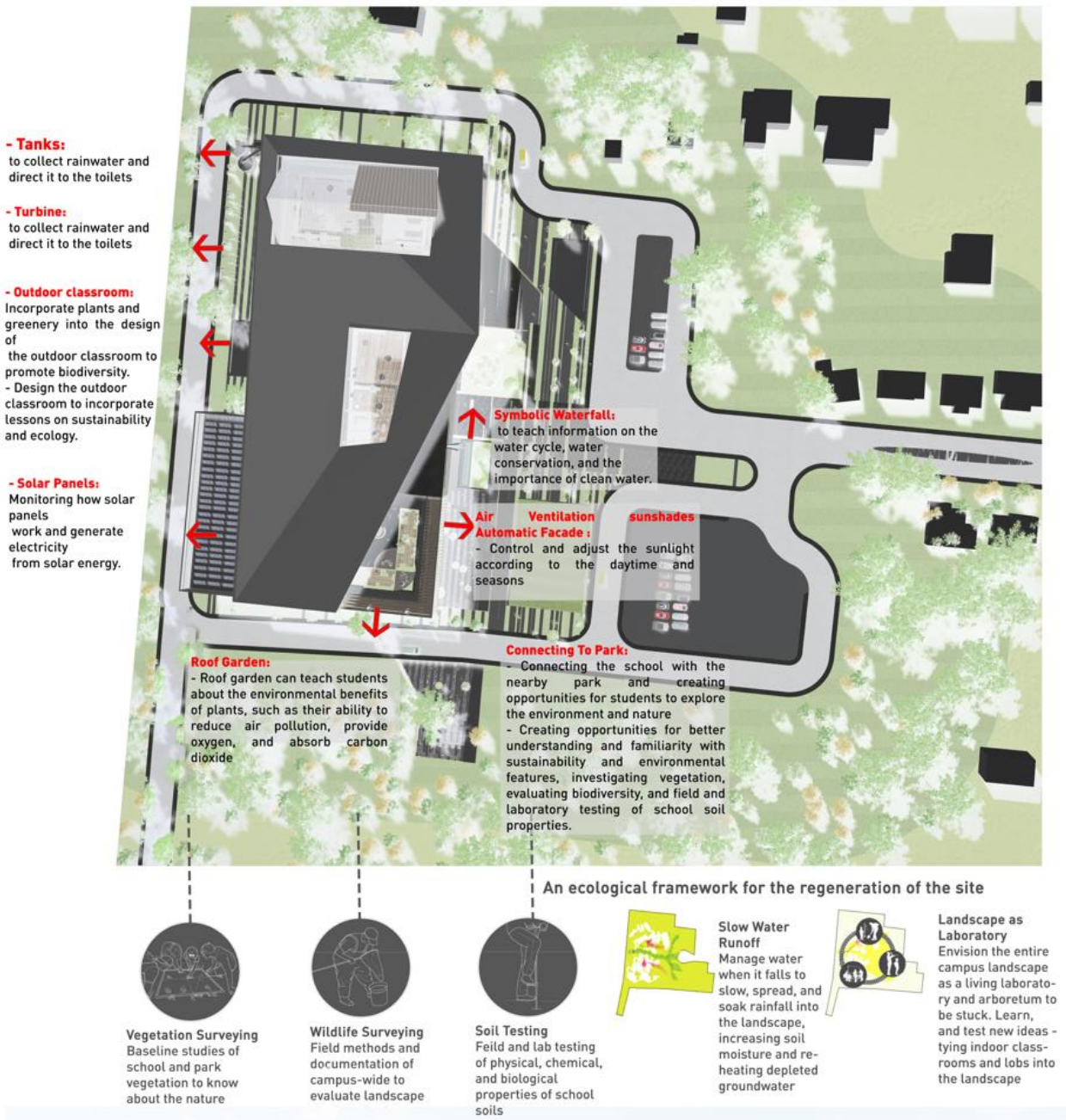


Fig. 9.13 – Landscape design and sustainable analysis  
Architect









Fig. 9.14 – Land scape and exterior design rendering  
Architect



### 9-8 large central stair with large void and plants:

Including a big central staircase with a spacious void, operable windows for bringing in natural light and ventilation, combined with plants as a group study and learning space, can provide students a number of advantages, including the development of 4C's abilities and learning sustainability. Students and instructors may use the central stairwell and void area as a common meeting place to encourage cooperation and group work. Plants can help to create a peaceful and motivating learning atmosphere that encourages creativity and innovation. The central stair and void area can also serve as a space for group discussions and debates, encouraging critical thinking and the exchange of ideas.



Fig. 9.15 – large central stair with large void and plants  
Architect

### 9-9 Recycle studio and innovation and gallery:

Participating in the construction of temporary, lightweight structures with recyclable materials can be a powerful way to teach students sustainability and 4 C's skills. By using recyclable materials to build structures, students can learn about the importance of sustainable materials and how to reduce waste and promote sustainability. They can also develop practical building skills such as designing, measuring and constructing structures. Building structures with recyclable materials requires cooperation and teamwork, which can help students develop important interpersonal skills such as communication, problem solving, and conflict resolution. Additionally, working with recyclable materials can encourage students to think creatively and provide innovative solutions to design and construction challenges, which can help them develop a sense of entrepreneurship and inspire them to pursue careers in fields that require creativity and innovation. BESIDES, seeing their work in the gallery in a public setting can boost students' confidence and self-esteem, promoting a sense of accomplishment and pride in their work. In this space, details of the construction of a greenhouse with recyclable materials have been designed, which can be supplied with rainwater.



Fig. 9.16 – Recycle studio and innovation and gallery

Architect



## 9- 10 Green house, roof garden and photovoltaic panels

Students have the opportunity to engage in cultivation in greenhouses, roof gardens and other indoor and outdoor spaces and grow products such as fruits and vegetables and then cook their products in the educational kitchen. Through this activity, students can learn about the benefits of a healthy diet and develop a taste for fresh and nutritious foods. They can also learn practical skills such as planting, watering, harvesting and cooking and learning about sustainable agriculture for the future. Additionally, by engaging in sustainable practices, students can develop a greater appreciation for the environment and a sense of responsibility to protect it. Additionally, by working together to grow and cook their own food, students can develop communication and teamwork skills, which can help create a sense of community and foster positive relationships between students.

A water purification device has been designed in the greenhouse to purify water with algae, native plants and ultraviolet rays. This can help students learn about the role of plants and algae in the ecosystem and how they can be used to solve environmental problems. Additionally, students can learn about the chemical processes involved in treating rainwater, including the role of UV rays in disinfecting water. Additionally, the remaining algae from the device can be used as biogas (renewable resource) to produce electricity. In addition, solar power systems have been set up next to the roof garden to show pupils how they operate and generate energy.



Fig. 9.17 – Green house, roof garden and photovoltaic panels

Architect





Fig. 9.18 – Music space interior design  
Architect



Fig. 9.19 – Gym interior design  
Architect



Fig. 9.20 – Dining room interior design  
Architect

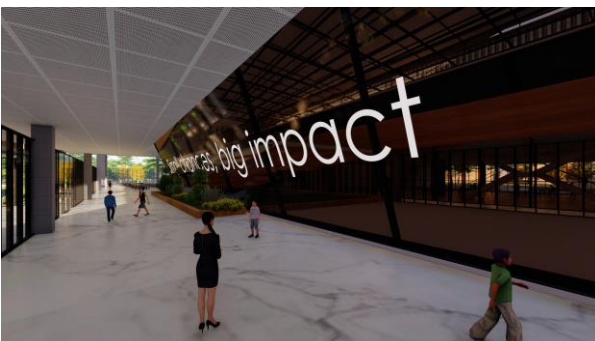


Fig. 9.21 – Entrance interior design  
Architect

## **9-11 Contribution and significant:**

For a number of reasons, it is crucial to design a teaching green building where sustainability is taught to students. It gives students the chance to learn about sustainability, contributes to the creation of a more ecologically friendly and sustainable learning environment, and gets them ready for a day when sustainability will be taken more seriously. Learning about green professions and technologies, such as renewable energy, sustainable agriculture, and green building design, may also be beneficial for students.

Through a combination of green school design and educational objectives, the purpose of my thesis is to investigate how sustainable features can be used as an educational tool to help students develop a sense of sustainability and build systems around them.

In my thesis research and design, there has been much discussion about how a green building school can serve as a 3D textbook and teaching tool for students, giving them a thorough understanding of not only the school's curriculum but also the principles of sustainable design for nature and humans. My objective is to discover how sustainable features, architecture, and education can be combined to reinforce all areas of students' development and learning by creating a welcoming environment. Additionally, I'm looking for concepts and frameworks in this thesis that will ensure students' learning and participation in all areas related to the core curriculum for middle school, the 4 C's (communicating, creativity, critical thinking, and collaborating), and sustainability.

Isolating kids, a lack of outside time, and a lack of social connection are current issues in schools that may result in social, psychological, and psychiatric crises. Lack of physical exercise may harm cognitive function and academic performance, while isolation can cause emotions of loneliness, melancholy, and anxiety. Students' self-esteem, interpersonal abilities, and emotional control may be impacted by a poor setting or lack of social engagement.

To combat these issues, I have introduced practices like group study and learning spaces, combining green areas, outdoor classrooms, physical activity breaks, and planting that encourage social connection, outside time, and minimize isolation. Additionally, I have helped students build interpersonal skills and foster a sense of community by creating classrooms and common areas that promote social interaction.

To achieve this, I concentrated on repurposing rooms to allow diverse forms of activity, such as collaborative work, project-based learning, and interdisciplinary teaching, rather than permanent places. Pupils may learn in a more interesting and participatory fashion as a result of instructors' ability to modify their teaching strategies to match the changing requirements of their pupils. I also attended to students' social and emotional needs by creating a more welcoming and inclusive learning environment, which may enhance 4c's abilities. A less constrictive setting may also make kids feel more at home and less alone, improving their general well-being and mental health.

I made every attempt to maintain the site's trees or thought of another green space and sustainable development in their place in order to solve the aforementioned issue and teach sustainability to the pupils. I've tried to encourage young people to congregate, interact, and learn in a number of settings, which I'll present to you. By encouraging social connection, this approach helps lessen pupils' feelings of isolation. Additionally, I've improved the students' access to outdoor learning opportunities and natural areas, which has increased their physical activity and can improve both their mental and physical health.



## **9-12 Reflection**

One of the key aspects of my thesis was to explore how sustainable features can be integrated into the educational objectives of a middle school. I wanted to investigate how the design of the school can serve as a teaching tool, and how sustainable features can reinforce all areas of students' development and learning. By creating a welcoming environment that encourages social connection, outside time, and minimizes isolation, I aimed to combat the issues of lack of physical exercise, social connection, and outside time that are currently prevalent in schools.

Throughout the design process, I paid close attention to the needs of the students and their social and emotional well-being. I recognized the importance of creating a less constrictive setting that would make students feel more at home and less alone, improving their general well-being and mental health. By providing diverse forms of activity and allowing instructors to modify their teaching strategies to match the changing requirements of their students, I hoped to create a more interesting and participatory learning environment.

In addition to creating a sustainable learning environment, I am also proud of the way in which I repurposed rooms to allow for collaborative work, project-based learning, and interdisciplinary teaching. By doing so, I was able to help students build interpersonal skills and foster a sense of community, which is crucial for their development. I believe that this approach helps to create a more holistic learning environment, where students can learn and grow in all areas of their lives.

Finally, I am proud to have designed a green middle school that emphasizes the importance of sustainability and serves as a model for other schools. By maintaining the site's trees and incorporating green spaces and sustainable development, I aimed to teach sustainability to the students and provide them with an understanding of the importance of environmental stewardship. I believe that this is an essential step towards creating a more sustainable future, and I am proud to have contributed to this effort.

Overall, my thesis has been an incredibly rewarding experience, and I am proud of what I have achieved. I believe that my design represents an important step towards creating a more sustainable and holistic learning environment for students. As I move forward in my career as an architect, I will continue to prioritize sustainable design and education, and work towards creating a better future for all.



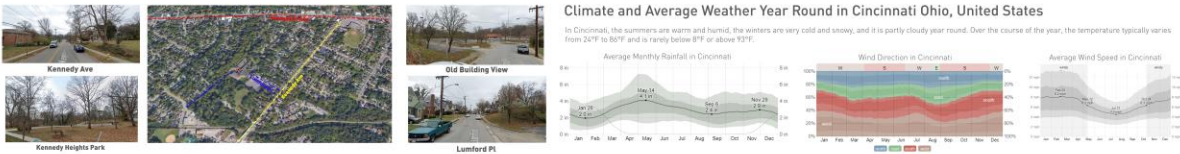




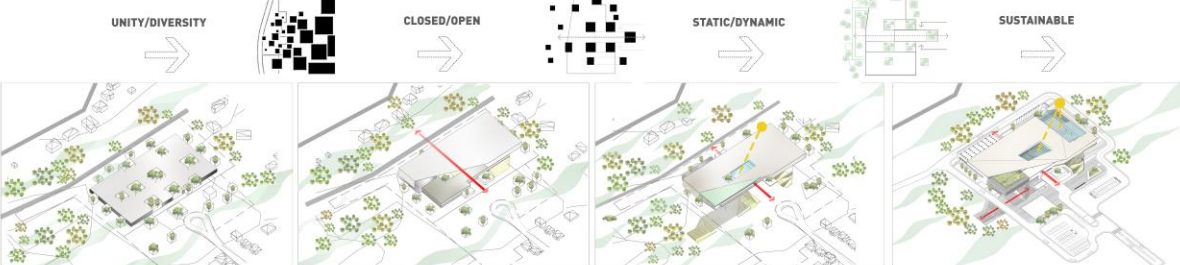
**SITE ANALYSIS**



Location: 3500 Lumford Pl, Cincinnati, OH 45213



**CONCEPT OF DESIGN**



Preserving nature and the trees on a site and involving students in the process, can create a unique and meaningful learning opportunity about sustainability and environmental conservation. It can also help to foster a sense of responsibility and stewardship for the environment in future generations.

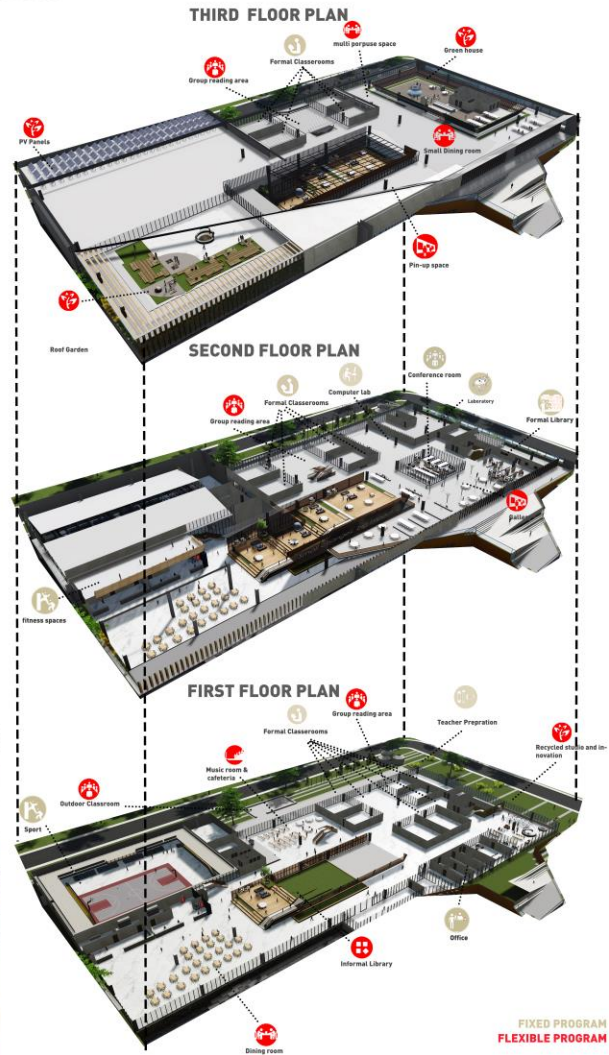
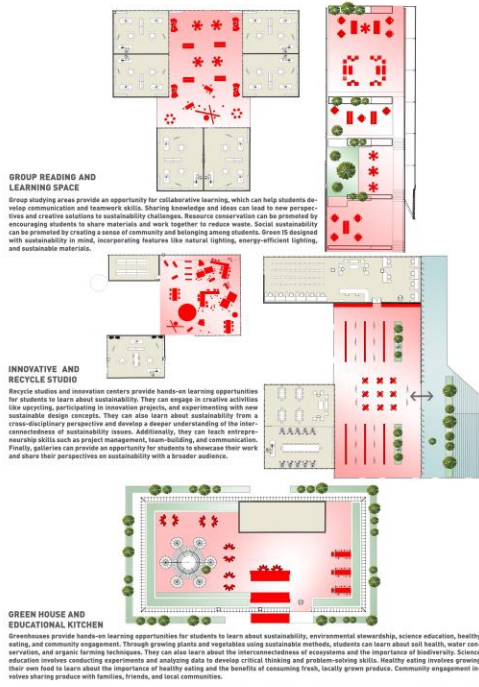
Bring nature inside to let students know more about the environment and is a great way to engage students' senses and teach them about different plants and textures.

Connecting the building to Kennedy Heights Park, creating territory inside and towards the forest where the outdoor educational space is set up in the middle of the forest to celebrate education with the approach to sustainability.

Creating a roof garden with PV panels and large windows and skylights to improve IAG and energy efficiency is a unique learning opportunity for students. These methods can improve their well-being, air quality, and energy efficiency.



## These Flexible Space encourage organic interactions with the academic spaces and peers







## GROUND FLOOR PLAN

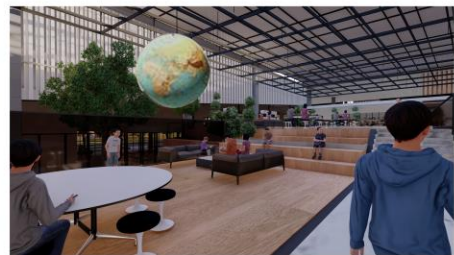
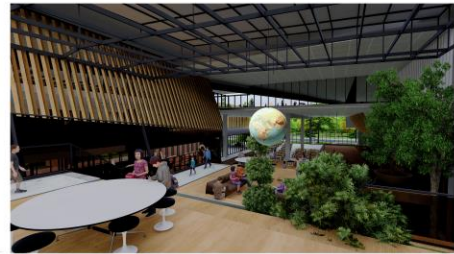
SC: 1/16"=1'-0"

- 1- Formal Classroom 40'x31'
- 2- Group Studying 50'x45'
- 3- Teacher Preparation 69'x28'
- 4- Fitness Room 30'x96'
- 5- Recycle Studio & Innovation 45'x63'
- 6- Mechanical & Electrical 30'x15'
- 7- Office 125'x56'
- 8- Music Space 45'x47'
- 9- Gym 104'x170'
- 10- Waiting area 45'x47'
- 11- Kitchen 30'x19'
- 12- Dining Room 94'x53'
- 13- Art Gallery 88'x42'
- 14- Conference Room 150'x45'
- 15- Laboratory 79'x71'
- 16- Computer Lab 55'x53'
- 17- Formal Library 121'x30'
- 18- Workshop 36'x89'
- 19- Central Gathering Stair 150'x45'
- 20- Multi-purposed Area 34'x41'
- 21- Roof Garden 79'x90'
- 22- Green House 140'x71'
- 23- Small Dining Room 27'x47'
- 24- Storage
- 25- Outdoor Classroom 57'x30'
- 26- Rest Room
- 27- Balcony
- 28- Pick-Up Area



## SOUTH ELEVATION

SC: 1/16"=1'-0"







RECYCLE STUDIO AND INNOVATION

**SECOND FLOOR PLAN**

SC: 1/16"=1'-0"

- 1- Formal Classroom 40'x31'
- 2- Group Studying 30'x45'
- 3- Teacher Preparation 69'x28'
- 4- Fitness Room 30'x46'
- 5- Recycle Studio & Innovation 45'x43'
- 6- Mechanical & Electrical 30'x15'
- 7- Office 125'x56'
- 8- Music Space 45'x27'
- 9- Gym 104'x170'
- 10- Waiting area 45'x47'
- 11- Kitchen 30'x46'
- 12- Dining Room 94'x53'
- 13- Art Gallery 88'x42'
- 14- Conference Room 150'x45'
- 15- Laboratory 78'x71'
- 16- Computer Lab 55'x53'
- 17- Formal Library 121'x50'
- 18- Workshop 36'x89'
- 19- Central Gathering Stair 150'x45'
- 20- Multi-purposed Area 34'x41'
- 21- Roof Garden 75'x90'
- 22- Green House 140'x71'
- 23- Small Dining Room 27'x67'
- 24- Storage
- 25- Outdoor Classroom 57'x30'
- 26- Rest Room
- 27- Balcony
- 28- Pick-Up Area



GALLERY



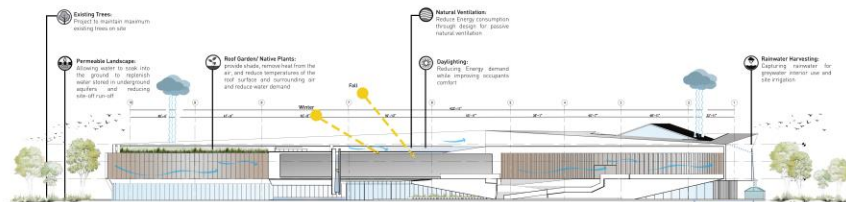
GALLERY



GALLERY

**EAST ELEVATION**

SC: 1/16"=1'-0"



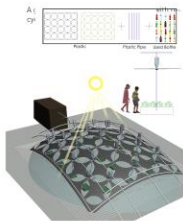
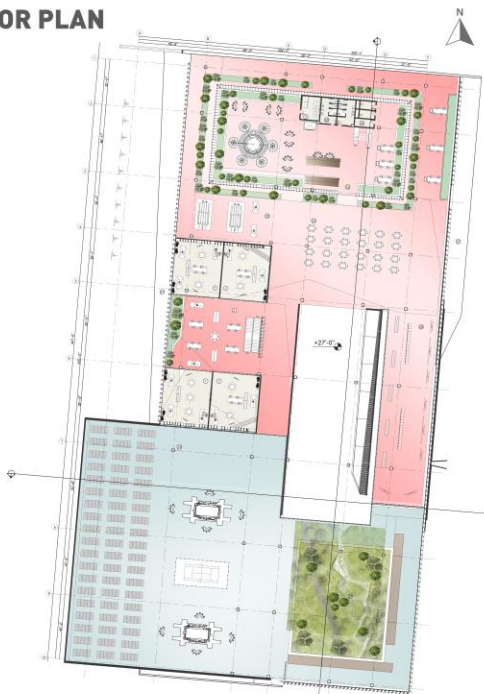




### THIRD FLOOR PLAN

SC: 1/16"=1'-0"

- 1- Formal Classroom  
48'x31'
- 2- Group Studying  
50'x45'
- 3- Teacher Preparation  
69'x28'
- 4- Fitness Room  
30'x96'
- 5- Recycle Studio & Innovation  
45'x63'
- 6- Mechanical & Electrical  
30'x15'
- 7- Office  
122'x36'
- 8- Music Space  
45'x47'
- 9- Gym  
104'x120'
- 10- Waiting area  
45'x47'
- 11- Kitchen  
30'x96'
- 12- Dining Room  
94'x52'
- 13- Art Gallery  
88'x42'
- 14- Conference Room  
150'x45'
- 15- Laboratory  
78'x71'
- 16- Computer Lab  
30'x33'
- 17- Formal Library  
121'x30'
- 18- Workshop  
36'x88'
- 19- Central Gathering Stair  
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- 20- Multi-purposed Area  
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57'x30'
- 26- Rest Room
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- 28- Pin-UP Area

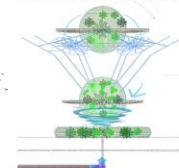


### SECTION 1

SC: 1/16"=1'-0"



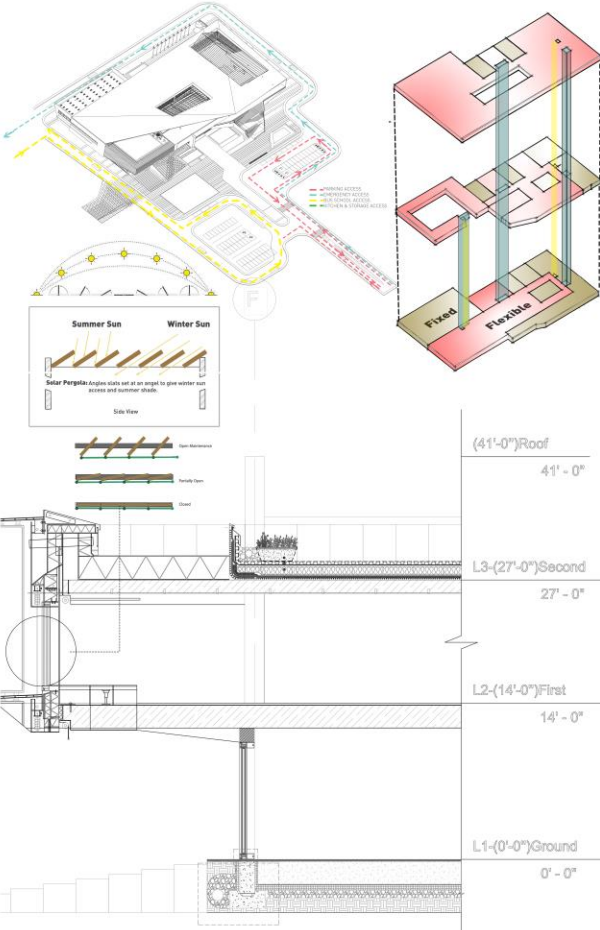
purifying of dirty water by native plants and algae





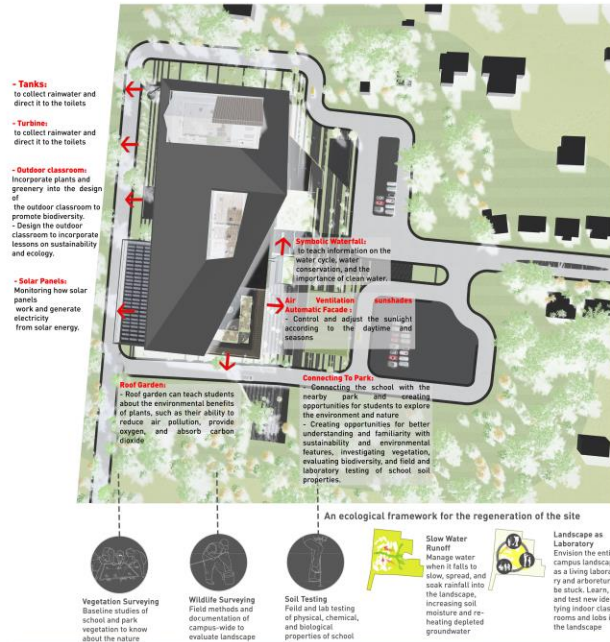


**OUTSIDE AND INSIDE CIRCULATION DIAGRAM**





# LANDSCAPE ANALYSIS

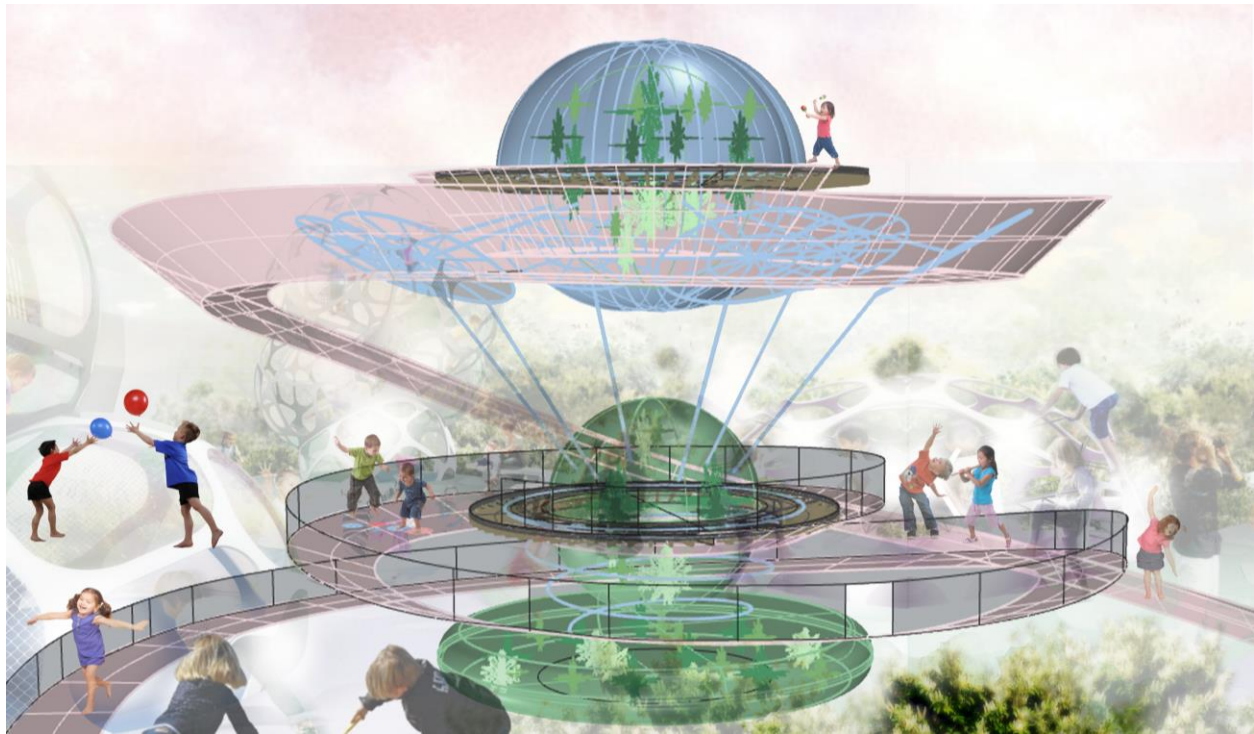


SECTION 2





# APPENDIX B: MISCLLANEOUS DESIGN AND SKETCHES



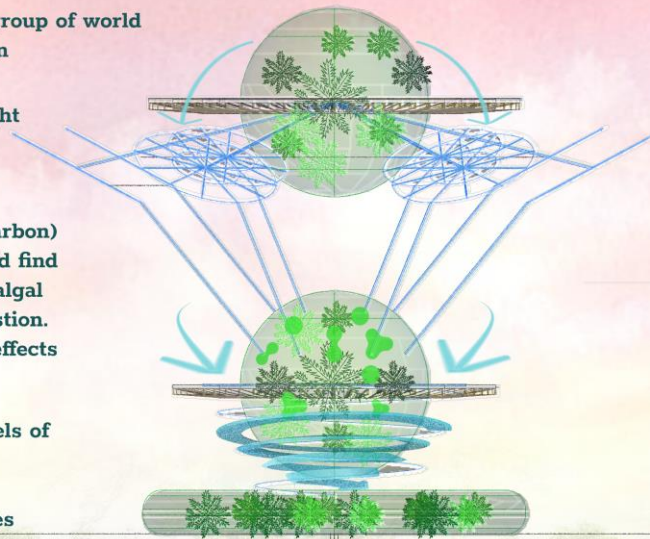
**Purifying dirty water in a tank, including a diverse group of world land plants which promote denitrification**

**Translucent tubes to expose the water toward UV light to ensure about biological stability**

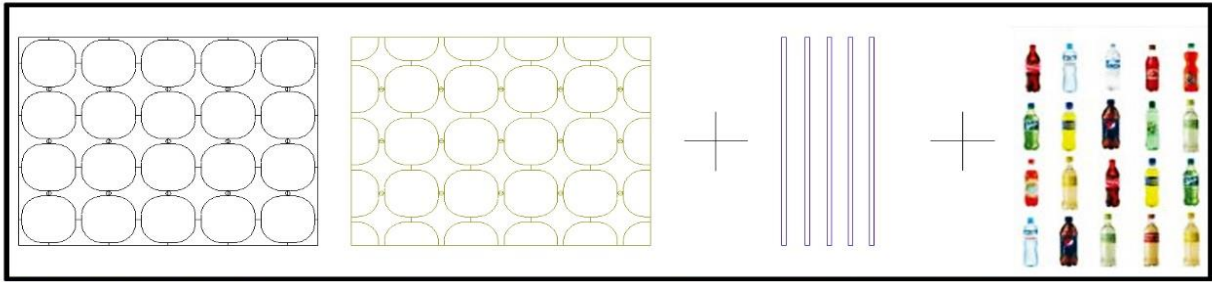
**A tank including algae to provide a way for contaminants-removal (nitrogen, phosphorus and carbon) from wastewater while producing biomass that could find a use for the production of high-value chemicals (algal metabolites) and/or biogas through anaerobic digestion. Additionally, microalgae can diminish the harmful effects of sewage effluent.**

**Increase the level of dissolved oxygen through 3 levels of waterfall**

**More vegetable to filter any remaining impurities**







Plastic

Plastic Pipe

Used Bottle





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"Children and Nature 2009: A Report on the Movement to Reconnect Children to the Natural World" is a joint project of the Children & Nature Network and ecoAmerica.

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