THINKING AHEAD:

PREPARING YOUNG MINDS FOR A FUTURE WORLD

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A Design Thesis Submitted to the

Department of Architecture

North Dakota State University

By

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THESIS PROPOSAL

THESIS ABSTRACT

Change occurs in a variety of ways. Sometimes overnight, sometimes silently over years. Consider the revolutions of the past forty years. Those in 2020 alone. Ponder the magnitude of changes our children will experience over the coming century. This thesis explores the relationship between future realities and our current understandings. Quantitative research, logical argumentation, and correlational research will offer a comprehensive look into the patterns of this ever-changing world. Case study analysis and qualitative research assess learning environments and understanding of building form as a key contributor to user experience. An independent learning environment, a museum of the future blended with a library of knowledge, allows an opportunity for a grand demonstration of architecture's powerful ability to inspire and educate.

THESIS NARRATIVE

Children are the future minds, creators, and problem solvers of the world. It is important that this future generation is equipped with the skills and experiences they need to successfully adapt to the ever changing world we live in. This thesis will concentrate on architectural form as an interactive tool for learning, specifically addressing the developmental and environmental shifts of our world.

CHANGING EDUCATION

Over 100 years ago Maria Montessori developed the Montessori Method as a student-led, self-paced approach to education. This focus on discovery allows for students to become independent learners within a prepared environment (Al et al., 2012). Although the student-led approach was adopted by some, a teacher-led approach remains a popular strategy by schools. The classic lecture classroom with individual desks all facing forward is a one-size fits all approach that is ineffective for many students. Fast forward to the recent pandemic and quick shift to online learning, a whole new world of possibilities became known as children were sent to learn in locations outside of their standard classroom. Children were expected to constructively use technology to complete their studies, find resources, and communicate with their peers. This is especially important as our technology rapidly advances around us.

The relevancy of skills are shifting as the world accepts that some jobs and skills will be automated in the near future. As a result, sense-making, social intelligence, and adaptive thinking are projected to be necessary for future situations (Fidler, 2016).

CHANGING ENVIRONMENT

The COVID-19 pandemic propelled society into an entirely new world, but masks and at-home careers are not the only changes we have seen. Consider climate change, a growing population with increased lifespans, and technology that appears to advance by the minute. Despite our efforts to predict and prepare for the next world crisis or monumental step, the future remains unpredictable. Not only that, but unimaginable. What will the next 90 years bring these children? How can they be prepared to overcome situations that, at this point, cannot be anticipated?

Que an environment where new and extraordinary is the norm. Everything from the form of the building to the individual exhibits, will encourage children to respond and solve in a new, innovative fashion. This thesis will explore the question: **How can architecture educate the future?** Examination of known successful learning styles and environments will be applied to a space that offers hope and insight into the future condition of the world. Exploration and manipulation of architectural form will aid in the creation of a fun, exciting experience to engage our youth in an impactful way.

" EDUCATION IS OUR PASSPORT TO THE FUTURE, FOR TOMORROW BELONGS TO THE PEOPLE WHO PREPARE FOR IT TODAY. "

- Malcolm X

FIGURE 2 | EL PASO CHILDREN'S MUSEUM (KTSM, 2021)

PROJECT TYPOLOGY

CHILDREN'S LEARNING CENTER

A center that merges two existing typologies; a museum and library. Both will be adapted to fit the needs of the future, while maintaining their traditional core goals:

> Education
>
> Entertainment
>
> Environment

This combination of typologies aims to create a public space that encourages daily use by locals, while being a destination for travelers. Working in harmony, the spaces will create an environment that fosters hope and invokes a sense of wonder. In a clean, healthy atmosphere, users will learn, prepare, and consider their role in the world to come.

MAJOR PROJECT ELEMENTS

MUSEUM

A space for children to organically learn from their environment through exploration and engagement.

Features interactive exhibits based on futuristic scenarios of the world.

LIBRARY

A space for children to develop knowledge.

Offers physical and technological resources, collaborative spaces, and work stations to be used by visitors.

CLASSROOMS

Utilized for structured learning activities and events hosted by the learning center.

OUTDOOR SPACE

Provides opportunity for children to extend their learning beyond the physical boundaries of the building.

CIRCULATION

Guides visitors through the center by providing thoughtful connections between spaces.

SUPPLEMENTARY SPACES

Assists in overall function and maintenance of the building.

- Bathrooms
- Parking
- Faculty offices
- Storage

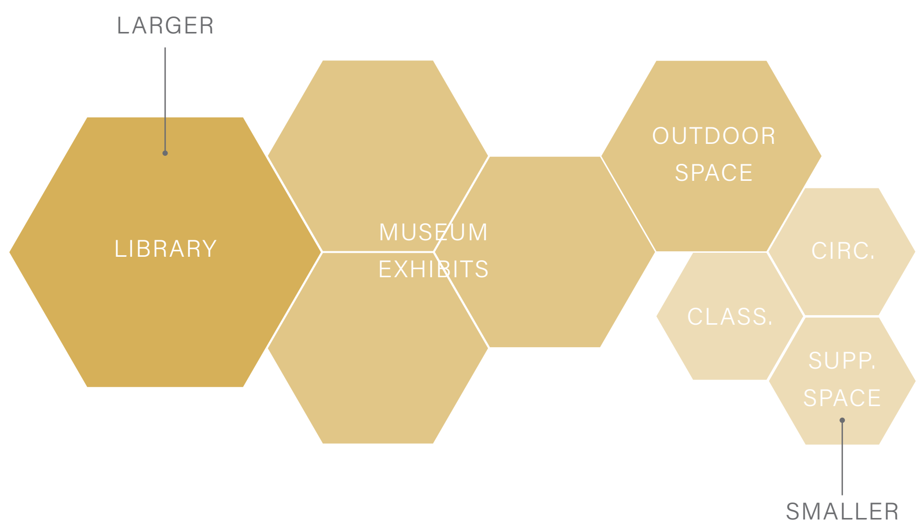


FIGURE 3 | ESTIMATED ELEMENT SIZE COMPARISON

CLIENT / USER DESCRIPTION

CHILDREN

The learning center will be designed to best accommodate children ages 7 to 12. Higher usage is expected after school hours and weekends.

STAFF

A team of staff members will work in the learning center on a daily basis. This diverse set of workers falls into three main categories: management and operations, visitor assistance, and maintenance.

EDUCATORS

Teachers enhance the learning experience through their educational demonstrations. Both parents and students will be invited to the classroom or collaborative library space to participate in specific events and programs prepared and led by the educators. Most programs will occur on weekends and summer weekdays.

PARENTS

Parents are invited to the museum to assist and supervise their children. They will be provided access to the same spaces as their children.

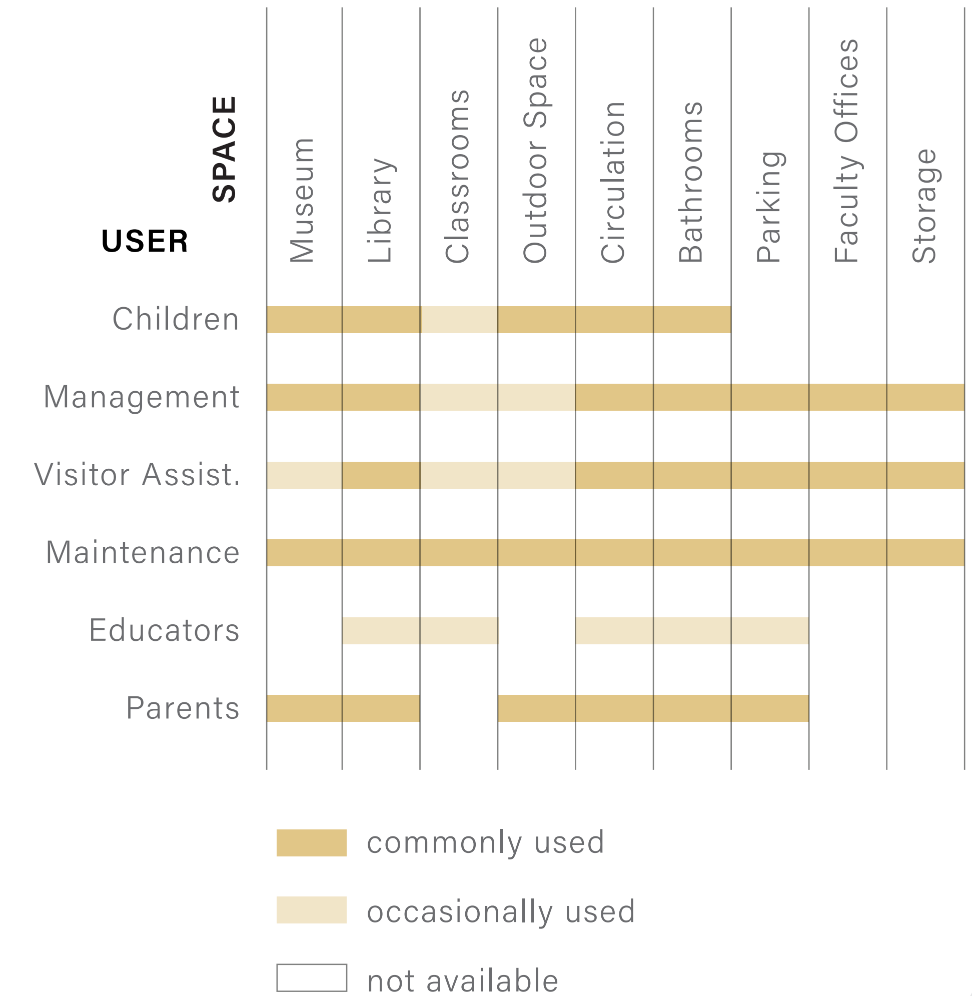


FIGURE 4 | ESTIMATED SPACE USAGE BY USERS

THE SITE

The site selection process began by focusing on two variables: children and innovation. To compliment the futuristic design, the site selected should present a forward-looking environment for the project to live and flourish. Chris Weller listed Dallas, Texas among the top 6 high-tech cities in the US in his article for *Insider* (Weller, 2017). When compared to the other ranked cities, Dallas had fewer buildings that offered a similar typology to that proposed in this project.

With over 28.9 million residents, Texas is the second most populated state in the United States (Population Reference Bureau, 2019b). In addition, 25.5% of the state population is under the age of 18 (Population Reference Bureau, 2019a). Dallas county, specifically, has over 2.6 million residents with 25.8% under the age of 18, totaling almost 680,000 children (Population Reference Bureau, 2019b). Overall, the high saturation of children and the progressive environment of Dallas creates an appropriate region for this thesis project.

REGION: Southern United States

CITY: Dallas, Texas

FIGURE 5 | REGIONAL MAP (Snazzy Maps, n.d.)

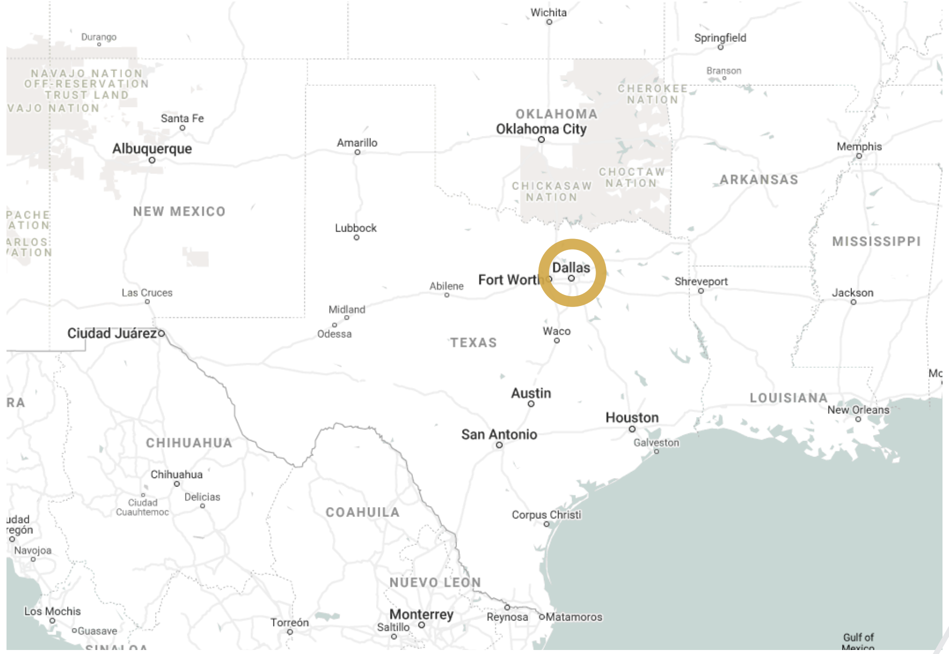


FIGURE 6 | STATE MAP (Snazzy Maps, n.d.)

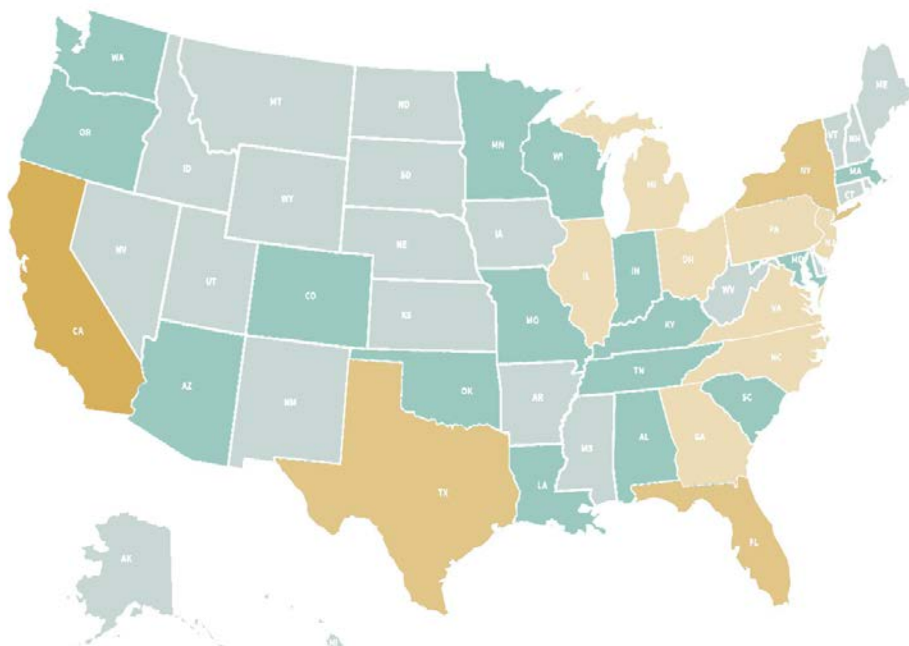


FIGURE 7 | TOTAL POPULATION (2019)

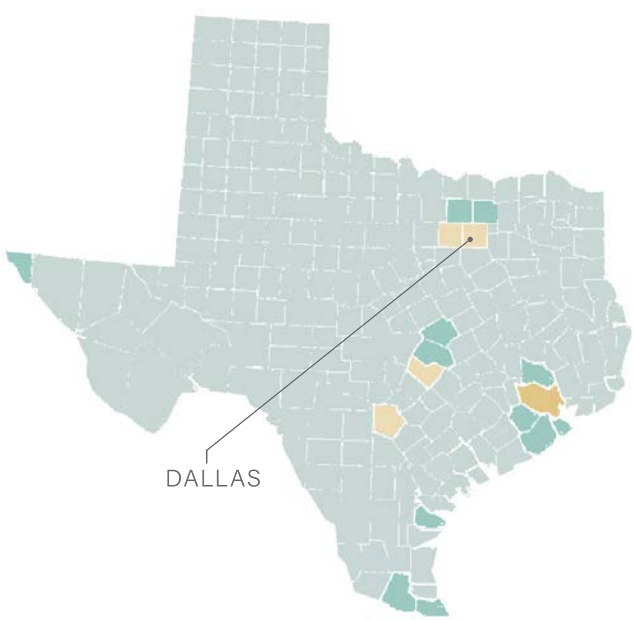


FIGURE 8 | TEXAS TOTAL POPULATION (2019)

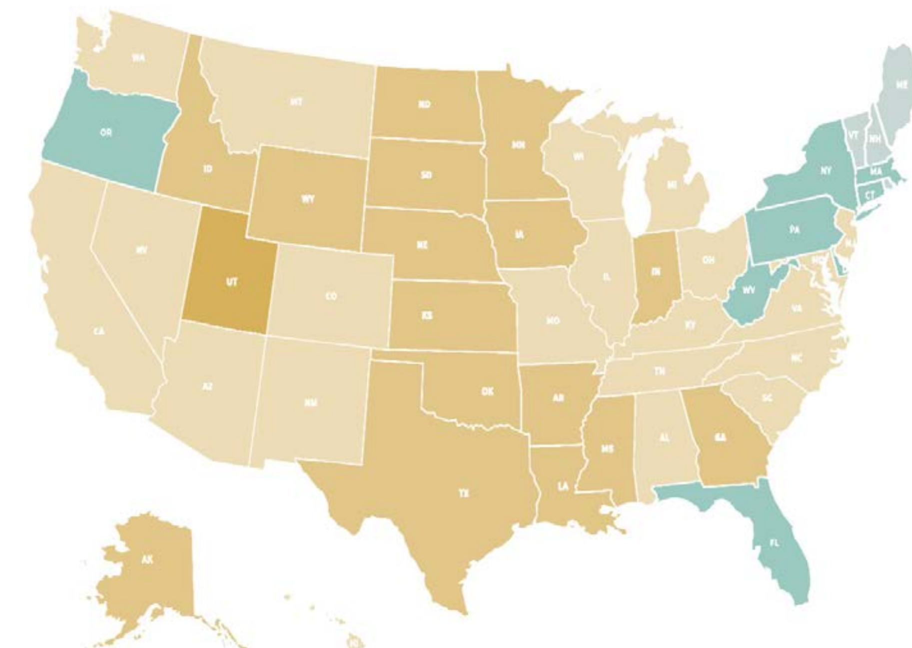


FIGURE 9 | PERCENTAGE OF THE POPULATION UNDER AGE 18 (2019)

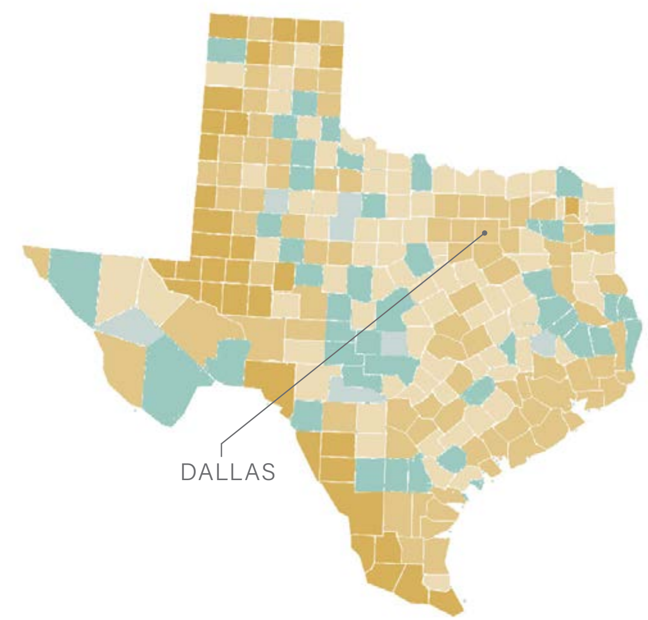


FIGURE 10 | TEXAS PERCENTAGE OF THE POPULATION UNDER AGE 18 (2019)

THE SITE

LOCATION: 1114 N Lancaster Ave | Dallas, TX 75203

Located along a popular route connecting downtown Dallas to the southwest residential neighborhoods, the Lancaster Ave site offers community exposure and easy access. On the site, currently, are the unappealing ruins of the Oak Farms Dairy plant as shown in Figure 11. Redevelopment of the site would aim to restore the land, revitalize community interaction, and reflect the innovative advancements of the city. The site is relatively large; site analysis research will be conducted to determine where on the site the project should sit to allow for potential adjacent development projects in the future.

FIGURE 11 | LANCASTER AVE SITE (Google Maps, n.d.)

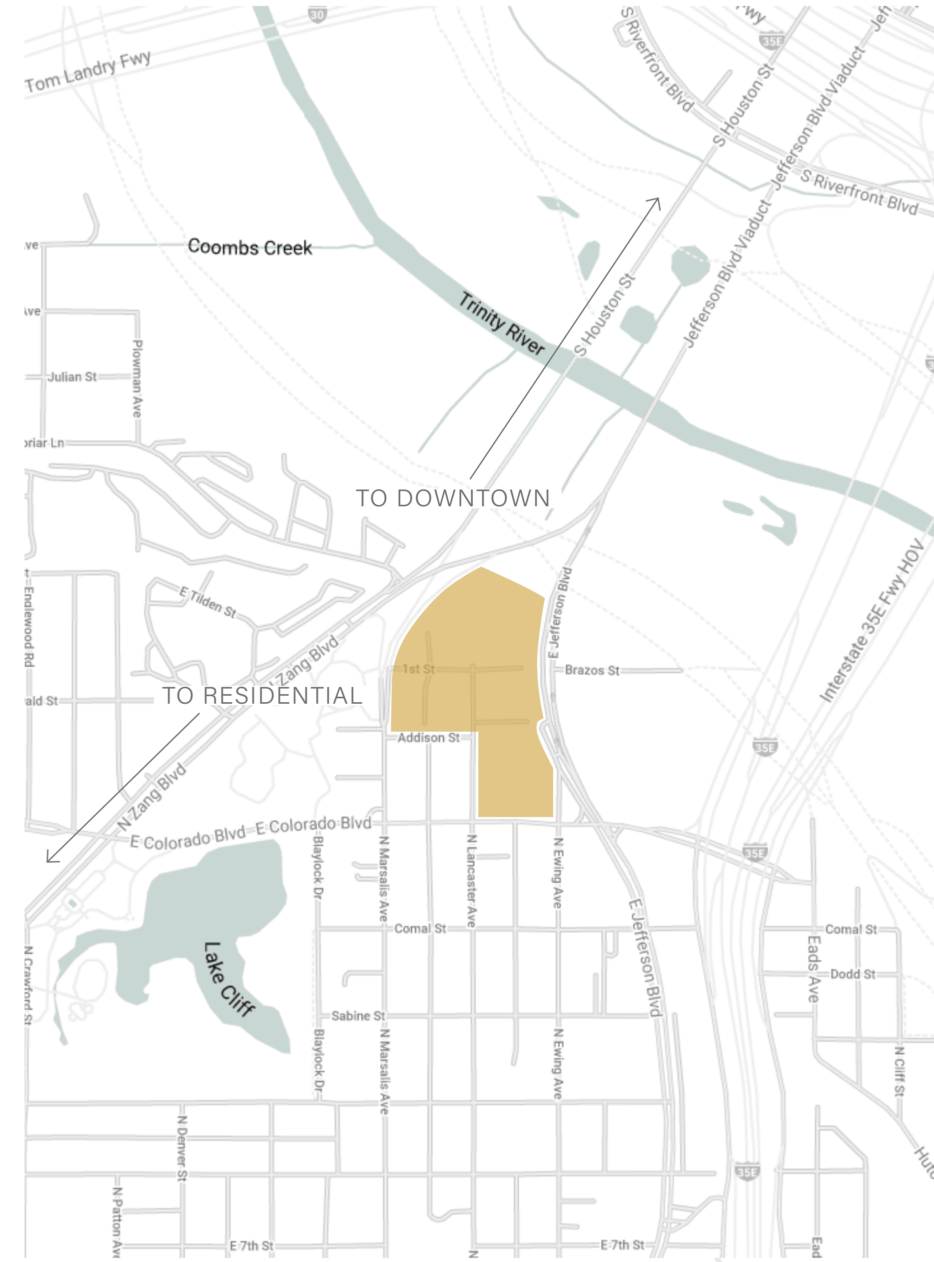


FIGURE 12 | SITE MAP (Snazzy Maps, n.d.)

PROJECT EMPHASIS

ARCHITECTURAL FORM & CHILDREN

Scale	The design should respond to the size of a child, rather than an adult. Interior forms should accommodate this scale to create spaces that prioritize the child experience.
Progression	The progression through spaces should be understandable for young minds to guide themselves through a logical pattern of spaces. Connections between spaces should be enhanced with architectural elements.
Interaction	The form of interior spaces should include interactive elements that contribute to the children's learning experience.
Emotion	The design should foster hope and excitement towards the future. Building form should prioritize the health of the interior spaces and promote the well-being of its occupants.

GOALS OF THE THESIS PROJECT

DESIGN GOALS

1 Create an inclusive design that addresses the learning needs of all children.

2 Better understand how architectural form and elements can enhance child engagement within a space.

3 Form spaces that prepare children for situations that are currently unknown.

4 Produce an environmentally conscious project through integration of sustainable strategies.

These goals will guide the project to create an intentional design that responds to the research conducted. Consequently, personal development as a designer will hopefully be achieved through the process.

ACADEMIC GOALS

1. Utilize knowledge gained from undergraduate education and apply it to a research driven design project.
2. To think innovatively to produce new solutions that respond to the project research.

PROFESSIONAL GOALS

3. Expand knowledge of learning environments that can be applied to potential projects in a future career.
4. Improve drawing skills to communicate ideas to advisor.

PERSONAL GOALS

5. To complete a thesis project that represents my dedication to design and builds confidence as I move into the next chapter of my life.
6. Gain a better sense of the career path I want to pursue following graduation.

PLAN FOR PROCEEDING

DESIGN METHODOLOGY

The thesis question under investigation is: **How can architecture educate the future?** The research methods used for analysis of the topic are quantitative research, qualitative research, logical argumentation, correlational research, and case studies.

A qualitative research strategy will be used to understand the vision children and adults have of the future. An analysis of their physical expectations and emotional barriers related to the topic will be conducted. In addition, the study of different pedagogical approaches and their successes with child development will be compared. Research will be collected from published articles, interviews, and books. Results will provide project context and influence the user needs addressed in the design solution.

In addition, correlational research and logical argumentation will be studied to identify relationships seen in the past. Quantitative research will provide data to measure patterns and trends seen around the world. Data for comparison will be collected from national agencies on weather patterns, population shifts, demographics, etc. Research conclusions will inform the exhibit curriculum to be developed in the design process.

The examination of case studies will offer comparison of typologies and architectural form. Understanding how children respond to these built spaces will render insight into their environmental preferences for learning. Firm portfolios and architectural publications will be referenced for information and diagrams of the projects. Research results will aid in the form exploration phases of the design solution process.

DOCUMENTATION OF THE DESIGN PROCESS

Applications	Hand sketching Physical models	Conceptual Design
	AutoDesk Revit Rhino	Design Development
	Lumion Adobe Photoshop Adobe Illustrator Adobe InDesign	Production

Deliverables

Thesis Book
Presentation Boards
Digital Presentation Slides
Visual Aid (animation or physical model)

Publication

North Dakota State University Repository

Preservation

Digitally - on cloud based server
Physically - printed as hard copy

Documentation Notes

1. All research to be documented digitally by scanning process sketches and photographing models.
2. Scheduled tasks should be collected and included in digital research collection folder on a weekly basis.
3. Thesis book to be revised weekly with updated information and saved.
4. All local files automatically sync to Google Drive back-up folder.

PROJECT SCHEDULE

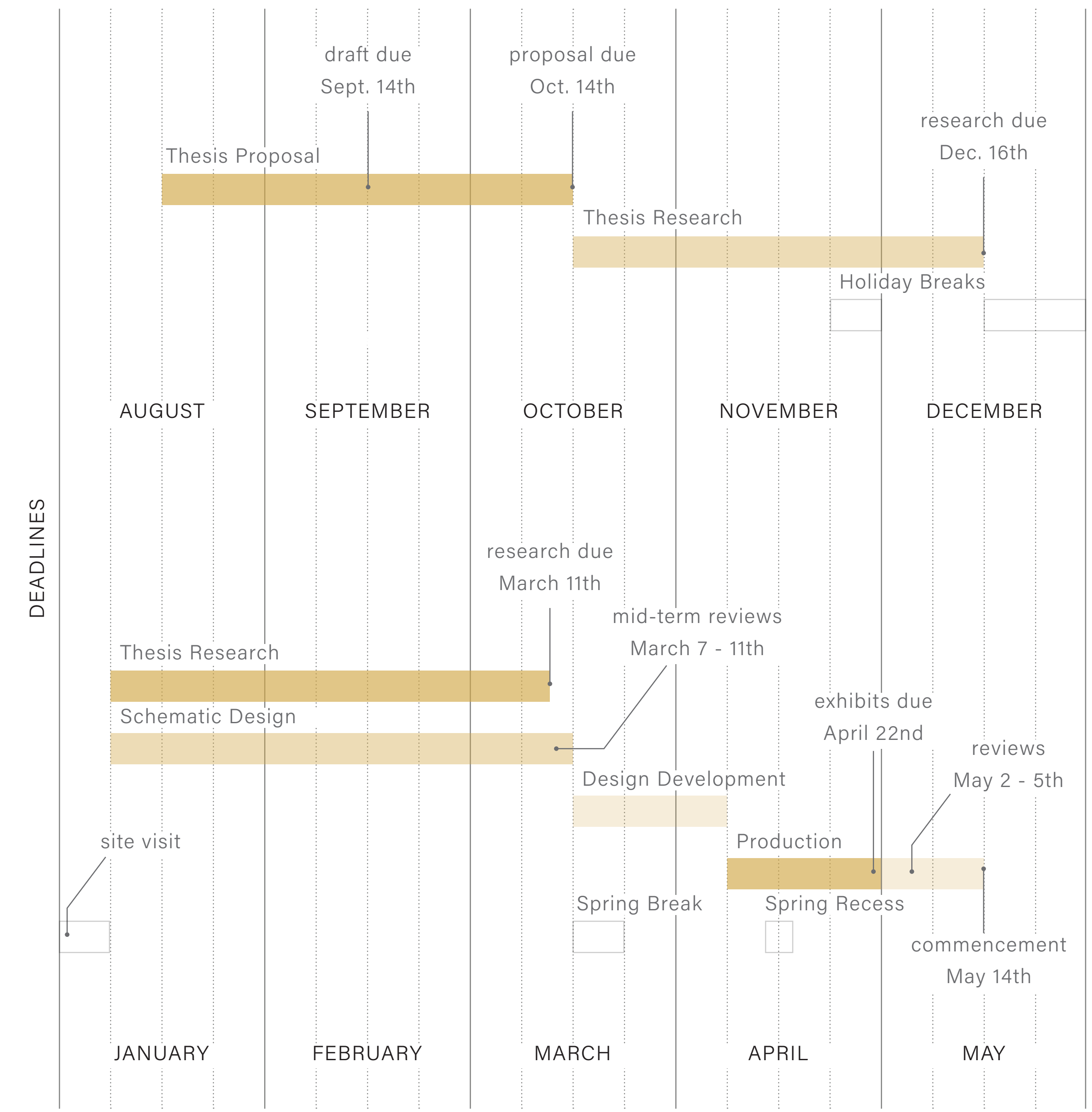
WEEKLY TASKS

FALL SEMESTER

WEEK 1 - 2	topic exploration
WEEK 3	create narrative & define typology
WEEK 4	identify project elements & users
WEEK 5 - 6	site selection & plan for proceeding
WEEK 7 - 8	topic refinement
WEEK 9 - 10	case study research & project justification
WEEK 11	explore historical, social, & cultural context
WEEK 12 - 13	complete site analysis & performance criteria
WEEK 14 - 16	collect / organize all data into book

SPRING SEMESTER

WEEK 1 - 2	spatial diagramming & massing
WEEK 3 - 4	form development
WEEK 5 - 6	concentration on interior form / exhibits
WEEK 7 - 8	focus on structure & sustainability
WEEK 9	digital modeling progress & refine plans
WEEK 10 - 12	design refinement
WEEK 13 - 14	render images & create graphics
WEEK 15	finalize presentation materials



THESIS RESEARCH

TYPOLOGICAL RESEARCH

PRECEDENTS

1 German Pavilion Expo 2020 | Dubai, UAE

2 Museum of the Future | Dubai, UAE

3 Yuecheng Courtyard Kindergarten | Beijing, China

The typological precedents were chosen based on typology, education through interaction, topics of exhibits, and year of project completion/design. The precedent typologies are a mix between museums and educational facilities. The essential pieces of each typology will be incorporated into the project to achieve the combination of both educational and entertaining, as described in the thesis proposal. Since this project focuses on technological advances, precedents with recent designs were chosen as they provide solutions that use the most advanced technology to date. The precedents provide a variety of targeted audiences and exhibits, demonstrating the influence of users on the design solution.

Each precedent was analyzed based on its approach to six design factors: project massing, hierarchy of space, circulation, interactive architectural elements, structure, and sustainable strategies.

TYPOLOGICAL RESEARCH

GERMAN PAVILION EXPO 2020

TYPOLOGY	Exhibition
LOCATION	Dubai, UAE
SIZE	4,500 square meters
BUILT	2021
DESIGNER	LAVA
PROGRAM	Exhibitions, restaurant, performance stage

As a contribution to the Sustainability District of Expo 2020 Dubai, the German Pavilion offers a look into the innovative steps Germany has taken. Education and entertainment are a focus of the pavilion, with hopes to provide visitors with knowledge on sustainable practices they can use in their daily lives. "During their visit to Campus Germany, they automatically engage with the questions raised by the Expo's overarching theme. And they can leave with ideas that they can apply in their own lives to help shape a sustainable future" (Campus Germany, 2021). A unique feature of the pavilion is its campus theme carried throughout the form and circulation of the project. "Designed as a vertical campus that blends nature and technology, the pavilion takes cues from local architecture and Germany's history of outstanding lightweight pavilion design" (Baldwin, 2018).

FIGURE 13 | GERMAN PAVILION EXTERIOR (Baldwin, 2018)

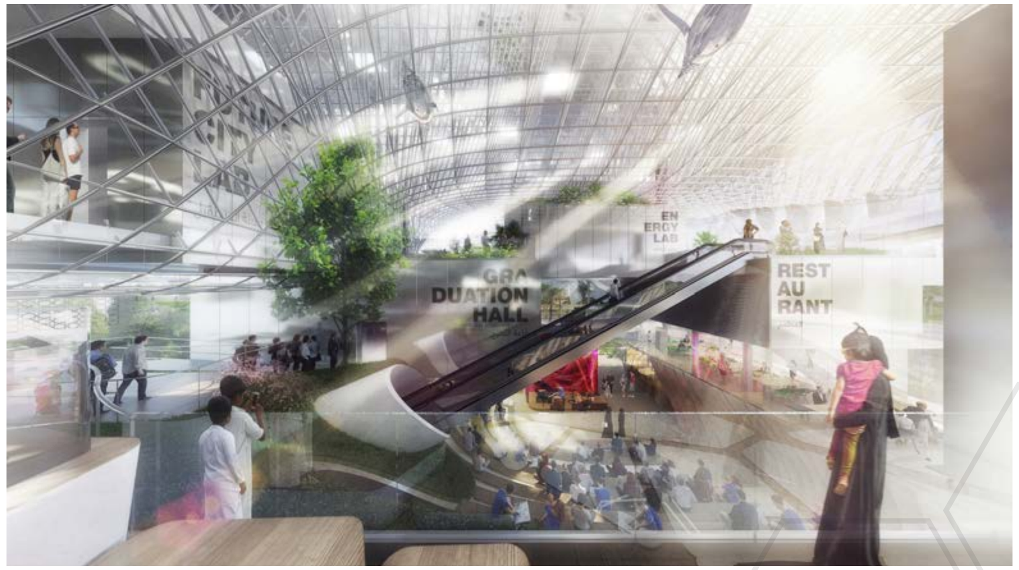


FIGURE 14 | GERMAN PAVILION INTERIOR (Baldwin, 2018)

MASSING

The massing of the building aimed to reflect a campus, altered to act vertically on the site. "The cubes stacked one on top of the other combine with enclosed voids in an interplay that results in a fascinating alternation between interior and exterior spaces and many exciting and surprising perspectives" (Campus Germany, 2021).

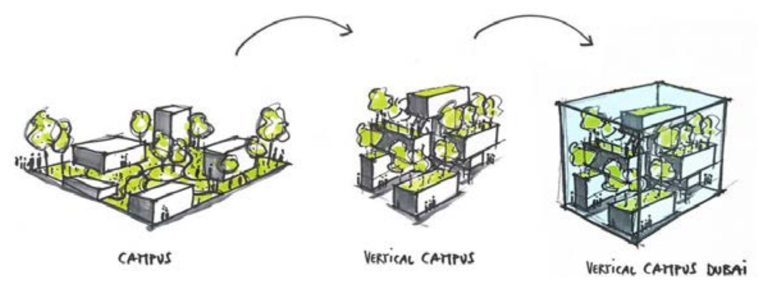


FIGURE 15 | VERTICAL CAMPUS PROCESS (Campus Germany, 2021)

HIERARCHY

The atrium is the core of the design, offering a connection to the entire project. Sitting in the void between the floating volumes above, the diverse set of perspectives offers an insight into what the pavilion stores. "The composition of exhibition spaces, event area and restaurants are interwoven through these manifold visual relationships" (Baldwin, 2018). Native German plants also add depth and comfort to the space.

FIGURE 16 | GERMAN PAVILION SECTION (Baldwin, 2018)

CIRCULATION

The progression through the pavilion also ties to the overarching idea of a campus and education. Visitors first must enroll, then follow a curriculum that guides them through a series of interactive experiences. The journey ends at the graduation hall where they finish their course on sustainability. The circulation patterns, as seen in Figure 17, show how visitors are guided through both an interior and exterior space for each exhibit. The mix of environments provides added interest and fluidity throughout the experience. Besides an escalator that runs directly through the atrium, most of the connections between exhibits are seamlessly accomplished through ramps.

FIGURE 17 | PAVILION CIRCULATION (Baldwin, 2018)

INTERACTIVE ARCHITECTURE

The pavilion features exhibits that create an immersive experience for visitors through interactive architectural and technological elements. "In the darkened Energy Lab, "energy cables" will pulsate with energy supply solutions for the future. In the Future City Lab, visitors will become part of an intricate urban landscape that completely surrounds them. In the Biodiversity Lab, they will experience the beauty and vulnerability of nature beneath a suspended installation of magnificent proportions" (Campus Germany, 2021). Additionally, a ball pit is available that connects the element of play with learning, offering thousands of balls with different questions. Visitors are able to choose a question they find interesting and insert it in the adjacent device to learn the answer. All of these exhibits offer unique physical interactions with the spaces, enhancing the overall learning experience.

FIGURE 18 | PAVILION EXHIBITS (Campus Germany, 2021)

STRUCTURE

The structure includes a transparent trapezoidal single-layer ETFE membrane that encloses the overall project. A metallic skin perforated with small holes allows sunlight into the interior spaces while remaining visually opaque on the exterior. The free-form roof is supported by vertical steel cables, resulting in the illusion of a floating structure (Baldwin, 2018)

SUSTAINABILITY / NATURAL LIGHT

As a member of the Expo's Sustainability District, LAVA's design demonstrates sustainable strategies throughout the building in response to Dubai's climate. Intentional placement of design elements offers visitors areas of shade, helping to passively cool the interior environment and contribute to overall human comfort. As visitors progress through the spaces they are gradually cooled, passing through zones that moderately increase air conditioning. Both of these strategies help reduce the active cooling load for the building (Campus Germany, 2021).

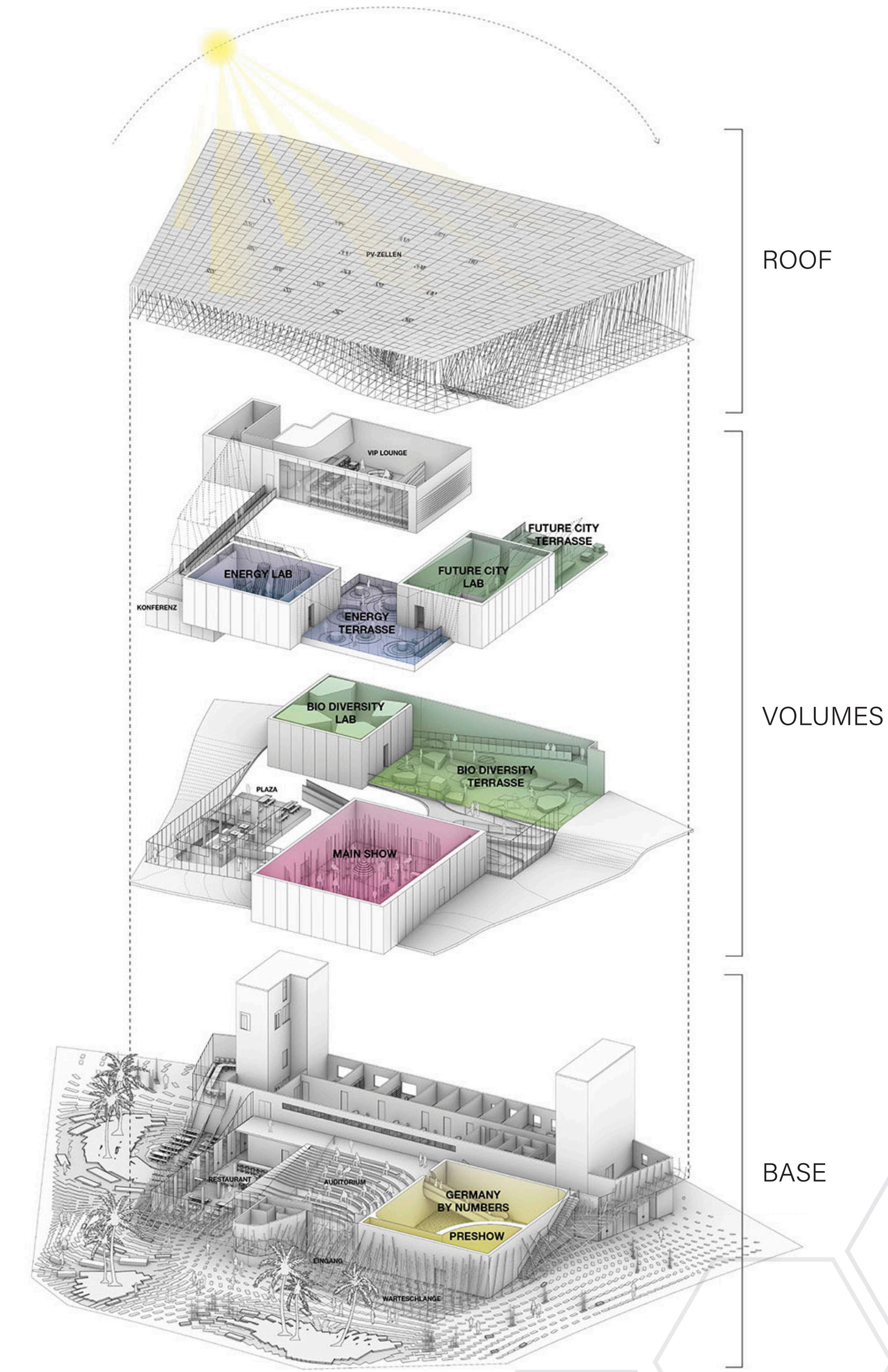


FIGURE 19 | PAVILION EXPLODED ISOMETRIC (Baldwin, 2018)

Since the pavilion is a temporary exhibition, material reuse and minimal waste was a major factor in the approach to sustainability. Building materials were designed to be reused following the life of the German Pavilion. One example is the roof structure that was designed to be broke apart to make smaller structures that can be reused on other projects (Campus Germany, 2021). Sustainable timber and recycled content were also used for interior furnishings. "When the Expo comes to an end in April 2022, around 80% of the buildings and structures on the Expo site will be repurposed in an urban development entitled "District 2020"" (Campus Germany, 2021).

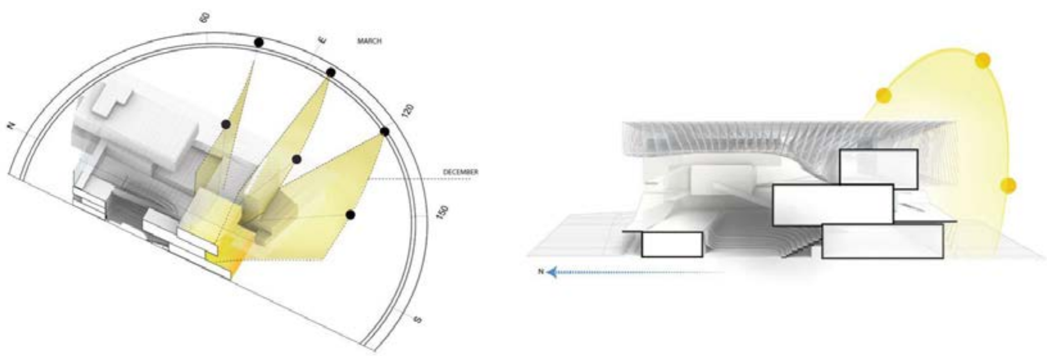


FIGURE 20 | PAVILION SUN PATHS (Baldwin, 2018)

CONTRIBUTION TO THEORETICAL PREMISE

The main take-away from the Germany Pavilion research was the user experience and how that translated into program, structure, and circulation of the project. The utilization of interior and exterior spaces created a dynamic experience that is engaging to visitors. Interactive architectural elements encouraged visitors to work together throughout the pavilion experience, increasing the understanding and importance of the topics at hand. This design approach utilizes architecture as a tool for learning, aligning with the theoretical premise of this thesis. These strategies for a positive user experience can be integrated in the design solution for this thesis.

TYPOLOGICAL RESEARCH

MUSEUM OF THE FUTURE

TYPOLOGY	Museum
LOCATION	Dubai, UAE
SIZE	17,000 square meters
BUILT	Under construction
DESIGNER	Shaun Killa
PROGRAM	Exhibitions, restaurant, cafe, auditorium

The Museum of the Future is an innovative approach to museum design, where future is explored and created. "Topics featured include the future of space travel and living, climate change and ecology, health, wellness and spirituality. Our goal is to provide light in dark times: in an age of anxiety and cynicism about the future, we are showing that things can and must progress" (Museum of the Future, n.d.). Curiosity will be a guide for visitors as they make their way through the exhibits. A unique feature of the museum is its use of parametric design and building information modeling. The intricate metal skin combined with the distinctive form of the project presents a complex design solution to be digitally represented. The use of both strategies have been an overall success in the construction project so far, requiring minimal changes and conflicts in the design (Bains, 2019).

FIGURE 21 | MUSEUM OF THE FUTURE EXTERIOR (Abushaikha, 2021)

FIGURE 22 | MUSEUM OF THE FUTURE APPROACH (Killa Design, 2021)

INTERACTIVE ARCHITECTURE

Lath Carlson, executive director of the Museum of the Future, states "This is not the museum where you will see objects in cases with labels next to them. In a lot of the main galleries, there will be no labels at all. It will be a completely immersive experience that engages the visitor as a really important contributor to the experience, rather than as a viewer of someone else's work" (Bains, 2019). This immersive experience is described as "a film set from a future" that are interactive and exploratory (Museum of the Future, n.d.). Technology integration, including the use of augmented and virtual reality, are used to enhance exhibits and amplify the future world (Bains, 2019).

FIGURE 23 | INTERIOR EXHIBITION PERSPECTIVE (Killa Design, 2021)

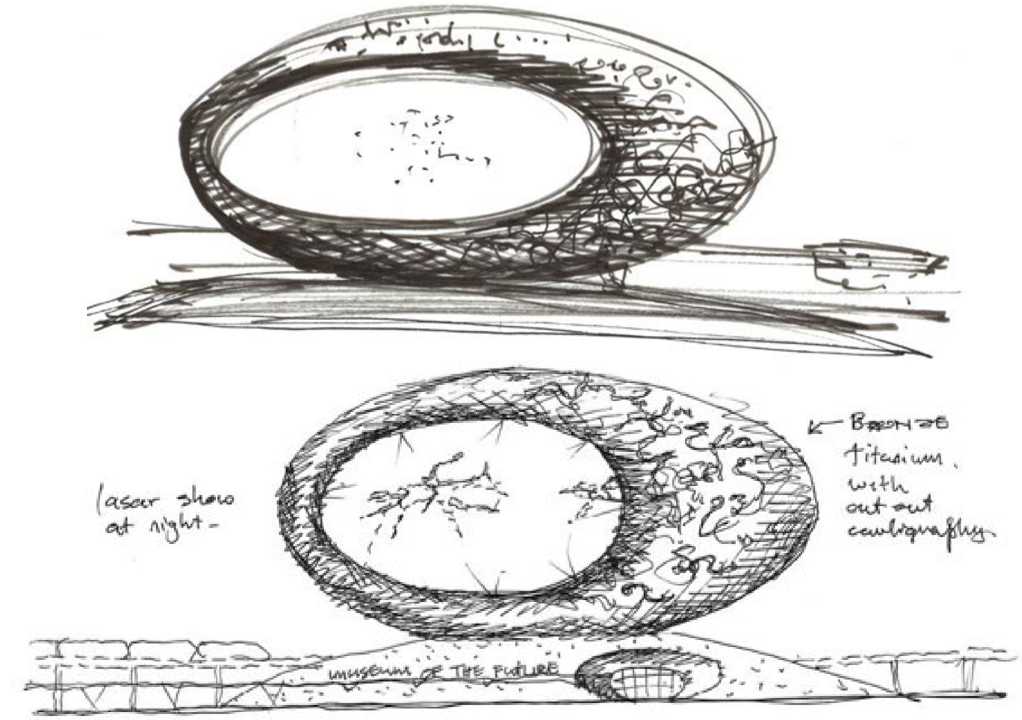


FIGURE 24 | CONCEPT SKETCHES (Killa Design, 2021)

MASSING

The form of the building is both symbolistic and revolutionary. In a city filled with legendary architecture, the Museum of the Future resembles a sculpture more than a high-rise structure, making it a major landmark for residents and visitors. The innovative torus shape of the project symbolizes humanity, with the void representing the unknown future, and the mound it rests on representing the earth (Museum of the Future). Inscribed in the curved facade are Arabic poetry from HH Sheikh Mohammed (*Museum of the Future* 2021b).

STRUCTURE

The project used a diagrid steel framework structure to accomplish the complex shape (Bains, 2019). This supports the 890 stainless steel and glass fibre reinforced polymer (GFRP) panels that make up the facade (*Museum of the Future* 2021a). Both the structure and facade panels can be seen in Figures 25 and 26.

FIGURE 25 | CONSTRUCTION PROCESS (*Museum of the Future* 2021a)

FIGURE 26 | BUILDING STRUCTURE AND FACADE (*Museum of the Future* 2021a)

SUSTAINABILITY / NATURAL LIGHT

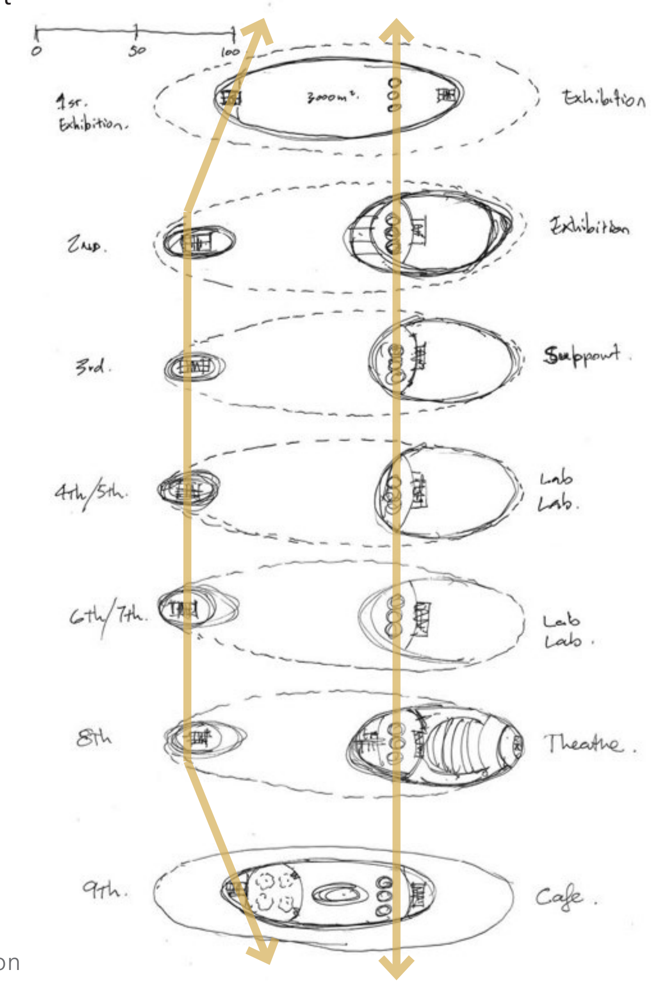
The project is aiming for a LEED Platinum certification by implementing a variety of sustainable strategies. These include:

- Passive solar gain
- Low-energy and low-water solutions
- Building integrated renewables
- Advanced building control systems
- Greywater recycling
- Regenerative drive lifts
- Electric vehicle chargers
- Reduced parking spaces to encourage public transit
- Photovoltaic solar arrays (off site)

(Bains, 2019) (*Museum of the Future* 2021b)

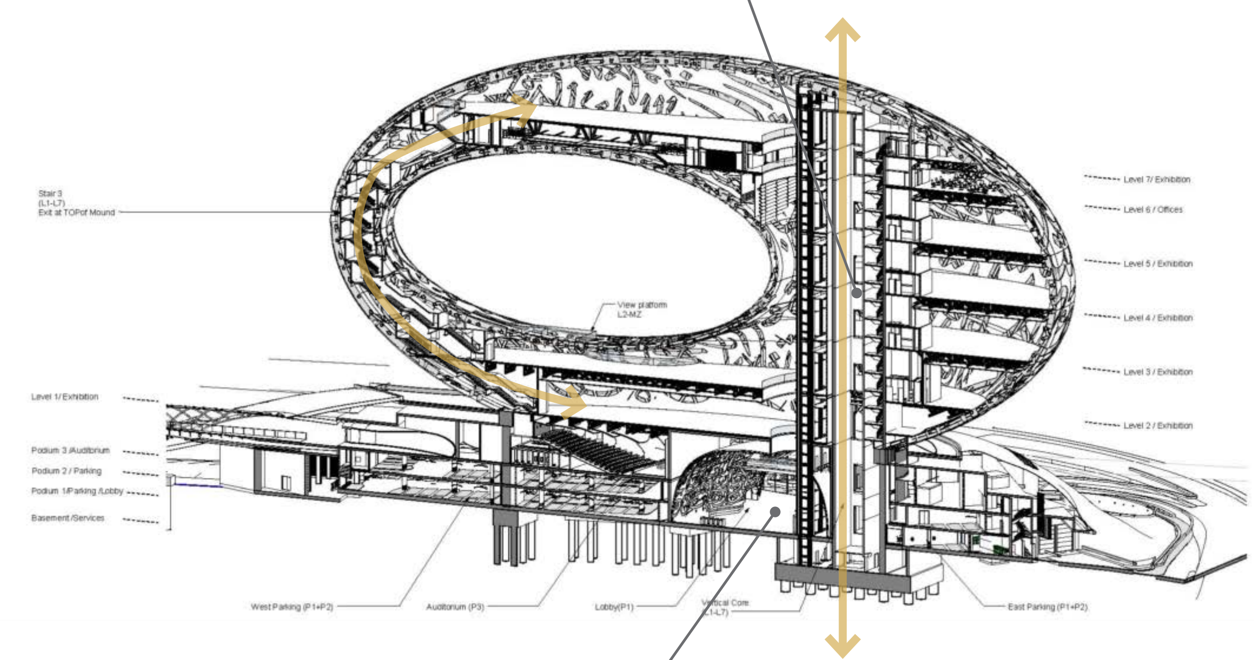
CIRCULATION

The project's main circulation goes through the thicker side of the torus, while offering a supplementary circulation path on the thinner side. The interior perspectives shown in Figure 28 and 30 demonstrate how the stairs and pathways pull visitors into spaces without revealing the entirety of the destination. The museum also provides direct circulation connections to adjacent buildings.



paths of circulation

FIGURE 27 | FLOOR PLAN SKETCHES (Killa Design, 2021)



paths of circulation

FIGURE 28 | ELEVATOR PERSPECTIVE

FIGURE 29 | MUSEUM OF THE FUTURE SECTION

FIGURE 30 | LOBBY PERSPECTIVE

(Killa Design, 2021)

(Abushaikha, 2021)

CONTRIBUTION TO THEORETICAL PREMISE

The overall form and circulation of the Museum of the Future has become a recognizable characteristic of the project. The circulation enhances the user experience by creating a sense of wonder and anticipation while taking users on a journey through the building elements. The design employed building form as a symbol of the museum's topics to foster a deeper understanding and interest into the subjects presented inside. Circulation techniques, as explored in the Museum of the Future, could be applied to this thesis design solution to enhance the learning experience utilizing form and anticipation.

FIGURE 31 | MUSEUM OF THE FUTURE FACADE (Killa Design, 2021)

TYPOLOGICAL RESEARCH

YUECHENG COURTYARD KINDERGARTEN

TYPOLOGY	School
LOCATION	Beijing, China
SIZE	10,778 square meters
BUILT	2020
DESIGNER	MAD Architects
PROGRAM	Classrooms, offices, library, gym, theater, courtyards

The Yuecheng Courtyard Kindergarten was built on an 18th-century courtyard located next to a senior citizens' apartment. The goal of blending these typologies was to achieve intergenerational integration. "The YueCheng Courtyard Kindergarten shows how several seemingly disparate, even sometimes contradictory, elements of architecture from different historical periods can coexist harmoniously while maintaining their authenticity and individuality" (Shuang, 2020). One of the unique elements of project is the roof form that drapes over the building, creating an interactive response to the project design. The kindergarten is occupied by 390 children, ranging from 1.5 years old to 6 years old (Shuang, 2020).

FIGURE 32 | COURTYARD BIRDS-EYE VIEW (Shuang, 2020)

FIGURE 33 | CONTRASTING ERAS (Shuang, 2020)

MASSING

The overall building mass weaves between the existing landscape to preserve the character of the site. The new form offers an organic roof contrasting the existing historic elements. "The new does not overshadow the old, while the past does not overtake the present" (Shuang, 2020). Integrated into the new mass are smaller courtyards that help invoke children and allow for a connection to nature.

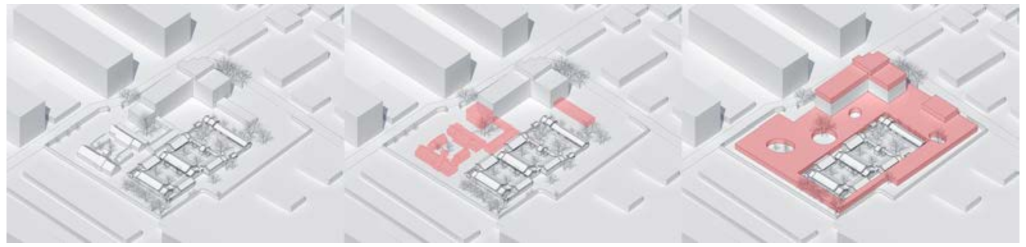


FIGURE 34 | KINDERGARTEN MASSING (Shuang, 2020)

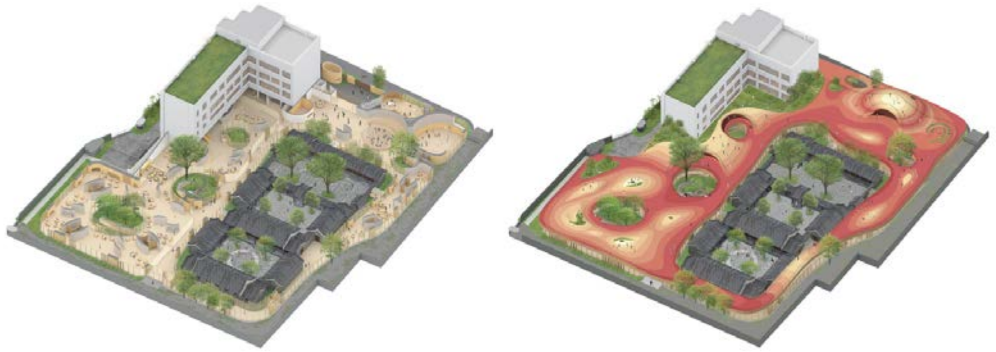


FIGURE 35 | COURTYARD OVERLAY (Shuang, 2020)

FIGURE 36 | COURTYARD PERSPECTIVE (Shuang, 2020)

INTERACTIVE ARCHITECTURE

The topographical form of the roof creates this natural playscape for children to interact. It fosters interaction through play with other students and interaction with the roof itself through varying slopes and use of color. The interpretation of the natural environment offers a place for children to think and reflect (Shuang, 2020).

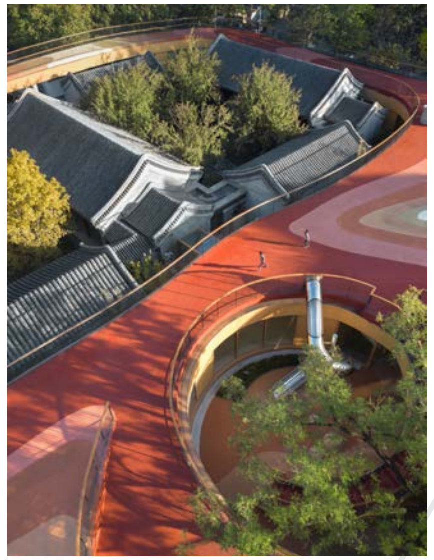


FIGURE 37 | ORGANIC ROOF (Shuang, 2020)

HIERARCHY / STRUCTURE

The entire kindergarten was designed to be open and give the students a sense of freedom. The courtyards become a dominate feature of interior spaces to enhance this idea of transparency between nature and humans. An open structural system enhances this idea by providing minimal obstructions to lines of sight. The roof of the building is supported by minimal curved walls scattered throughout the building, as seen in Figure 38.

FIGURE 38 | CLASSROOM INTERIOR (Shuang, 2020)

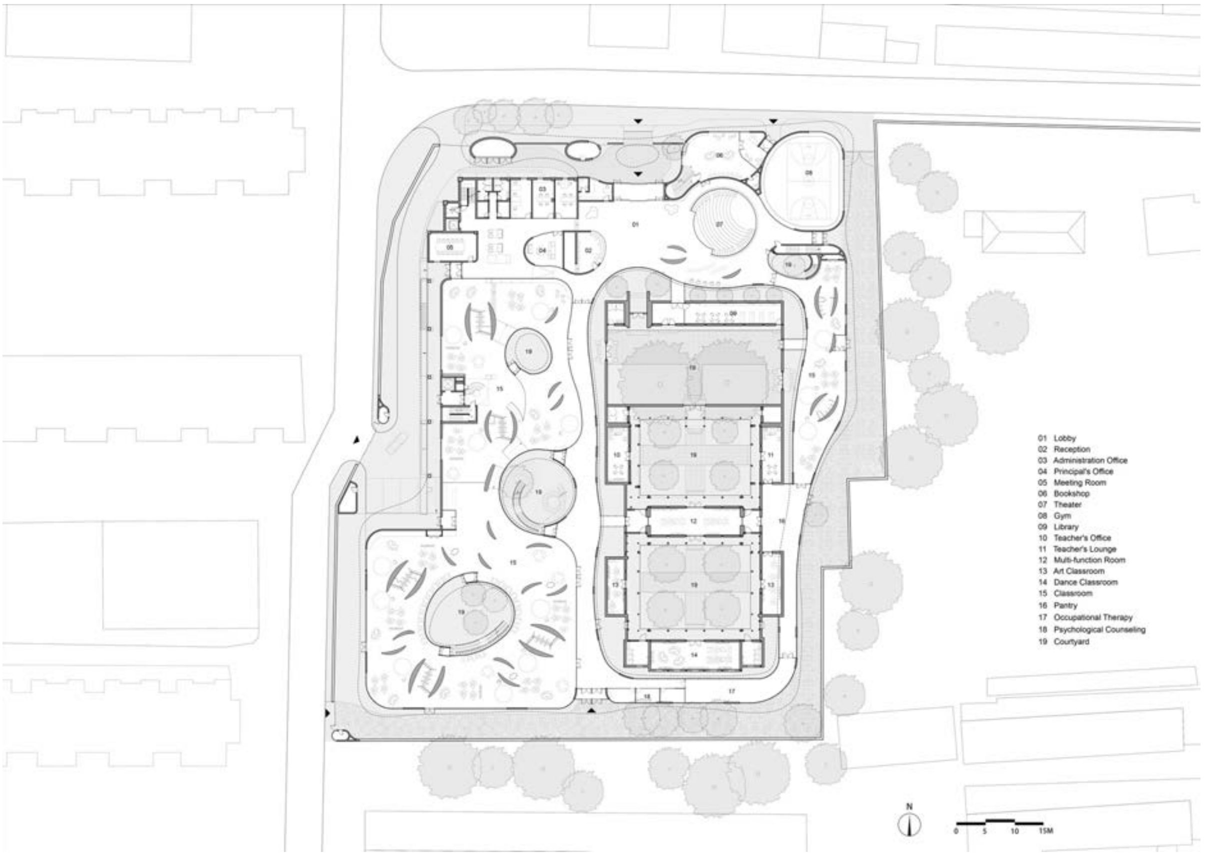


FIGURE 39 | COURTYARD KINDERGARTEN FLOOR PLAN (Ravenscroft, 2020)

CIRCULATION

The circulation through corresponds with the overall idea of openness and freedom. The classic corridor style hallways are not seen in the project, instead a more fluid approach to circulation is utilized. Vertical circulation to the roof is accomplished through the use of an exterior stair and a slide. These strategies are used to excite and appeal to the younger children.

SUSTAINABILITY / NATURAL LIGHT

Tall glass windows that surround the courtyard space allows for daylight to penetrate into the building, creating a warm and bright learning environment. Comfort is enhanced by providing lower ceiling heights that respond to the scale of children.

FIGURE 40 | COURTYARD KINDERGARTEN SECTION 1 (Ravenscroft, 2020)

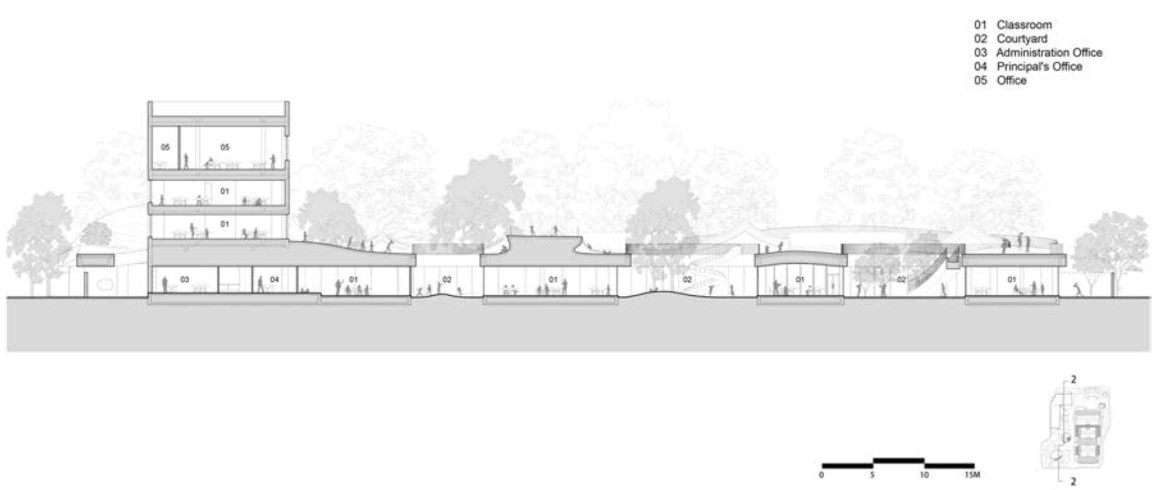


FIGURE 41 | COURTYARD KINDERGARTEN SECTION 2 (Ravenscroft, 2020)

FIGURE 42 | CLASSROOM INTERIOR (Ravenscroft, 2020)

CONTRIBUTION TO THEORETICAL PREMISE

The main contribution of the Yuecheng Courtyard Kindergarten research to this thesis would be its response to the site and solution to maximize children interaction and comfort. By protecting areas of the existing green space, the project draws attention to nature to create a seamless interaction with the children. The roof structure as a whole encourages interaction with students and appeals to the interests of children. This thesis project could utilize these strategies to respond to the site and encourage an interaction with nature, even through the built environment.

TYPOLOGICAL RESEARCH

RESEARCH SUMMARY

The precedent research offered a glimpse into the design process of three unique projects. The projects are united through four commonalities: dynamic forms, hands-on elements, the integration of futuristic ideas, and sustainable strategies. Each of the projects offer a dynamic, recognizable form that stands out from its environment. The overall form becomes the identity of the place and adds a sense of interest to visiting. The futuristic exterior forms presented in the Museum of the Future and German Pavilion visually transferred to the project's interior forms. Each project presented hands-on activities in their own way. The Yuecheng Courtyard Kindergarten used the outdoor space and roof to create an interactive experience, while the Museum of the Future uses technology to create fully immersive spaces.

A notable contrast between projects was the path users traveled through the space in response to design goals. The German Pavilion offered a direct path to follow through the exhibits, while the Yuecheng Courtyard Kindergarten encouraged freedom and exploration as children maneuvered the open space. Exploring a variety of project circulation designs provides clever insight to its importance, especially as the second thesis goal is pursued in this project.

Each project took into account the context surrounding the project but demonstrated unique approaches as they did so. The Museum of the Future's location in Dubai is significant as Dubai offers some of the most recognizable architectural works in the world. The bold form is appropriately placed in a city of iconic architecture. The Yuecheng Courtyard Kindergarten responds to the historical elements of its surroundings by strategically leaving part of the site undisturbed. An intentional contrast of design was utilized to complement each era. The German Pavilion appeals to the social context of the site and its location in the Sustainability District of the expo. The importance of designing in response to site context is evident in the overall design solutions of these projects. This thesis design solution should respond to Dallas' ambiance and the character of the surrounding buildings.

In conclusion, the precedents and proposed children's learning center all require great attention to user engagement. The combination of the German Pavilion's curriculum approach, Yuecheng Courtyard Kindergarten's adaptations to meet a child's needs, and the Museum of the Future's use of symbolism and iconic design are the start of a tangible solution to the theoretical premise. Sustainable strategies used by the projects present options that could apply to the design of the children's learning center, satisfying its goal of providing an environmentally conscious project.

LITERATURE REVIEW

THE FUTURE IS FASTER THAN YOU THINK
BY PETER H. DIAMANDIS AND STEVEN KOTLER

Humanity's touch on the Earth is causing rapid change to everyday life. *The Future is Faster Than You Think* considers current technologies and the latest research to create an educated prediction of where our world is heading. Mimicking the organization structure of the book, this literature review begins by identifying leading technologies and explanations for their rapid growth. Next, focusing on how those technologies are and will profoundly enhance education. Finally, exploring the major migrations our world is taking as a result of world threats.

LEADING TECHNOLOGIES

What may be advanced, profound technology one day, quickly becomes normal and average the next. These are known as exponential technologies; technologies which rapidly increase in power while simultaneously decline in costs. As powerful technologies become more cost effective, they increase availability in all parts of the world. Consider Artificial Intelligence, Virtual Reality, 3D printing, and more.

One of the most referenced technologies in the book is Artificial Intelligence (AI). AI has the amazing ability to learn on its own by finding connections between information and using it to produce smarter solutions. These connections can be minuscule and unrecognized by humans. AI is powerful enough to understand emotion and humor, developing realistic human characteristics. We see examples of AI today through our smartphones and Google Home devices. Popular brands, like Tesla, GM, Ford, and Amazon, are going fully automated in their factories utilizing AI robots. In education, AI has the capability to collect and interpret energy levels and emotional state of pupils to identify strengths and weaknesses of the classroom environment The result is an efficient classroom customized to meet the needs of its unique students.

Less sophisticated than AI is Virtual Reality (VR), a technology becoming increasingly accessible. VR simulations offer a unique perception of the sensory experience. Combining the realistic visual quality of the simulation with haptic gloves and bodysuits, users become fully immersed in the virtual environment. To convince the mind that the body is somewhere it is not is a powerful tool and incredible opportunity. Comparatively to traditional media, VR offers increased engagement and deeper influence on the users. In education, VR can "transport" students not only across the world but also across time. Past experiences, future possibilities, and different cultures can be intimately experienced in a way traditional media does not allow. Empathy can be trained by experiencing homelessness, climate change, and racial prejudice firsthand.

Augmented Reality (AR) is a technology that offers a similar experience but is not yet as accessible as VR. AR merges the virtual and real realities in which we live. AR is currently employed by glasses, with the lenses overlaying the virtual on the real. An upgrade to contact lens AR is expected in the future. What can AR offer education? Imagine medical students operating on virtual cadavers, construction students practicing machine operation, or flight students navigating a virtual airplane through a virtual storm. AR offers the added level of detail to an experience that otherwise would not be possible.

In addition to these iconic technologies, the authors' list of technologies goes on from 3D printers to robots, blockchain, holograms, and even avatars. 3D printers are creating complex engines, wind turbines, solar cells, prosthetics, and soon organs. The faster fabrication times, weight reduction, and on-demand nature of 3D printing make it an efficient solution compared to traditional methods. For example, on the 2018 ISS mission to space, the astronauts were able to 3D print a splint for a broken finger, avoiding the challenge of trying to get one from Earth. Up to 800 square foot homes can be 3D printed in 48 hours for a significantly cheaper rate. Holograms are also in the works as another option for immersive experiences, working with light, ultrasound, and haptic gloves. These have the potential to become three-dimensional interactive elements for education and fantastic tools to promote innovative thinking.

The authors recognize seven factors that contribute to the existence of exponential technologies: saved time, availability of capital, demonetization, more genius, communication abundance, new business models, and longer lives. To summarize, the more technology advances, the more efficient the development of technologies becomes. As computers get faster, users spend less time waiting and more time creating. Similarly, as technology advances, communication around the world became easier, contributing to shared knowledge and new ideas. This cycle of acceleration continues as new technical models are developed and ideas are shared.

EFFECTS OF TECHNOLOGY ON EDUCATION

Diamandis and Kotler identify two problems facing education: quantity and quality. Quantity refers to the lack of teachers in comparison to students. In the United States alone, 1.6 million additional teachers are needed. Globally, 69 million. That leaves 263 million children without access to basic education. Furthermore, the quality of education needs revitalization. Created for the past, the school systems create standardized products focusing on a narrow set of skills that are not applicable to all futures. Back in 2012, Nicholas Negroponte gave tables and solar charging stations to remote Ethiopian villages. With no instructions or knowledge on how to read or write, the children learned to navigate through the tablet's apps. Within weeks the children knew their ABC's and within months they hacked the tablet's system. This experiment proves children are capable of self-study and current technologies already provide effective learning aids. Classroom structures and collaborative spaces can impressively improve education quality.

Additionally, emerging technologies in the entertainment market could impact the presentation of educational material. The authors deem passive entertainment as an idea of the past. Active entertainment, where information flows both ways, will become a popular strategy. This means users will take part in their experiences, becoming more collaborative, immersive, and personalized. One example is participatory movie-going, the idea that viewers become part of the movie to fully engage with the content. In this form of entertainment, the integration of senses is an important factor. The more senses engaged, the more attention given to the activity.

WORLD MIGRATIONS

As a response to developing technologies and the threat of climate change, the book identifies five major migrations humanity will take in the future. These include climate migrations, urban relocations, virtual worlds, space migration, and meta-intelligence. The world is accelerating at a remarkable speed and these migrations will be initiated sooner than many realize.

CONCLUSION

The Future is Faster Than You Think painted an eye-opening image of the future. Floating cities, vertical farming, and flying cars are a few of the ideas to be anticipated. Awareness of social issues like climate change will be important as their effects become more drastic. How do we prepare children for this world? From the text, one of the principal components of child preparation for the future is comfortability with and the ability to use technology. Artificial Intelligence, Virtual Reality, Augmented Reality, and 3D printing provide enriched educational opportunities. Integration of these at an earlier age can establish a base knowledge to allow for creative and constructive use of the products throughout their lives. Active environments will stimulate more of a children's senses, resulting in a deeper engagement with the topics being discussed. Each of these elements will contribute to the educational environment focused on preparation for successful futures. These advancements will be considered in the design solution for the children's learning center to create interactive and progressive learning spaces.

LITERATURE REVIEW

LINKING ARCHITECTURE AND EDUCATION

BY ANNE TAYLOR

Published in 2009, a look beyond the industrial factory model learning, a once new way of thinking explores how educational facilities can better society and invest in education. Anne Taylor's book, *Linking Architecture and Education*, describes the relationship between architectural design and the success of learning environments. Topics covered in this review include designing for the whole learner, the philosophical approaches to learning environments, and the application of Olmsted's principles to a learningscape.

DESIGNING FOR THE WHOLE LEARNER

Designing for the whole learner, one of the most referenced ideas in the book, focuses on three main aspects: mind, body, and spirit. Student success goes beyond only supporting their cognitive learning. The physical and emotional needs of children must be supported by their learning environments to maximize student success. The author provides a variety of student needs and how they can be satisfied by architectural design.

The mind requires a learning environment that is spacious but with minimal distractions. A crowded or cluttered space creates distractions or causes stress for the child. Children who feel lost and uncomfortable are less likely to benefit from a lesson being taught. The entirety of the school should be built with the children in mind; including connections between spaces children can interpret and constructively utilize, invoking a sense of independence and appreciation.

The needs of the body in a learning environment largely relates to the safety and wellness of the space. Meeting, and ideally exceeding, building codes to create a healthy and safe space ultimately leads to healthier occupants. The book shows the children are especially vulnerable to environmental hazards that could affect their growth and academic performance. Sick Building Syndrome is a concern among educational facilities, as many suffer from unfit air quality and indoor pollution. In response, an air change of 15 to 20 cubic feet of air per minute is recommended for a healthy learning environment.

Noise is another external factor that affects the quality of a learning space. The opportunity to be in silence is crucial as loud noises can contribute to poor academic progress and increased stress among students. Shifting away from wellness, the needs of the body also include components like multi-sensory opportunities, child-oriented and scaled spaces, and spatial arrangements that are physically easy to maneuver for children.

Spiritual needs for children include many of the ambient qualities of a space, including the colors, light, and aesthetics. Statistics from the book show that students with exterior views have an increase in performance by 10 to 25% on tests. In addition to views, windows allow for natural light to seep into the learning environment, further improving test performance. The daylighting also improves concentration and helps to regulate moods. A temperature of 68 to 74 degrees Fahrenheit with 40 to 70% humidity is recommended to maximize comfort levels in a space. Negative effects on the overall psychological

comfort and delight in a space can stem from the absence of culture, privacy, or intimacy in a large space.

Stemming off Vituvius' concept of architecture as firmness, commodity, and delight, the author defines three levels that interpret the habitability of a space. These include psychological comfort and aesthetic satisfaction, functional performance, and health and safety. The three tiers presented directly correlate to the mind, body, and spirit of the occupants. Figure 43 shows the alignment of each of these ideas, in addition to Maslow's Hierarchy of Needs.

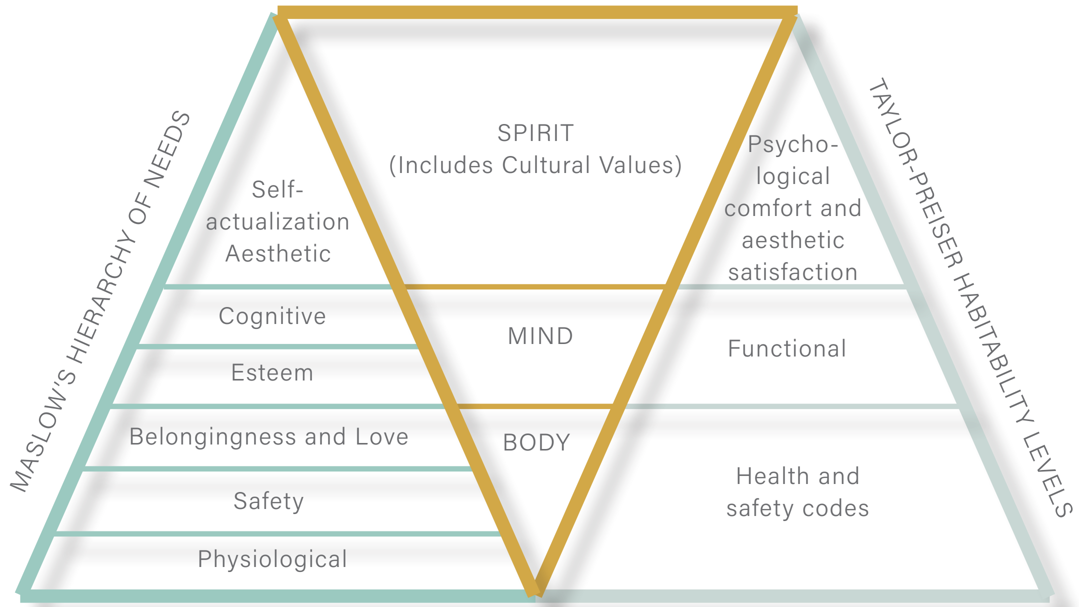


FIGURE 43 | THE HABITABILITY FRAMEWORK (Taylor, 2009, p.133)

PHILOSOPHICAL APPROACHES

The author outlines a series of five philosophical approaches and their application in a learning environment. Each approach offers a unique image of the learning environment and can be used as a starting point for design integration. The environment based on idealism revolves around the traditional intellectual environment. This approach utilizes the environment as a three-dimensional textbook, an additional teacher in the space, through shapes and proportions. In comparison to the environment of realism, a focus on the logical environment can be achieved through multi-sensory spaces and opportunities to reason with the surroundings. Experimentalism in a space drives the idea of active, hands-on learning. Interaction and manipulation of the surroundings encourage occupant participation. Where existentialism offers a world of choice, allowing children to become the decision-makers of their experiences. Finally, the ecologically responsive philosophy provides a sense of belonging in children, furthering the connection with the natural environment.

THE LEARNINGSCAPE

In a *Designer Perspective* section of the book, written by Elliot Washor, Frederick Olmsted's landscape design principles are applied to an interior learning space mimicking the outdoor environment. The result is a learningscape, a place where learning flows comfortably to and from the building. Olmsted's design principles are broken down into three major elements: prospect, refuge, and mystery. Prospect is an uninterrupted view of the project where visitors can absorb their surroundings. To break away from the vastness, refuge can be found in a smaller, secluded space for children to learn. Mystery lingers as visitors move through a space in anticipation of more information to be discovered. In addition, Washor covers the importance of the environment's legibility to children. The design should balance exploration and openness to keep the sense of mystery without initiating fear of getting lost.

CONCLUSION

Linking Architecture and Education provided a versatile look into the design of educational facilities. Although many of the strategies were targeted towards schools, a children's learning center has the freedom to implement these ideas extensively without the limitation of curriculum and exam standards imposed on schools. By narrowing the topics covered in exhibits, in comparison to schools, more elaborate learner integrated experiences can be accomplished. Utilization of the philosophical approaches provides a starting image for how this can be executed through the design solution. This strategy focuses on the perception of space rather than the current high-performance technologies available. This is important as it creates a timeless standard for design, one that continues to be relevant even to the extent of new inventions, like virtual worlds. In a similar way, the overall physical and psychological needs of children have remained consistent over the years. Humanity is essentially rooted in these needs that allow us to develop and evolve. The application of a whole learner approach can ensure a well-rounded set of children's needs are fulfilled in the space.

RESEARCH RESULTS INTO ARCHITECTURAL PROGRAM

This section synthesizes the research as related to the development of the architectural program of the project. Three major social and economical advances were drawn from the research: climate change, space travel, and the reshaping of urban life. Connection to technology and philosophical approaches to learning were explored to provide context for the exhibit spaces in the architectural program.

CLIMATE CHANGE

Climate change, rising sea levels, pollution, and diminishing ecosystems are evidence our natural world is changing, and not for the better. Understanding the threats our world faces and its causes will encourage children to consider the power of their actions. They will grow into a society that recognizes the real problems we face and the real need for solutions.

Since the 19th century, the increased use of fossil fuels has contributed to Earth's increasing temperature of 2.12 degrees Fahrenheit. The warmest being the seven most recent years (NASA, n.d.-a). Today, humans are pushing 40 billion tons of carbon dioxide a year into the atmosphere (Diamandis & Kotler, 2020). As a result, the rising temperatures have caused the melting of glaciers. Between 1993 and 2019, Antarctica and Greenland combined have lost on average 427 billion tons of ice per year, adding more water to the ocean (NASA, n.d.-a). In addition, the Earth's warming has warmed the ocean more than .6 degrees Fahrenheit in the last 50 years, causing the ocean water to expand (NASA, n.d.-a). The combination of added water volume and water expansion has caused a global sea rise of 8 inches since 1880. An additional 1 to 8 feet rise is expected by the year 2100 (NASA, n.d.-b). If we continue as we are today, the sea level rise could submerge a significant amount of land where people live and work, displacing 470 to 760 million people (Diamandis & Kotler, 2020).

Sea level rise is not the only concern with the ocean environment. The ocean has absorbed 20-30% of the carbon dioxide emissions resulting in a 30% increase in water acidity

(NASA, n.d.-a). Coral reefs are taking a massive hit from these actions. "These reefs are home to 25 percent of the world's biodiversity, which both supports the livelihood of over 500 million people and produces 70 percent of the oxygen in the

FIGURE 44 | CAUSE AND EFFECT DIAGRAM

atmosphere. Yet, by 2050, if nothing changes, 90 percent of those reefs will be gone" (Diamandis & Kotler, 2020, p.223-224). Additionally, 900 million people today do not have access to clean drinking water, expecting to grow to half the globe by 2025 (Diamandis & Kotler, 2020). Beyond the ocean, the abuse caused by climate change, deforestation, and pollution will cause a decline of large mammals by 50%, if we continue as we do today (Diamandis & Kotler, 2020).

Solutions we have today, including water purifier technologies, solar and wind energy generation, drone reforestation, closed-loop economies, and electric vehicles, offer a glimpse of hope. Developmental technology has been the driving force in these advancements. Children's understanding of these threats will cultivate environmental consciousness and self-awareness of their actions (Taylor, 2009). An ecologically responsive philosophy to learning offers an understanding of these interdependencies of the world, viewing elements as contributions to a larger image rather than in isolation

(Taylor, 2009). An application of this philosophy to a learning environment would create a strong link to the outdoors and design for life skills, such as agriculture. In addition, transparency of sustainable strategies in a building can be used as a learning device for children (Taylor, 2009). It can inspire creative problem solving.

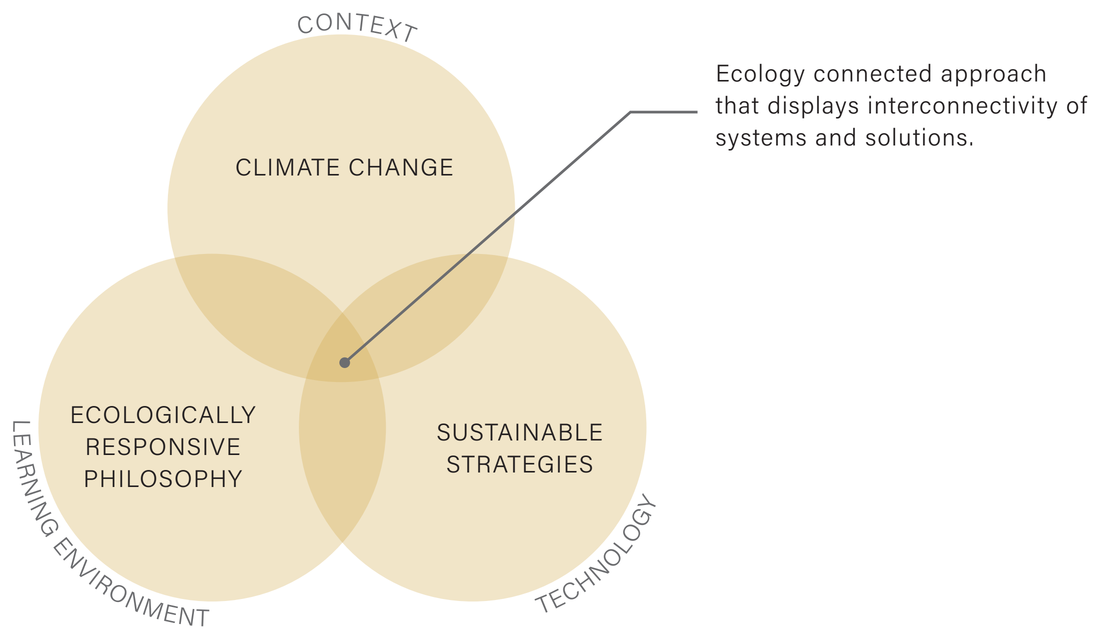


FIGURE 45 | CLIMATE CHANGE SYNERGIES

SPACE TRAVEL

Mars exploration is underway with NASA's advancing rovers and orbiters. In addition, the SpaceX program, founded by Elon Musk, has been developing technologies with the goal of sending humans to Mars. Iterations of spaceships developed by SpaceX have become increasingly cheaper (Diamandis & Kotler, 2020). As development continues, as seen with other technologies, space travel is expected a more financially realistic idea. SpaceX anticipates having humans on Mars' surface by 2030, followed by an entire city by the year 2050 (Diamandis & Kotler, 2020). With these advancements, it is likely that today's children will see space travel as a reality for more than the wealthy and elite. Presenting these ideas to children early can spark interest and creativity in the emerging field.

The Martian (Scott, 2015) paints a potential picture of human life on Mars. In the film, a garden is created in an isolated bubble; fertilized with bio-waste and watered using rocket fuel

FIGURE 46 | LIFE ON MARS (NBC News, 2019)

and condensation, the garden is able to grow and produce food in the Martian soil. A rover provides transportation around the Red Planet (Scott, 2015). In a post on The Future Timeline website, predictions of life on Mars look similar to those presented in the film. Permanent living on Mars is predicted by the year 2059, including food production and recycling facilities and radiation-absorbing materials (2019, n.d.).

In *The Martian*, Mark Watney utilizes problem solving and creativity as he navigates through the Mars environment with limited resources. A study conducted by The Millennium Project showed that skills needed for the future include critical thinking, reasoning, compassion, data, and enquiry-based learning (Glenn & Florescu, 2016). The Millennium Project study also revealed that technology-based learning will be integrated at an earlier age in the future (Glenn & Florescu, 2016). This is important as we head into a technological society where computational thinking and computer science will be necessary (Yadav et al., 2016). VR and AR can be integrated into learning to create a fully immersive experience (Diamandis & Kotler, 2020). Virtual Reality also offers accessibility benefits to accommodate physical needs, according to a study posted in Virtual Creativity (See et al., 2020).

Space travel offers a whole new realm of sensory experiences, from anti-gravity effects to climate differences. A learning environment based on the philosophical approach of realism focuses on the multi-sensory environment. Sensory engagement can be stimulated through soft and hard play areas or various displays (Taylor, 2009)

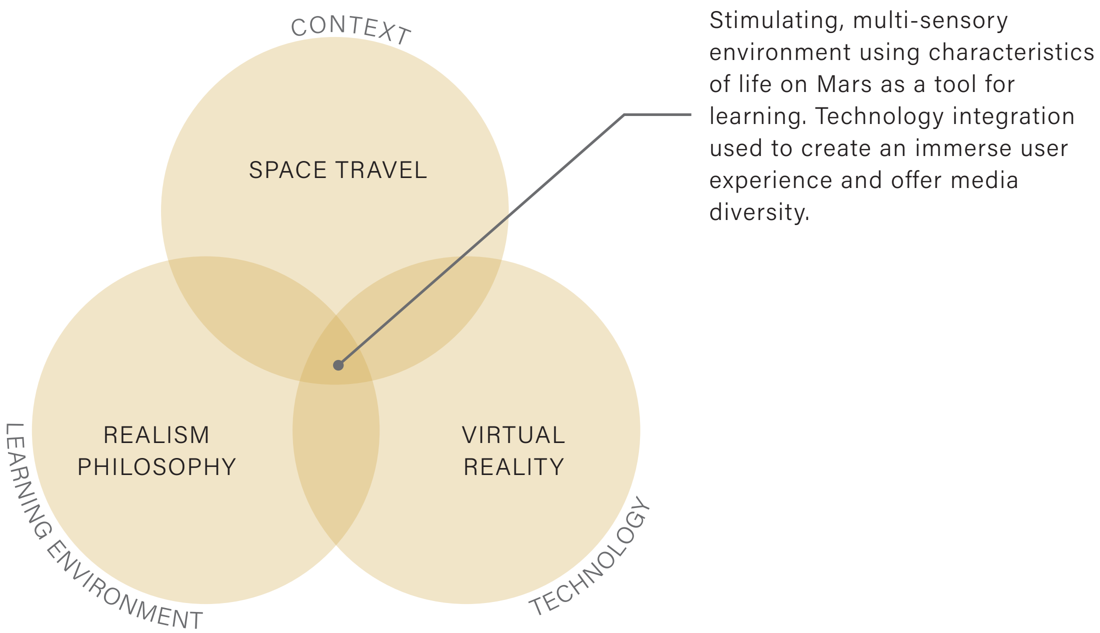


FIGURE 47 | SPACE TRAVEL SYNERGIES

RESHAPING OF URBAN LIFE

As outlined in the climate change section, rising sea levels are predicted to flood land that today, many people call home. In addition, the human population is growing as people live longer. The idea of "longevity escape velocity" is that someday science will be rapidly advancing in its ability to extend lives. So much so, that we will ultimately be one step ahead of death. Ray Kurzweil and Aubrey de Grey anticipate this occurring in the next 12 to 30 years (Diamandis & Kotler, 2020, p.173). As the human life span is lengthened, the world must provide for the increasing number of humans that occupy it. A floating city responds to many of these challenges and remains a viable solution for the future (Diamandis & Kotler, 2020).

In fact, one iteration of the self-sustaining floating city has already been developed, called the Oceanix City. The city utilizes closed-loop processing systems to create zero waste and net-zero energy (*Leading the next*, n.d.). Approaches to farming include options for indoor, outdoor, vertical, and even underwater farms. The city is supported by Biorock, a new, innovative technology, that offers a strong structure and prevents rusting or corrosion (*Leading the next*, n.d.). Biorock also has the capability to regenerate marine life and

FIGURE 48 | FLOATING CITY (*2100*, n.d.)

filter polluted seawater in order to create a cleaner ocean environment (*Leading the next*, n.d.). Furthermore, a prediction on the Future Timeline website suggests that future floating cities will have facilities including virtual reality, android servants, and landing pads for flying vehicles (*2100*, n.d.).

The film *Waterworld* (Reynolds, 1995) takes a more industrial approach to the idea of living on the water but outlines many of the same concepts. In *Waterworld*, the ocean's icecaps have melted, submerging most of the world's cities. Land is a rare commodity that many living out at sea have never seen (Reynolds, 1995). Communities were formed by linking together rafts and boats, creating one floating structure. Food came from fishing, or on rare occasions, from a potted plant that has survived from the land. Water was purified to create drinking water. The film referenced early designs of flying vehicles as transportation above the water's surface (Reynolds, 1995).

In addition to shifts in urban placement, a social shift in employment is expected. The Millennium Project's study predicts that the objective of work in the future will be self-actualization and that of the economy will be the well-being of humans. Also, they predict that activities and job duties will be transferred to a virtual world (Glenn & Florescu, 2016).

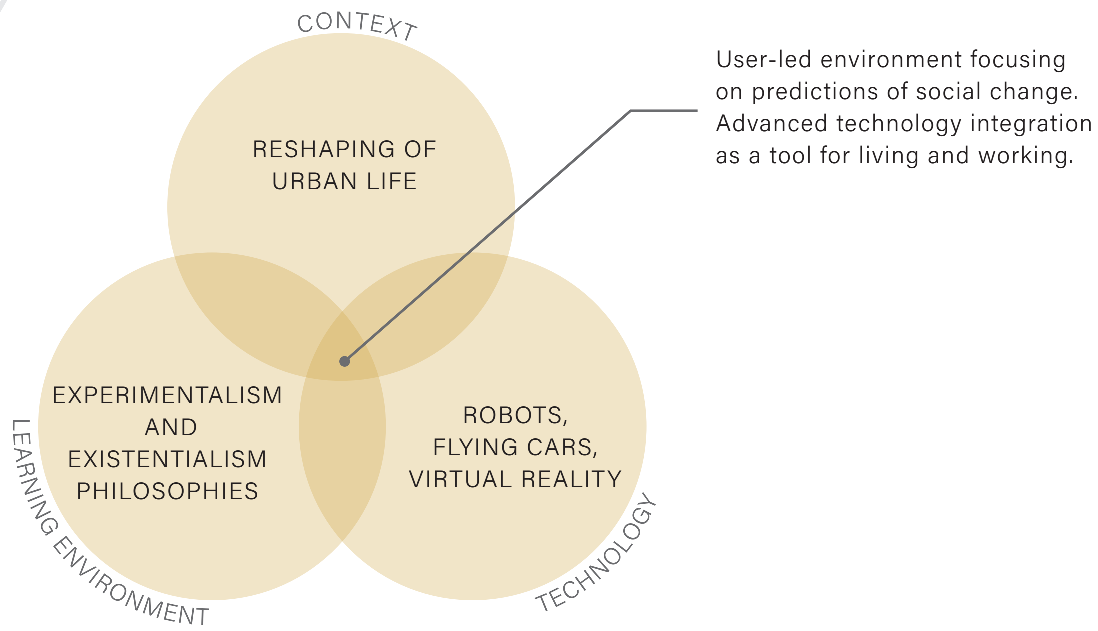


FIGURE 49 | RESHAPING OF URBAN LIFE SYNERGIES

Self-actualization is defined as "the realization or fulfillment of one's talents and potentialities, especially considered as a drive or need present in everyone." Flexibility for user choice and decision-making in a space will aid in the ability for children to make realizations. Experimentalism and existentialism approaches to learning environments encourage user-led, interactive environments. Open-ended questions allow children to be creative through problem-solving. As urban life reshapes, new situations will emerge and reveal similar questions, ones that today's children may be tasked with answering.

CONCLUSION

Overall, the research emphasized that the future is changing in how we live and learn. Similar characteristics can be found between the learning environment philosophies and scenarios predicted for the future, revealing the importance of each. Interpretation of the research will be applied to the exhibits of the architectural program to create relevant experiences and effective spaces for children. The characteristics of the utopian and dystopian experiences presented in films and predictive readings can be translated to the exhibits to provide logical and evidence-based scenarios.

HISTORICAL CONTEXT

EDUCATION

- Education, at its roots, developed from our time as hunter-gatherers. Before schools were created, children relied on their own play and exploration to be successful, educated adults (Gray, 2008). With the free lifestyle, hunter-gatherers “did not distinguish between work and play--essentially all of life was understood as play” (Gray, 2008).

- The shift to the world of agriculture turned explorers into laborers. The attention farms needed was high and included long hours with tedious tasks. A need to learn became less important, being replaced with the ability to work long, hard hours (Gray, 2008). Children were capable of this work and often required to do it as it meant providing for the family (Gray, 2008).

- Processes evolved and the need for child labor lessened. Germany led the march for required education. In the beginning, schools were often run by religions and focused on discipline, repetition, and testing (Gray, 2008). Play and exploratory learning were suppressed, as adult-run obedient classrooms were encouraged.

- The evolution of schools made progress in the curriculum and eased away from harsh tactics. However, the general idea of a teacher-led educational approach has remained in the conventional education we see today (Gray, 2008).

- Theorists have proposed new theories for education throughout the years. Jean Piaget established the developmental psychology theory where children learn through identifiable developmental stages (Taylor, 2009). Experimentation, research, and discovery are emphasized throughout Piaget’s theory. Additionally, Lev Vygotsky focused on the social psychology of education. The theory hones in on social and cultural environments contributing to a process of internalization (Taylor, 2009).

- Maria Montessori established a new method of learning focused on the prepared environment. The Montessori Method offers more freedom to children in the educational process, compared to traditional schooling. Students have access to intellectually and developmentally stimulating activities to choose from (Taylor, 2009). This method continues to be practiced today but has not replaced conventional education.

- Educational reforms, like the development of national standards, have created a uniform set of goals for children's education in the United States. Common Core standards cover mathematics and English language arts. When first established in 2010, the goal was to prepare high school graduates to enter into college or their careers (Mathis, 2010). Now, in 2021, critiques write that the overall benefit of the Common Core standards were minimal (Strauss, 2021). The Next Generation Science Standards (NGSS) offers standards in the science curriculum for schools. This system aims to help students gain a deeper understanding of science, beyond just memorization of topics (Pruitt, 2014). Topics related to climate change are referenced in the standards.

- In 2020, due to the COVID-19 pandemic, schools were operating almost entirely online. Students managed to use technologies, like laptops and tablets, to communicate and learn from their teachers. Detached from the physical school learning environment, children were challenged to learn independently through their home environment.

FIGURE 50 | EDUCATION THEN AND NOW (Green, 2016) (Jackson, 2013)

TECHNOLOGY

- In the 1870s, the world mostly occupied rural areas, using wood and candles to produce heat and light for their homes. People were faced with a constant struggle to produce and preserve the food they needed for their families. Pork was a popular meal staple as pigs were reliable and could be preserved without refrigeration (Irwin, 2016). Horseback was a preferred way of travel and forms of communication were limited (Irwin, 2016).

- By the 1920s, everyday life shifted with new innovations. Plumbing systems contributed to more hygienic cities and an increase in public health. Electricity was discovered and light bulbs were widely used in homes. Transportation was more efficient with the implementation of automobiles, streetcars, and subways. And the invention of the telephone made communication more accessible (Irwin, 2016).

- The connectivity increased through the 1970s as jets offered a fast form of transportation and the Interstate highway system was constructed (Irwin, 2016). As well, computers add a new realm of connectivity. The idea of computers was evolving and by 1973 plans for the TV Typewriter were released (Computer History Museum, n.d.). A beginning iteration of the internet, called ARPANET, was publicly displayed in 1972. The same year, the first iteration of electronic mail, also known as e-mail, was introduced (Mowery & Simcoe, 2002). Household technologies including refrigerators, air-conditioning, and electric lighting became more accessible (Irwin, 2016).

- The early 2000s brought the invention of the iPod, nanotechnology wearable fabrics, Toyota's hybrid car, and YouTube (Western Kentucky University, n.d.). By the end of the decade, the iPhone was invented, Google had developed a driverless car, and a 3D Bioprinter

- was created to print human organs (Western Kentucky University, n.d.).

- Today, we have access to an entire world of information at our fingertips. Humans are constantly connected through smartphones and watches, around the world streaming capabilities, and easily-accessible travel on airplanes. AI, as presented in the research, is consistently developing and we are seeing changes in technologies around the world, like the development of Tesla's self-driving vehicles.

FIGURE 51 | APPLE PRODUCTS THEN AND NOW (Brant & Buzzi, 2020) (Gibbs, 2016)

SOCIAL CONTEXT

The image of the future is perceived differently by varying groups of people. Age, race, and economic status are a few of the factors that affect the perception of the future. Higher levels of creativity and hope for the future are evident in younger children, ages 4 and 5. However, they showed a basic awareness of issues causing a negative impact on the environment, such as littering (Hicks & Holden, 2007). As age increases, creativity and hope frequently shifts to a "framework of conventional, dystopian science fiction imagery" (Hicks & Holden, 2007). 7 to 11-year-olds show an increase in concern for the impact of social and environmental issues on both a local and global level (Hicks & Holden, 2007). A study conducted on 11-year-olds reveal their desire for local improvements, indicating their wants for more amenities, affordable housing, and better relationships while fostering peace through reduced violence and racism (Hicks & Holden, 2007). More positive expectations for the future correlated to children with higher self-esteem, problem-solving efficacy, supportive social interactions, and comfortability in the school environment (Dubow et al., 2001).

Hicks and Holden's article labeled collaborative learning as a successful tool in allowing students to process concerns about the future (2007). Children who struggle with anxiety, depression, or behavioral problems had comparatively more negative cognitions toward the future (Dubow et al., 2001). "Adolescents from low-income and from African American families simultaneously held the abstract expectancy that education is a valued accomplishment and the personal expectation that academic achievement was unlikely to yield them economic advancement" (Dubow et al., 2001). As children are exposed to new futuristic ideas, their current concerns and pessimist views towards the subject need to be navigated to foster an optimistic environment. Currently, the division of expectations is stemmed from the social and emotional conditions facing groups of children.

SITE ANALYSIS

NARRATIVE

The Lancaster Avenue site sits just southwest of Downtown Dallas, across the Trinity River. A view of the site is framed perfectly as you cross the bridge, driving away from downtown. However, right now that view looks more like a concrete playground than a continuation of the modern, green setting offered by Dallas' city center. First impressions of the site were that it seemed cold, due to lack of vegetation, color, and human interaction. Interestingly enough, it also seemed intriguing to explore. Left behind by the Oak Farms Dairy plant that used to occupy the site were staggered concrete slabs, stairs, and retaining walls. Some of which have now have been decorated with graffiti. The evidence of human impact on the site was obvious. The 580,000 square foot site is almost completely covered in concrete, leaving very few areas for natural green space and vegetation. Lucky, to the west/southwest of the site is the Oak Cliff Founders Park and Lake Cliff Park. These offer open green space and a small lake to the well-developed area of the city.

As mentioned, another body of water adjacent to the site is the Trinity River. The small river is predominantly unaesthetic as its bordered with sand and dirt, showing evidence that the land is prone to flooding. However, Downtown Dallas and the river are located in the same line of sight from the Lancaster Avenue project site. This view offers a unique contrast of the built and the natural world, one that could be framed to be both beautiful and educational.

The location of the project site offers opportunities to mirror the development downtown and merge the gap between the city center and the residential neighborhoods surrounding the site. The children's learning center would offer a new amenity to children in the area and revitalize the abandoned site. The site is currently zoned as a Planned Development District, which offers development flexibility. The proposed children's learning center would fit within the limitations of this zone.

SITE HISTORY

The land was owned by Oak Farms Dairy until 2014 when it was sold to Cienda Partners. The site has been relatively unchanged since the removal of the buildings in 2014.

2011

2021

FIGURE 52 | PAST AND PRESENT SITE

2001

The Oak Farms Dairy plants occupies a majority of the site. To the east of the site is the Oak Cliff Founders Park.

2015

The Interstate system to the west has expanded and the adjacent lot is being utilized as equipment storage.

2021

Construction has finished on the Interstate and the lot to the west has been restored. The Oak Farms Dairy plant has been torn down and removed from the site

FIGURE 53 | HISTORIC AERIAL PHOTOS

SITE CHARACTERISTICS

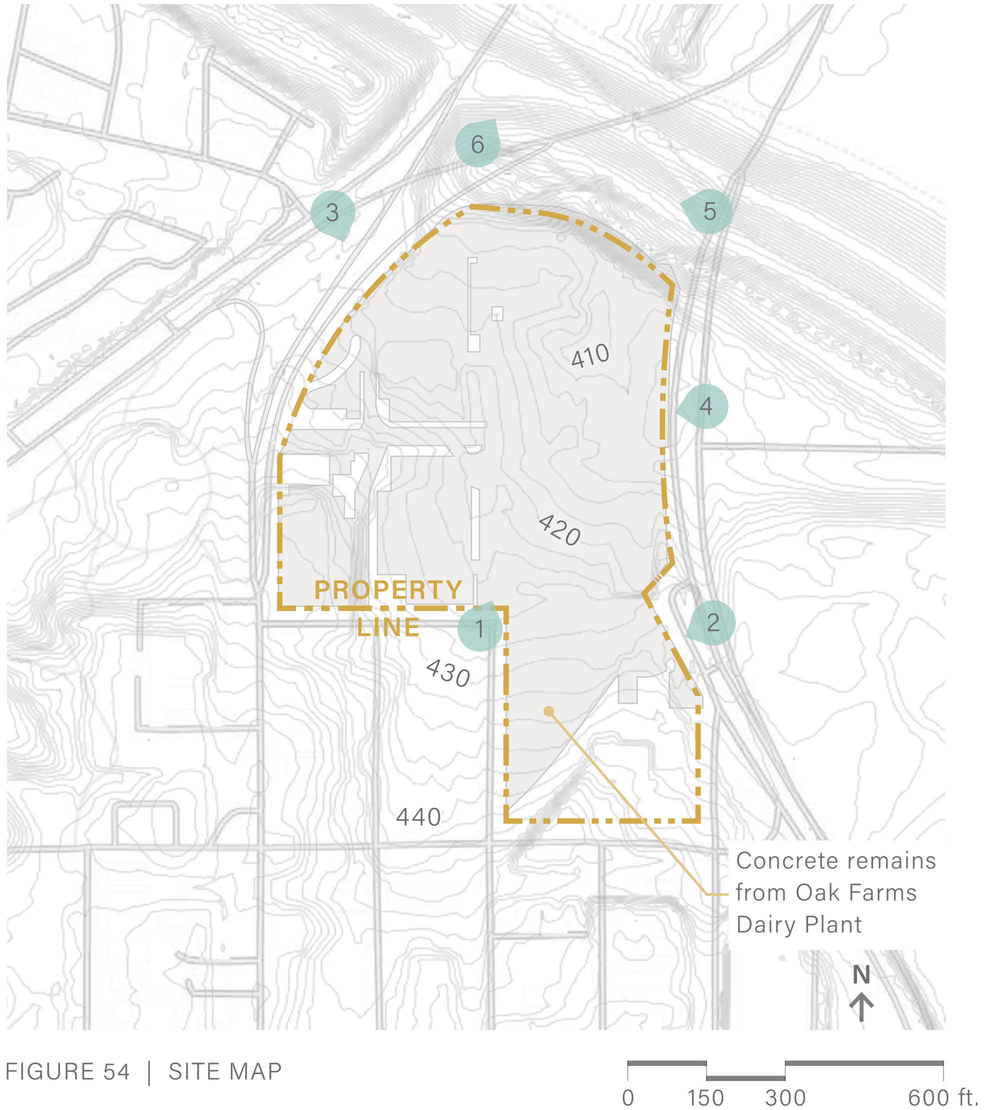


FIGURE 54 | SITE MAP

FIGURE 55 | VIEWS TO AND FROM SITE

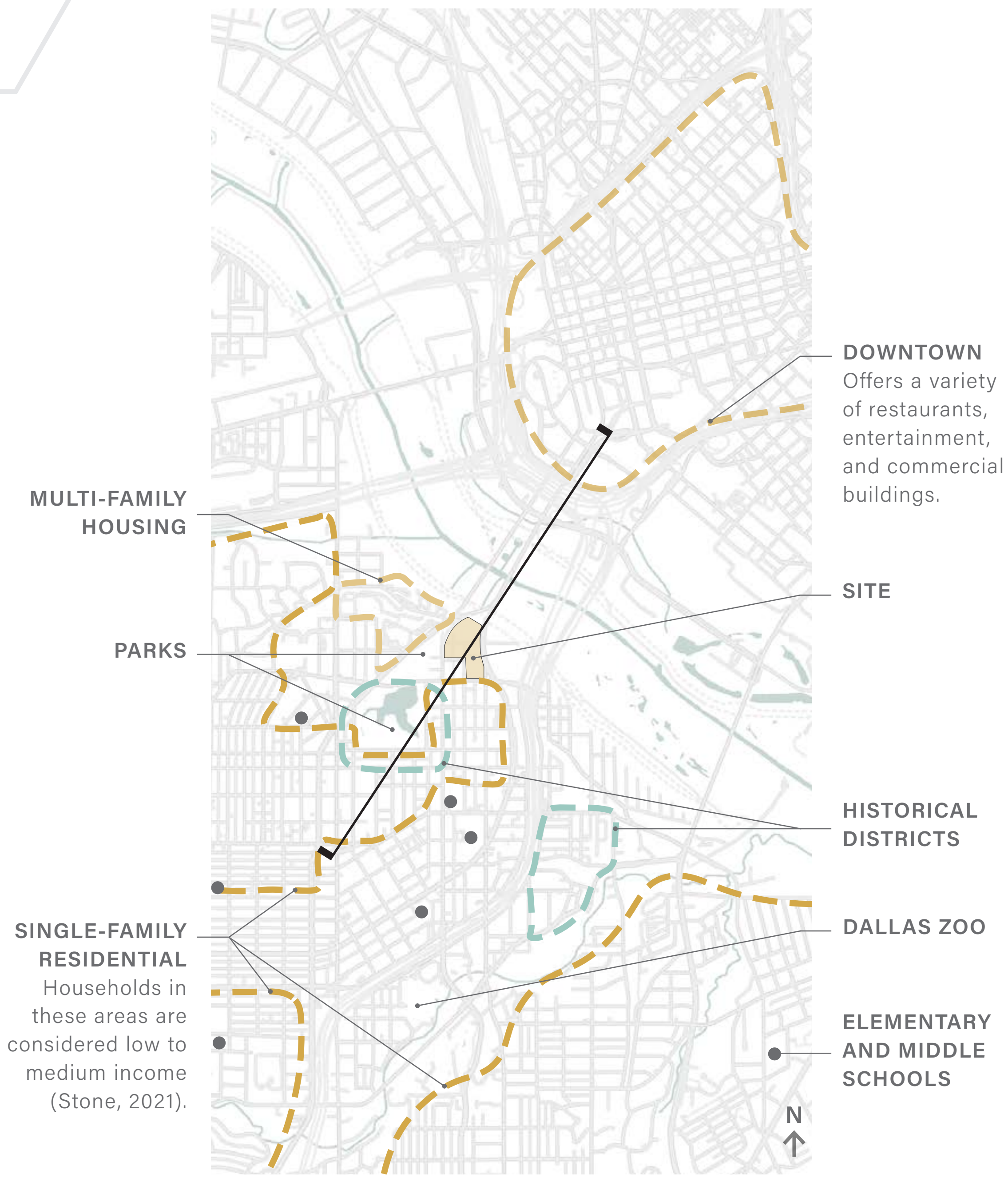


FIGURE 56 | SITE PLAN IN SURROUNDING CONTEXT

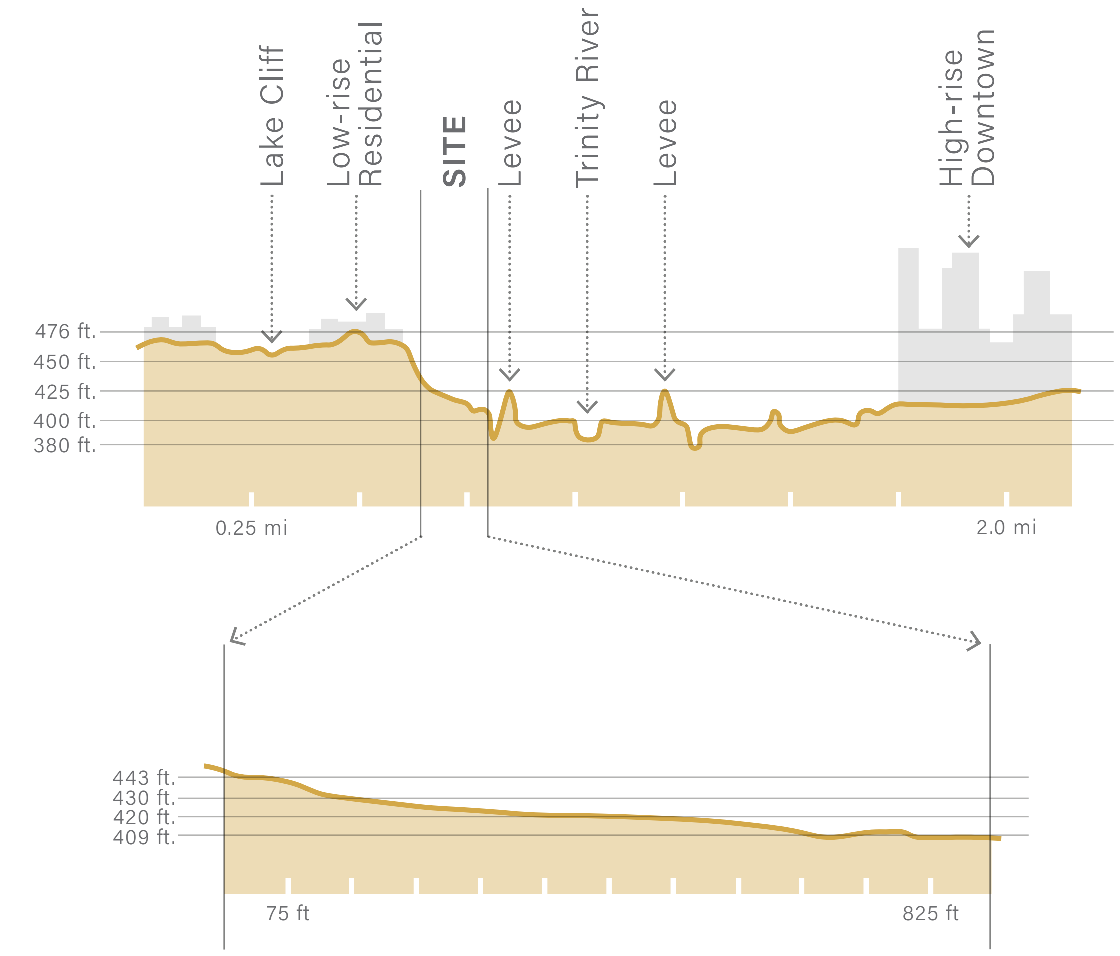


FIGURE 57 | TOPOGRAPHIC SECTIONS

The slope of the adjacent southern land follows the sun pattern fairly closely and as a result does not create any significant shadows on the site. However, the slope does limit the opportunities for views to the south. One advantage of the sloped site is that it provides the opportunity to increase the height of the project without it dominating the surrounding low-rise buildings.

The United States Department of Agriculture Soil Conservation Service classifies this site as having Eddy-Stephen-Austin soil (Coffee et al., 1980). As shown in Figure 58, the soil sits on a chalky limestone with shale underneath. The biggest challenges for this soil type, identified in the soil survey, are navigating the land slope and distance to rock. However, the underlying rock does provide good stability for project foundations (Coffee et al., 1980).

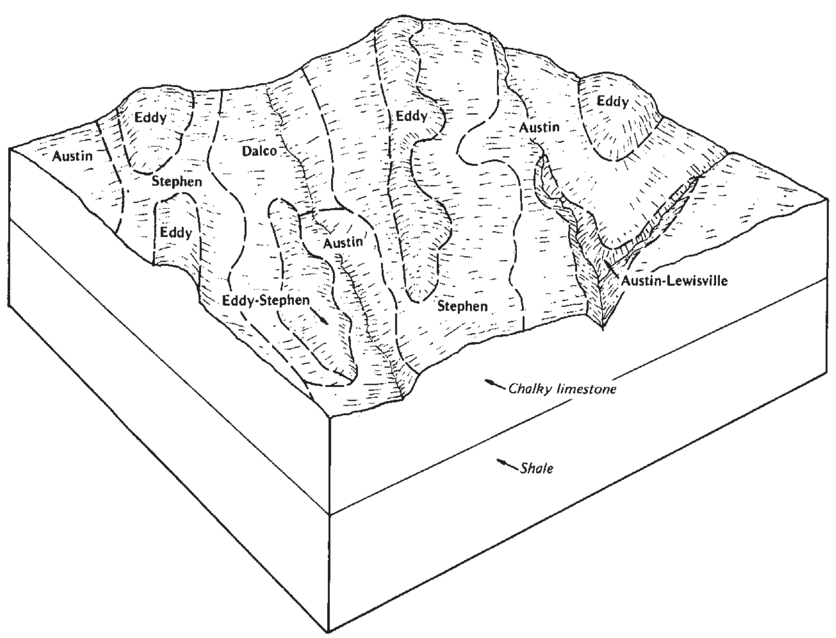
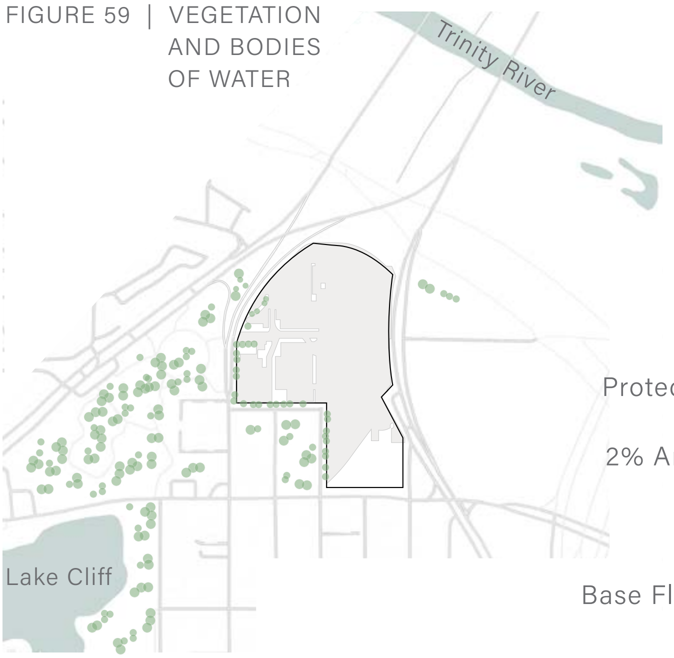


FIGURE 58 | TYPICAL EDDY-STEPHEN-AUSTIN SOIL (Coffee et al., 1980)

FIGURE 59 | VEGETATION AND BODIES OF WATER



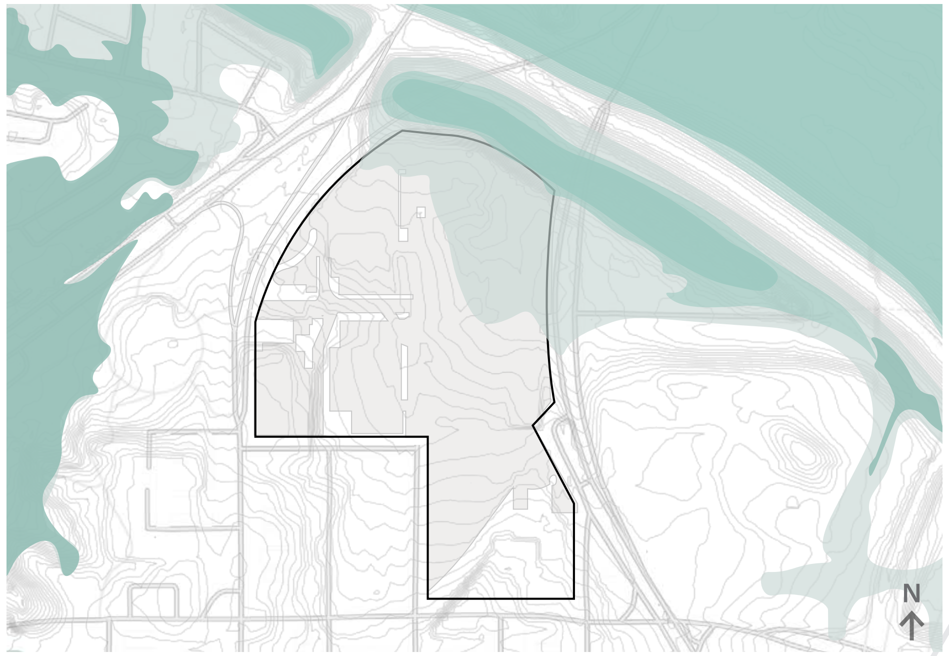


FIGURE 60 | FLOOD PLAIN

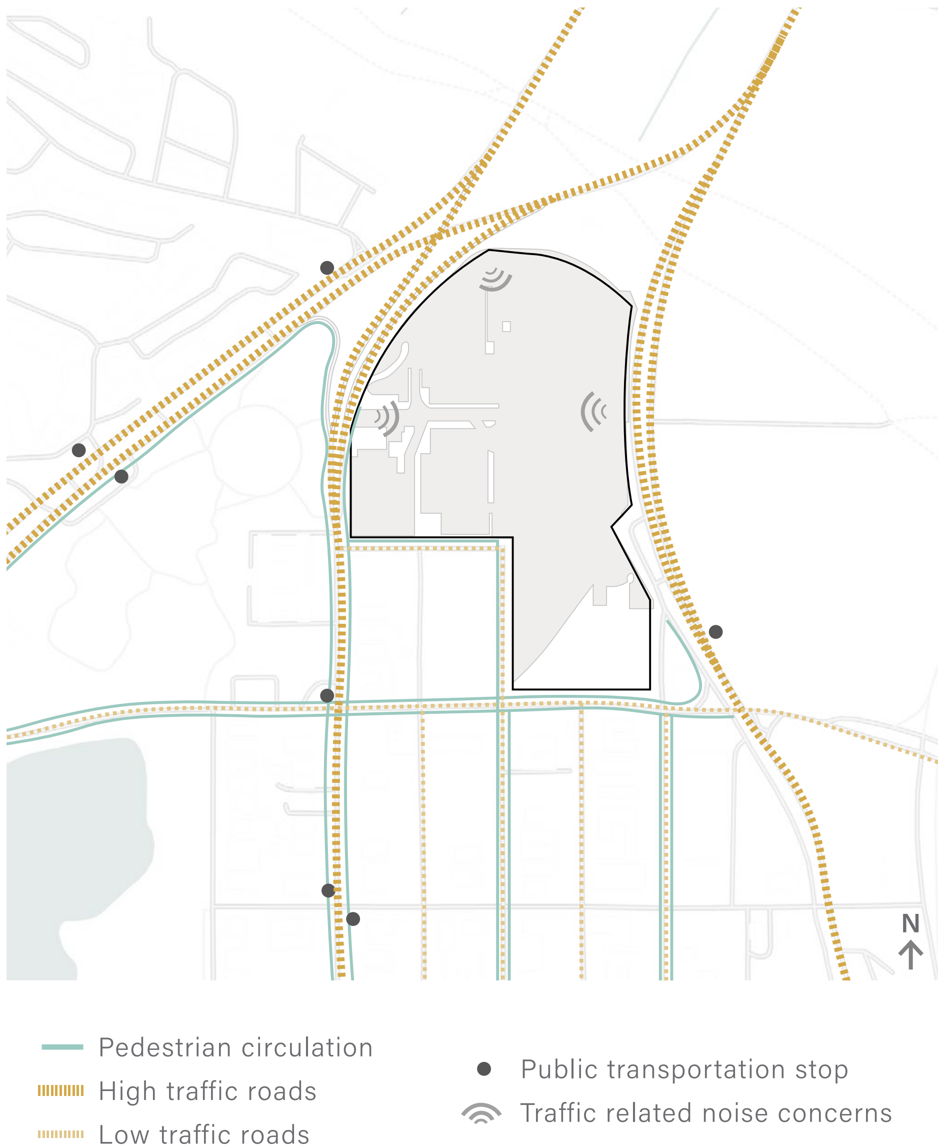


FIGURE 61 | TRANSPORTATION ANALYSIS

CLIMATE DATA

Dallas's climate is considered humid subtropical for its hot, humid summers and cool winters. The average humidity in Dallas is between 60 to 70%. Experiencing mostly sunny days year-round, Dallas' environment will provide a good source of light quality to be used as daylighting or renewable energy in the project. Wind direction and strength experienced in Dallas changes based on the season. Summer winds mainly blow from the south, while winters winds are stronger and blow from the north, as well. Wind patterns will translate into the design of outdoor space, natural ventilation, and sustainable strategies.

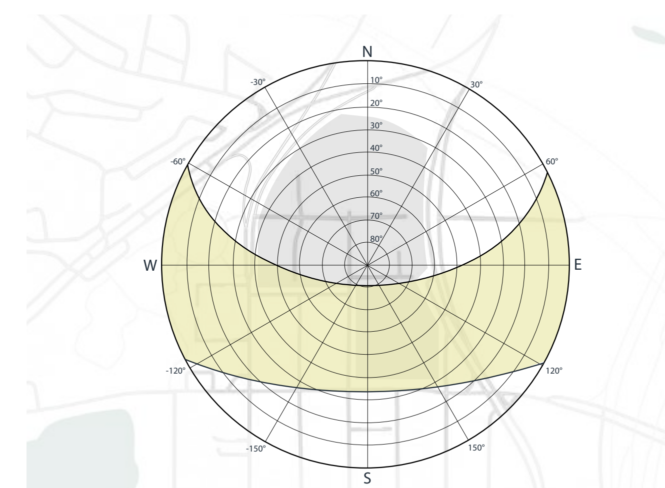


FIGURE 62 | SUN PATH DIAGRAM

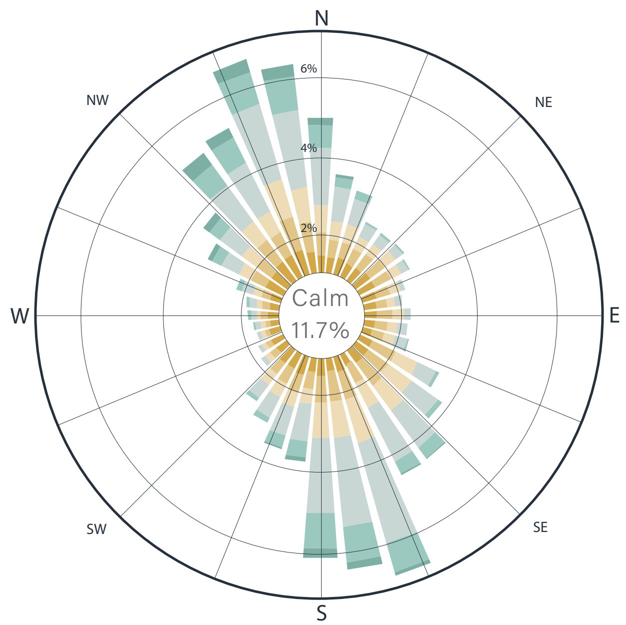
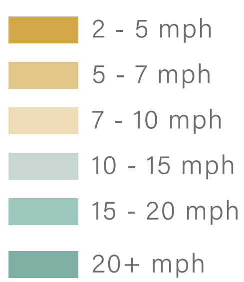


FIGURE 63 | WINTER WIND PATTERNS - JANUARY



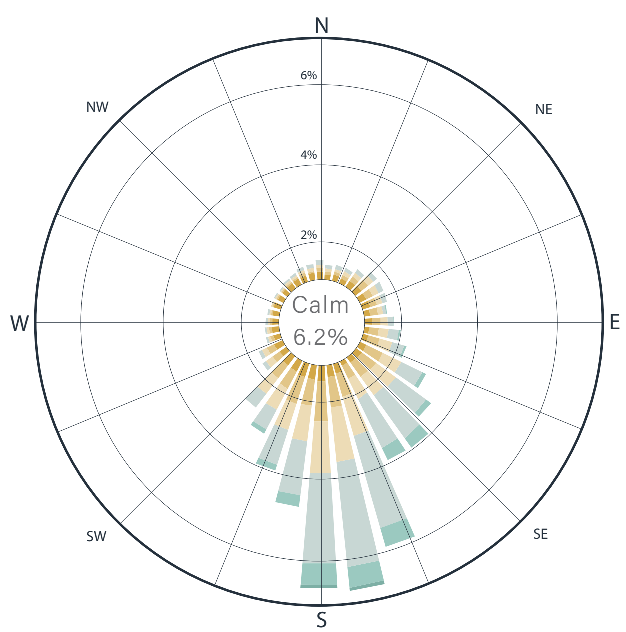


FIGURE 64 | SUMMER WIND PATTERNS - JULY

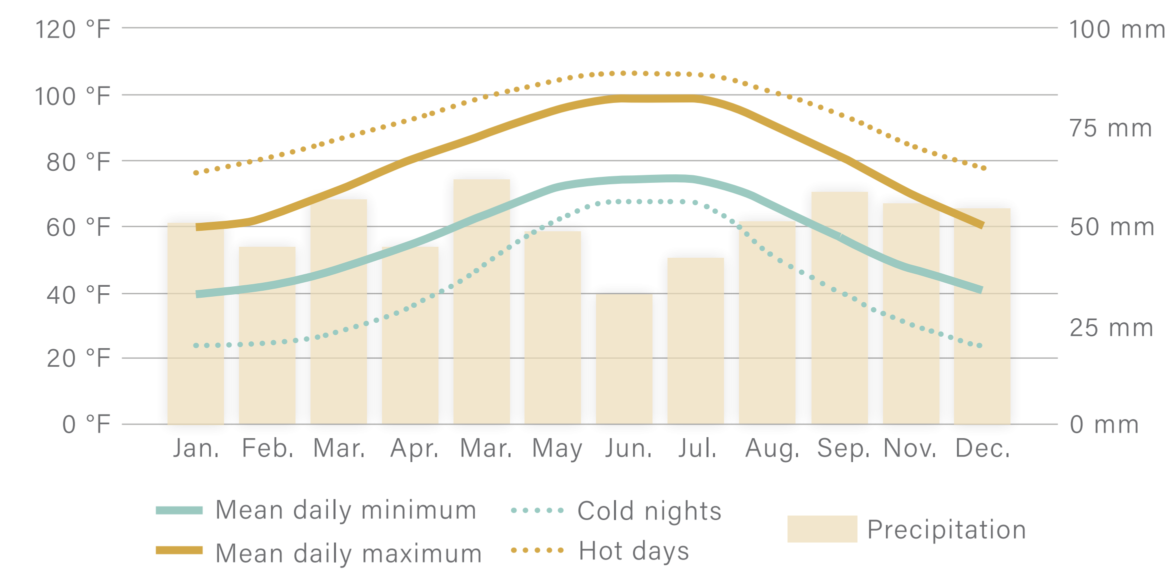


FIGURE 65 | AVERAGE TEMPERATURES AND PRECIPITATION IN DALLAS

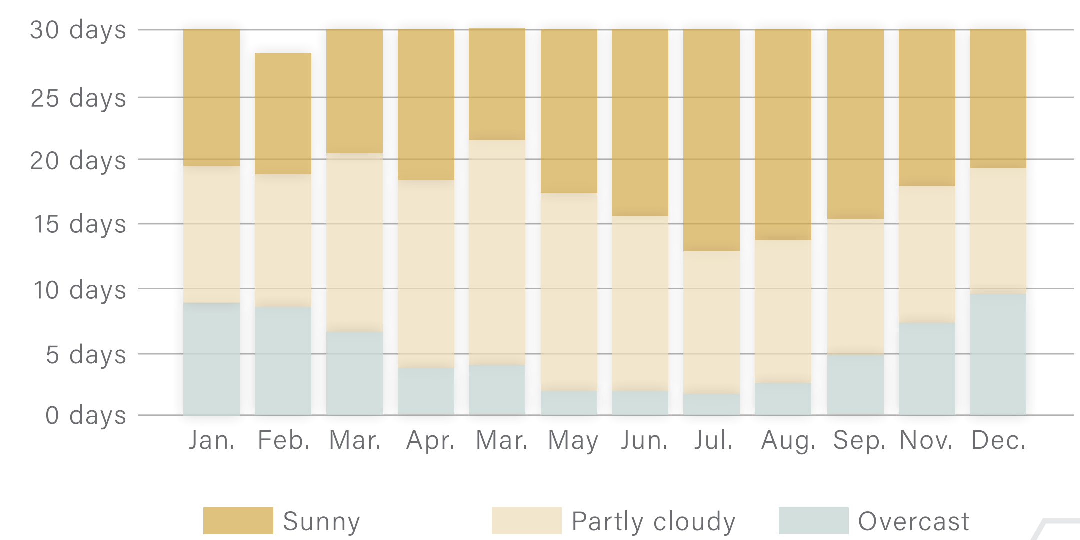


FIGURE 66 | SUNNY AND CLOUDY DAYS IN DALLAS

PROJECT JUSTIFICATION

The years as a child are critical to mental, physical, and emotional development. Schools offer structured education they can be limited by curriculum requirements and funding. A new model of learning at the children's learning center can break away from traditional methods and be an additional form of education in a child's routine. As a non-profit organization, funded through donations and sponsorships, the public facility will offer affordable admission rates and memberships.

The proposed project addresses the social and environmental issues facing children today. Through the strike of the COVID-19 pandemic, the world's unpreparedness was exposed, leaving many without jobs, stuck in isolation, and struggling to adapt mentally and physically to the new normal of the world. When will the next major world event happen? The answer is unknown. Preparation for the future through transferable skill development, such as problem-solving and computing skills, can help combat the mental and physical effects of unpreparedness and contribute an overall more knowledgeable framework as crisis arise. "The need for children to think more critically and creatively about the future is both under-theorized and as yet underdeveloped" (Hicks & Holden, 2007, p. 509). The future-based curriculum of the leaning center will offer a niche that is not covered by the conventional school curriculum.

Additionally, humanity's impact on the world is causing a series of negative effects on the environment. Designing a sustainable project will provide a safe, healthy environment for children to learn while minimizing the negative consequences to the natural environment. "What children and young people need is guidance on how to think more, rather than less, critically and creatively about the future, whether personal, local or global" (Hicks & Holden, 2007, p. 503). The children's learning center will educate children on their role in protecting the environment, leading to a more knowledgeable and aware generation.

While this project is placed in Dallas, Texas, the social and environmental issues addressed are relevant to children all over the world. This thesis project is a step to starting the conversation of presenting more extreme utopian and dystopian ideas to children to foster learning and optimism toward a future time. The idea presented can continually be addressed by designers and evolve as the relevancy of topics changes.

Personally, the architectural field I am most interested in pursuing after graduation is educational facilities. The information drawn from the research is transferable to designing for learning environments in schools. Experimenting with organic forms and design solutions will expand my technological abilities through the creative process.

PERFORMANCE CRITERIA

BUILDING PERFORMANCE

The project will follow local and national building codes to ensure the safety of the structure. Quantifiable measures, such as egress travel distance, fire ratings, and material qualities, will be used to evaluate compliance. The children's learning center is classified as Assembly Group A-3 under the 2021 International Building Code. Additional specialty requirements for building elements that may be relevant in the design solution include Section 242: Play Structures.

Overall energy performance will be measured using the LEED rating system, developed by the U.S. Green Building Council. As the world fights to counteract the effects of climate change, the project solution will contribute to the sustainable approach by establishing a goal of a LEED Gold rating.

SPATIAL PERFORMANCE

Spatial adjacencies for the proposed project are shown in Figures 68 and 69. The application of Olmsted's design principles:

prospect, refuge, and mystery were considered when determining adjacency (Taylor, 2009). Corresponding users and uses were also a consideration towards the overall functionality of the project. Comparison of the values in Figures 67 and 68 to the travel distance and square footages of the final design solution will provide a percentage of performance accuracy.

LEARNING ENVIRONMENT PERFORMANCE

Adapted from the ideas in Anne Taylor's book (2009), a chart of basic needs, Figure 70, was constructed as a basis for all learning environments in the project. Utilizing Taylor's concept of designing for the whole learner, each building element is accessed based on its appeal to the mind, body, and spirit. Quantifiable criteria is noted in the chart and will be judged using software analysis and calculations from the *Mechanical and Electrical Equipment for Buildings* (Grondzik & Kwok, 2014). Qualitative criteria will be analyzed through professional and user judgment based on their perception and past experiences.

SPACE	SIZE (SQ. FT.)	QUANTITY	PERCENTAGE
Lobby / Entry	1,000	1	3%
Exhibits	3,000	3	26%
Flex Learning Space	4,000	1	12%
Breakout Space	40	8	1%
Technology Space	100	4	1%
Classrooms	900	3	8%
Circulation	11,250	1	33%
Bathroom	500	4	6%
Faculty Office	150	6	3%
Conference Room	300	1	1%
Storage	500	3	4%
Mechanical	1,000	1	3%
TOTAL	**34,370**		

FIGURE 67 | SPACE ALLOCATIONS

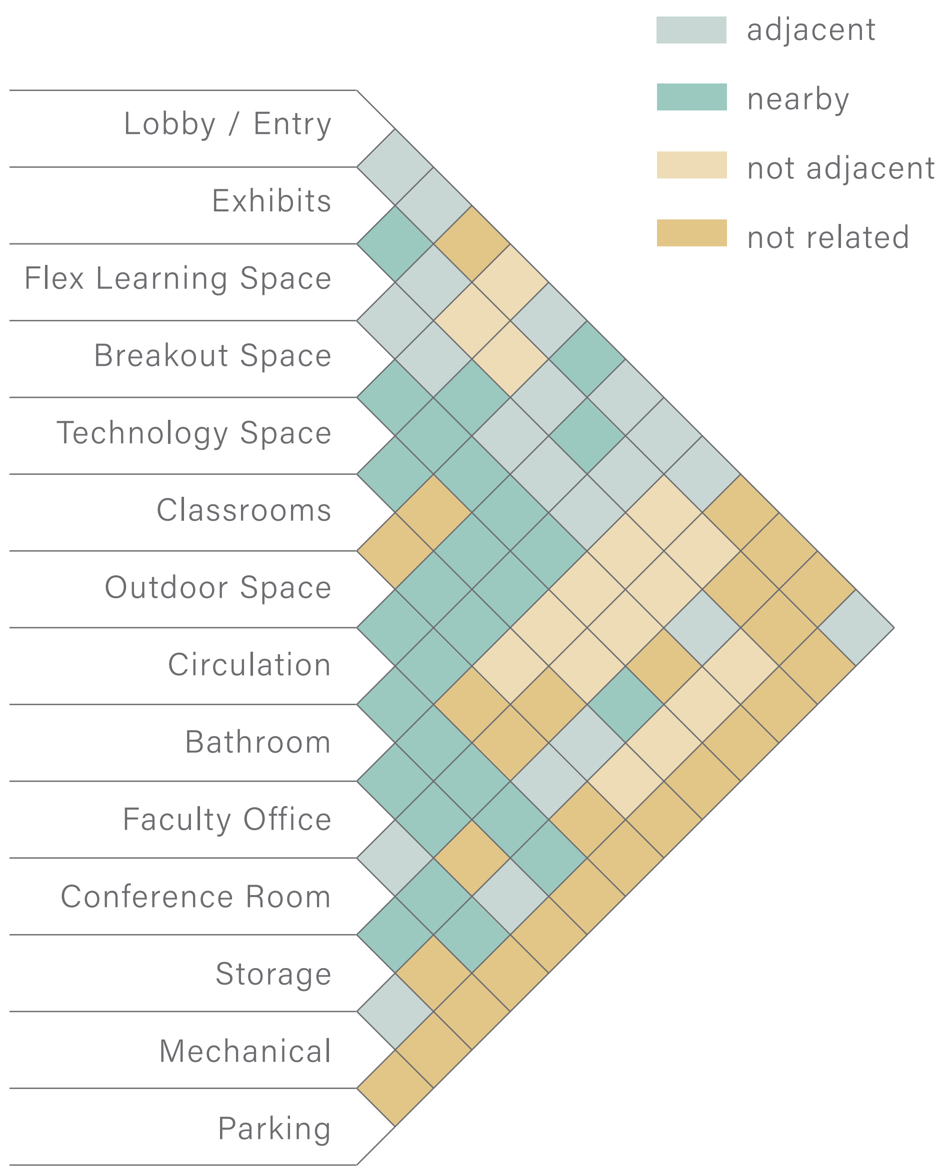


FIGURE 68 | SPACE INTERACTION MATRIX

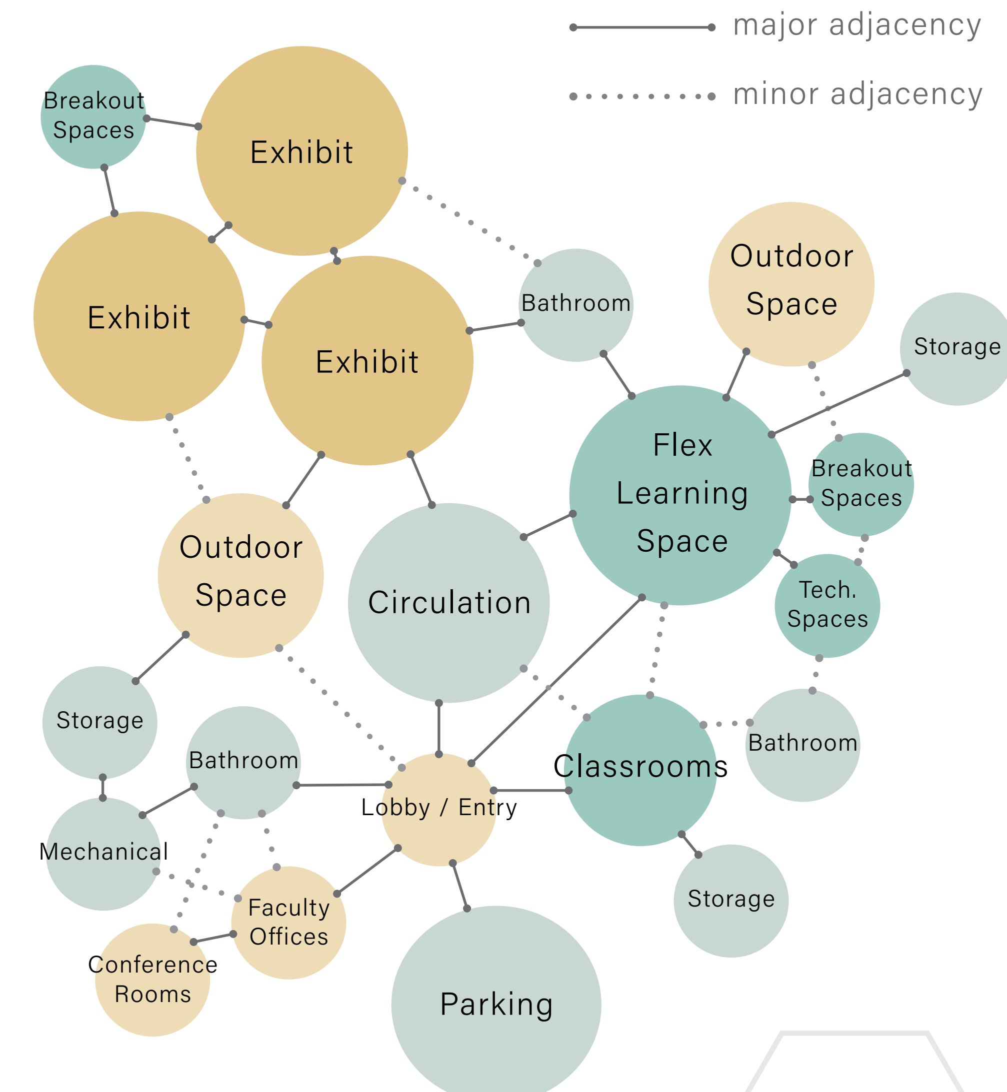


FIGURE 69 | SPACE INTERACTION NET

	MIND	BODY	SPIRIT
Accessibility	Activities presented in different medias	Meets ADA Guidelines	Inclusive environment
Circulation	Easily understood connections	Open sight lines to allow for easy maneuvering	Inviting and self-guided
Color	Limits distraction by integrating neutral colors	Used as wayfinding system	Bright accent colors
Daylighting	Connections to nature	10 to 500 fc	Transparency and openness to outdoors
Flexibility	User decision making	Flexible elements for user customization	User freedom and control
Furniture	Variety of options	Ergonomically correct for children	Clean and well maintained
Height	Learning opportunity from exposed ceiling or patterns	9' - 0" ceilings	Feeling of comfort and security
Lighting	Task lighting for added concentration, 100 fc	50 fc for general learning space	Uniform and without glare

FIGURE 70 | LEARNING ENVIRONMENT ASSESSMENT

Adapted from *Linking architecture and education* (Taylor, 2009)

	MIND	BODY	SPIRIT
Scale	Easily interpreted by children	Responsive to user height, 4' to 5'	Personal and sense of belonging
Socialization	Opportunity for collaborative learning	Multi-user interactive elements	Friendly environment
Sound	35 to 45 dBA in higher focus areas	45 to 55 dBA in collaborative spaces	Contributes to the sensory experience of a space
Structure	Used as a visual teaching tool, if exposed	Follows international and local safety code	Adds to environment aesthetic
Technology	Ability to be understood by users	Part of the integrated experience	Communication and connectiveness to world
Temperature	Comfortable with higher levels of physical activity	68 to 74°F with 40 to 60% humidity	Relief from Texas' climate
Ventilation	15 to 20 cfm per occupant	Access to outdoors and operable windows	Not congested with high activity

FIGURE 70 | LEARNING ENVIRONMENT ASSESSMENT

Adapted from *Linking architecture and education* (Taylor, 2009)

DESIGN SOLUTION

PROCESS DOCUMENTATION

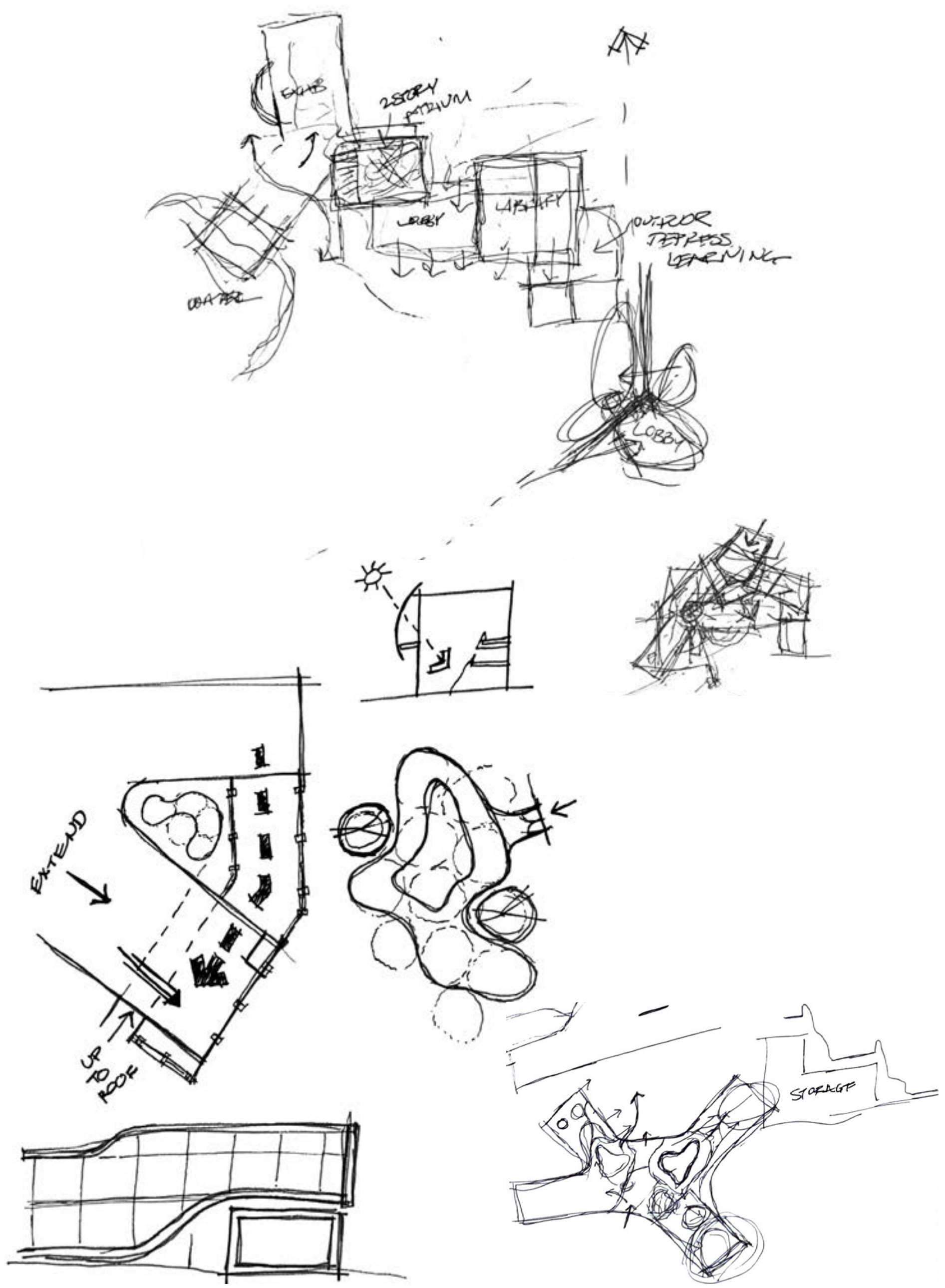


FIGURE 71 | PROCESS SKETCHES

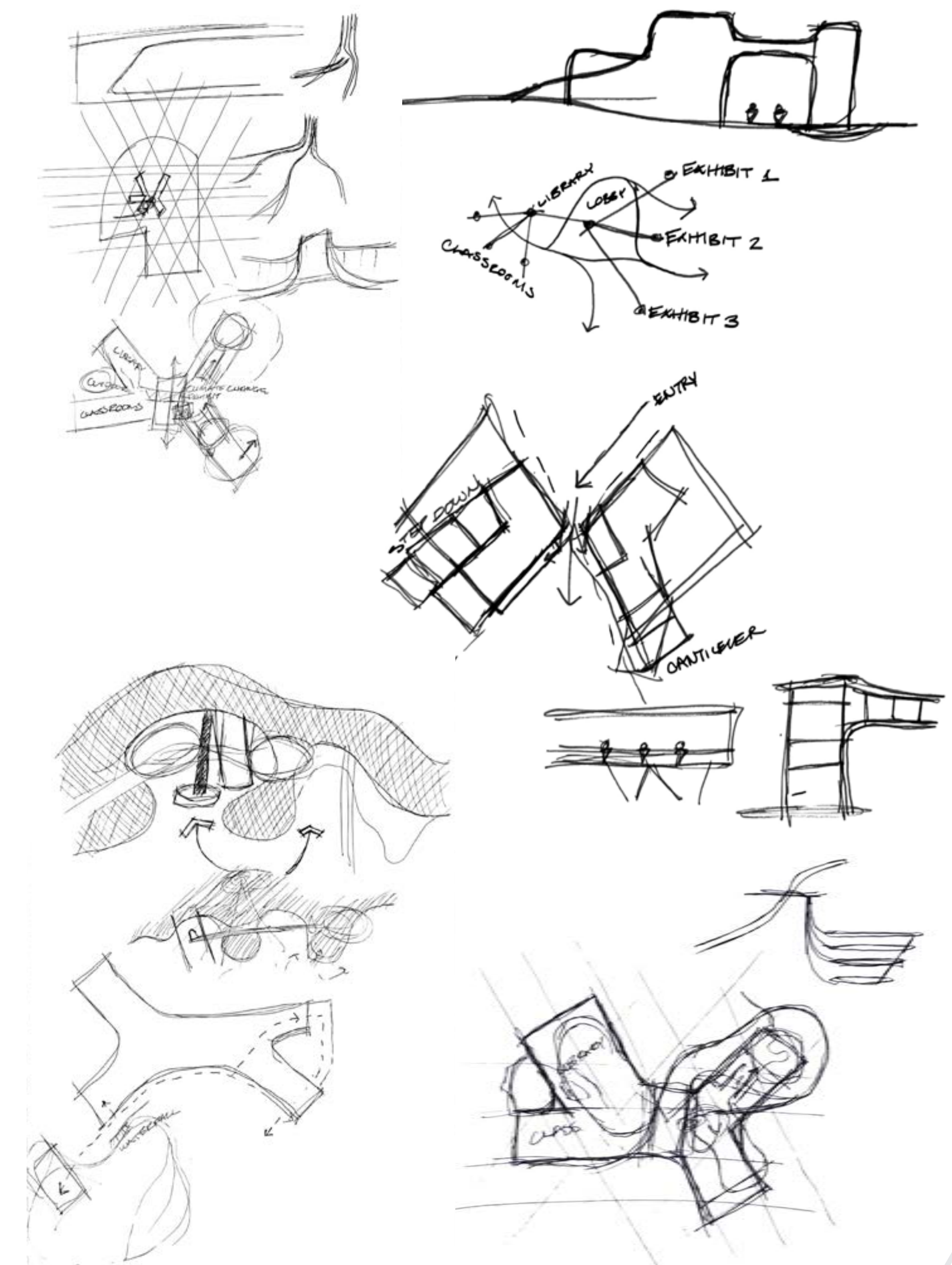
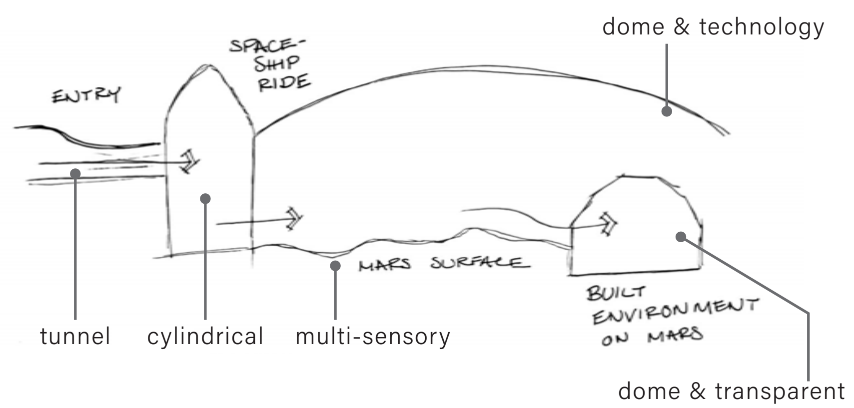


FIGURE 71 | PROCESS SKETCHES

SPATIAL IDEATION

User progression through exhibits was considered early on as it was an important influence on form and spatial connections. The exhibit topics and individual programs were chosen based on the research presented. Sections were sketched that show the spatial progression of exhibits and coordinating architectural elements that achieve the desired user experience.

TRIP TO MARS



CLIMATE CHANGE

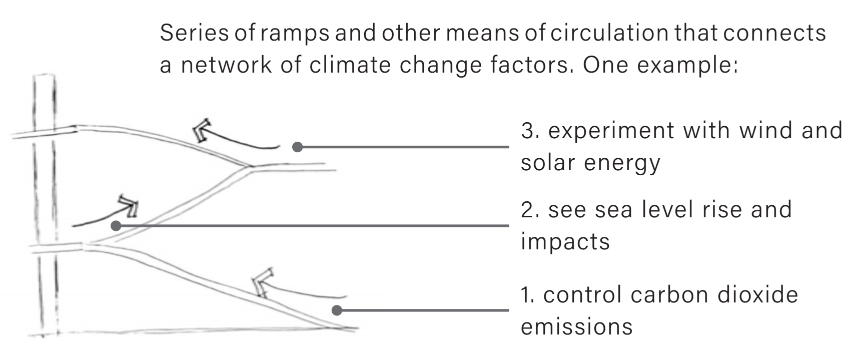


FIGURE 72 | SPATIAL IDEATION SKETCHES

FLOATING CITY

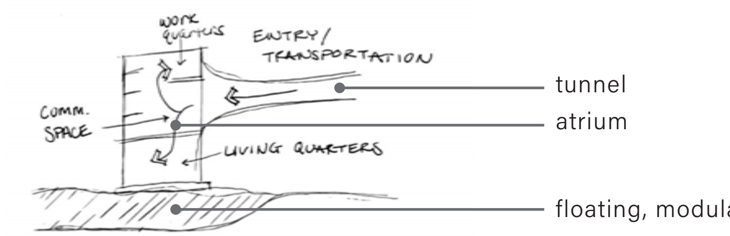


FIGURE 72 | SPATIAL IDEATION SKETCHES

FORM CREATION

Connection is a recurring theme throughout the design solution. Connections to the present, past, and future are represented throughout the project. The chosen final form responds to the surrounding context, site influences, and program needs.

Grid lines were formed from circulation paths to and from the site. Combined with a radial organization, chosen to maintain open sight lines and transparency, a simple form with four separate wings is created.

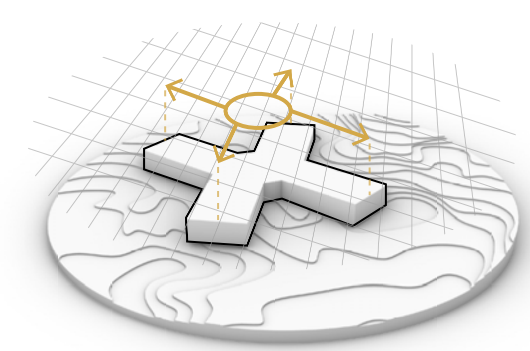


FIGURE 73 | FORM CREATION PROCESS: PHASE 1

The separation of the wings creates an open courtyard that provides an opportunity for the transition from indoor to outdoor learning. The courtyard also has a direct view of downtown, the heart of Dallas, showing the innovations and progression of the city.

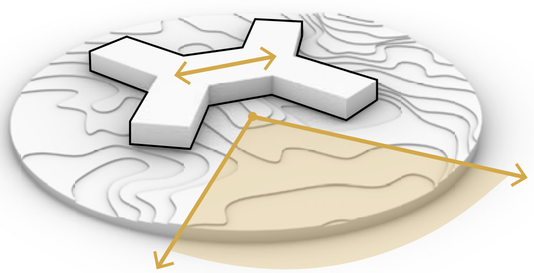


FIGURE 74 | FORM CREATION PROCESS: PHASE 2

Shifting the southwest wing creates a linear visitor approach from the neighboring parks. Connection to the parks encourages the use of the parks and learning center alike. Walking or biking to the site is encouraged through these efforts.

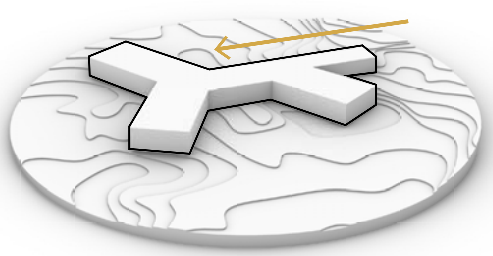


FIGURE 75 | FORM CREATION PROCESS: PHASE 3

Openings added in the form allow for outdoor circulation through and around site. Multiple circulation routes add flexibility and exploration for users. The openings also direct the southern winds through the form to cool the courtyard, creating a more comfortable environment.

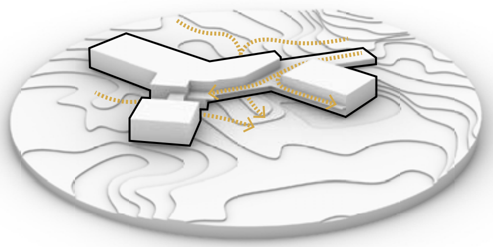


FIGURE 76 | FORM CREATION PROCESS: PHASE 4

Levels of the project are adapted to the original topography of the site, connecting past with present. The form is further adjusted to connect the education wing with the main courtyard.

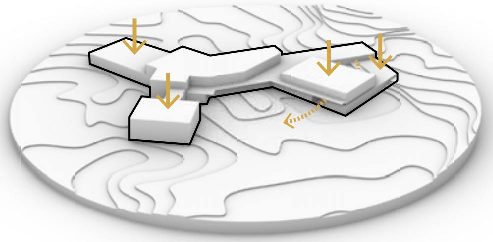


FIGURE 77 | FORM CREATION PROCESS: PHASE 5

PROJECT SOLUTION DOCUMENTATION

FIGURE 78 | FINAL DISPLAY BOARDS

PERFORMANCE ANALYSIS: RESPONSE TO SITE

The design process, explained earlier, demonstrates many of the decisions for the building form as it relates to the site context. Additionally, sustainable solutions were integrated into the design that responds to Dallas's climate, as shown in Figure 80. One of these sustainable solutions being the restoration of green space on the site. This project removes the existing concrete from the site and restores it to open green space with native vegetation. Not only does this reduce the urban heat island effect but it also offers a healthy outdoor environment for visitors. The removal of vehicular circulation from this portion of the site further enhances the safety of the children.

As a response to the large size of the site, the southern portion of the site is dedicated to the future development of a children's campus, offering additional resources or learning opportunities.

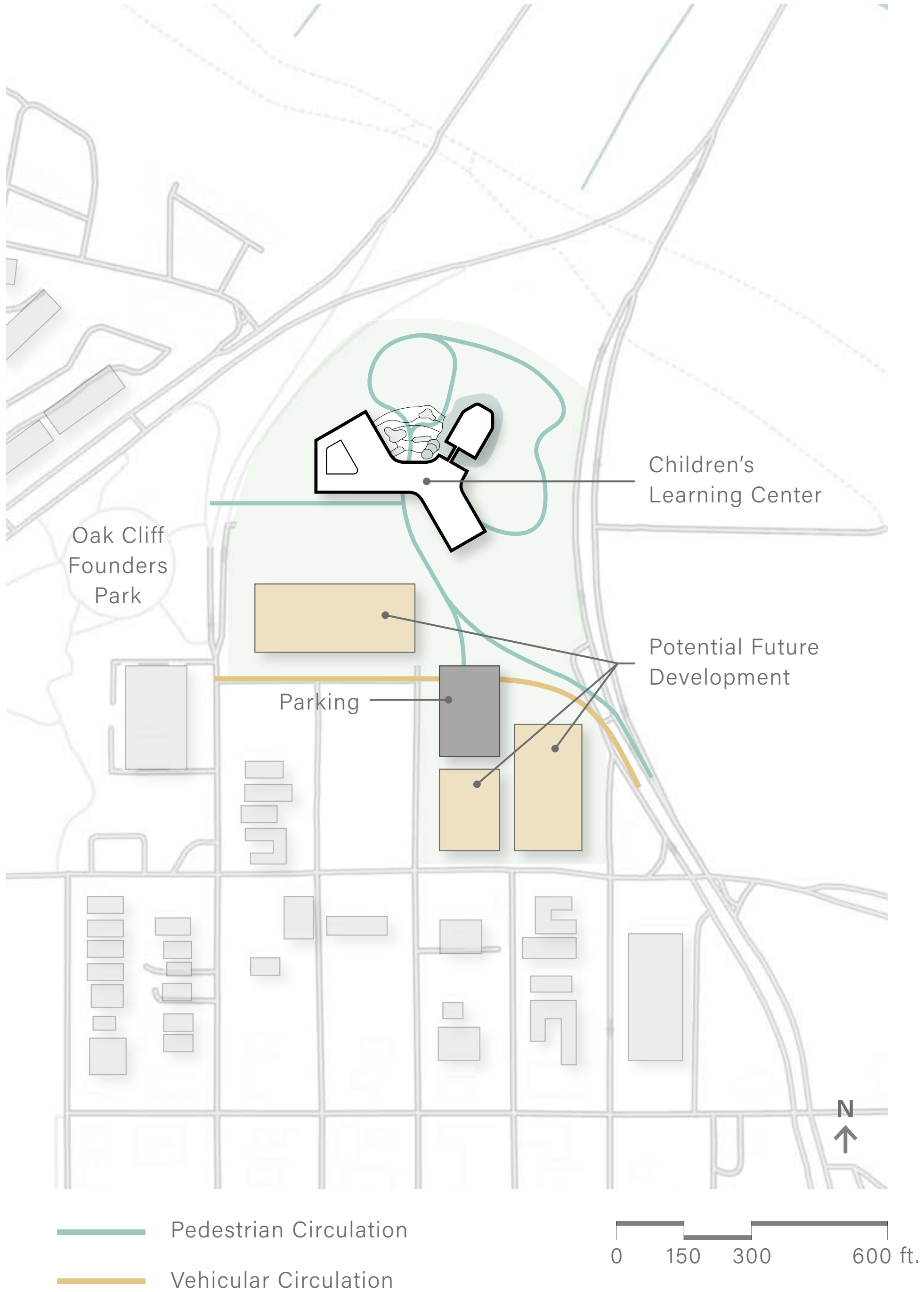


FIGURE 79 | SITE PLAN

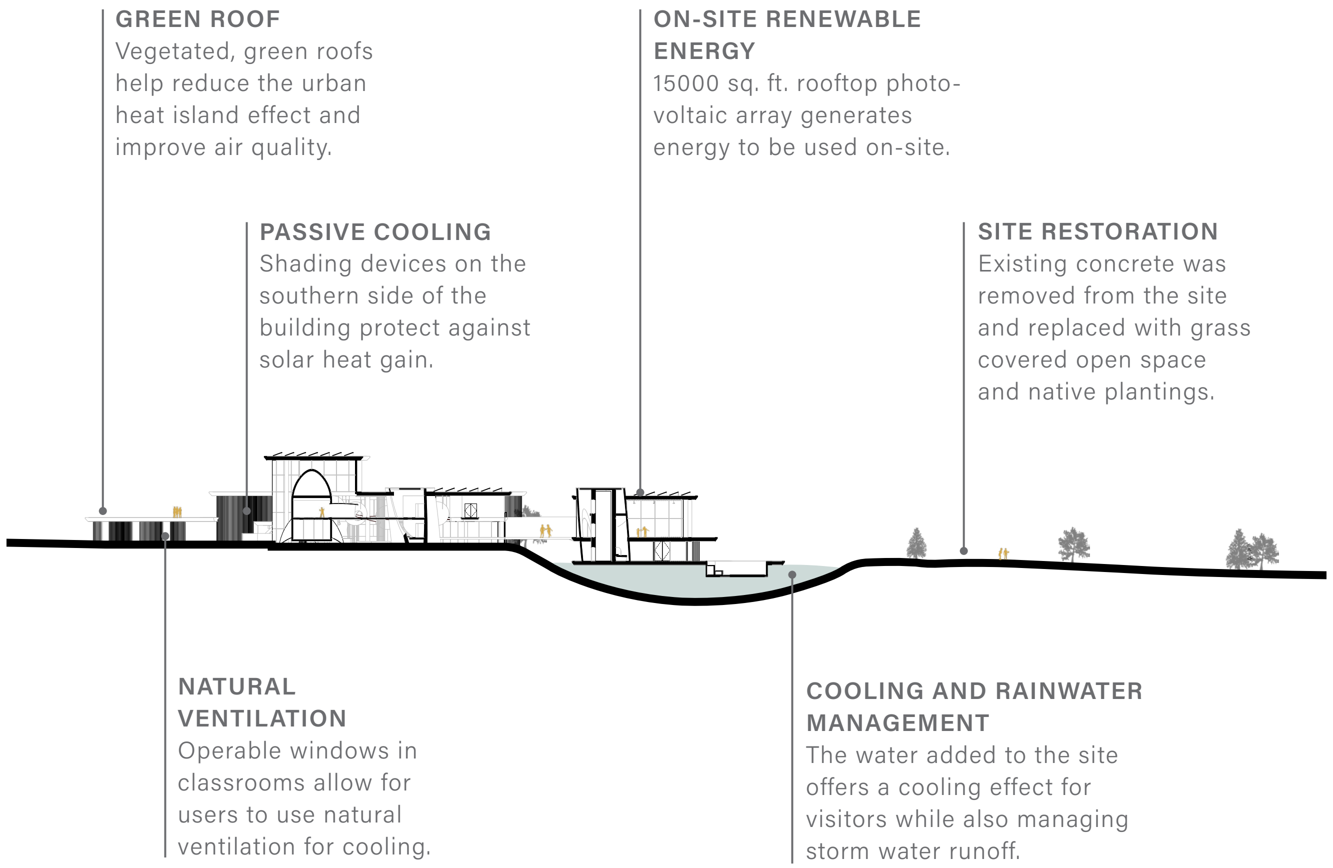


FIGURE 80 | SECTION B: SUSTAINABLE STRATEGIES

FIGURE 81 | COURTYARD VIEW

PERFORMANCE ANALYSIS: RESPONSE TO TYPOLOGICAL RESEARCH

The typological research concluded that the use of dynamic forms, hands-on elements, futuristic ideas, and sustainable strategies were necessary in this project if the goals were to be achieved. The architectural forms and elements of the design solution entice user engagement. Careful consideration was given to the circulation strategies employed. A flexible circulation approach, as used in the Yuecheng Courtyard Kindergarten, was used through the largest spaces of the building to spark curiosity and entice further exploration. As opposed to the exhibits, where a more structured circulation method was selected, mirroring the approach taken by the German Pavilion.

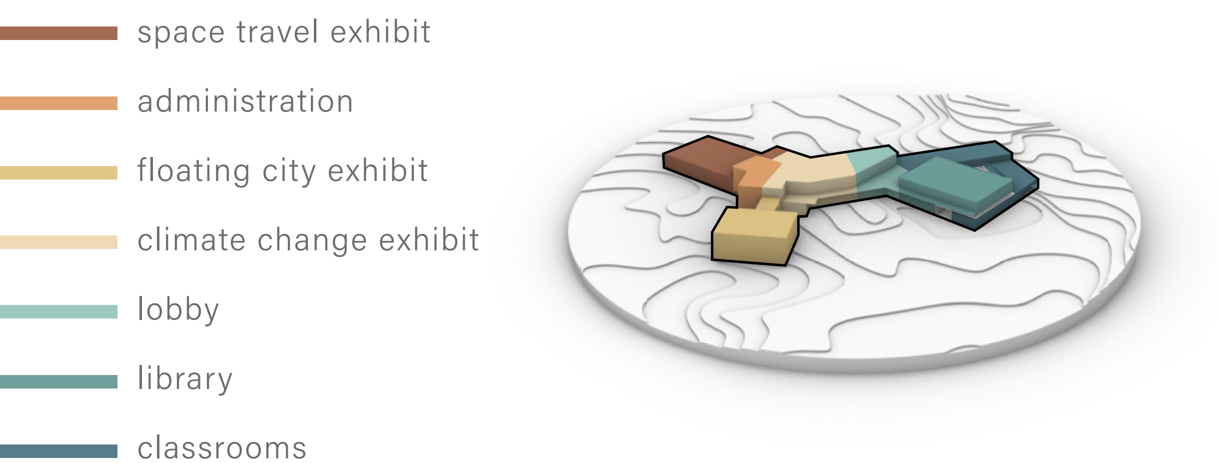


FIGURE 82 | PROJECT PROGRAM

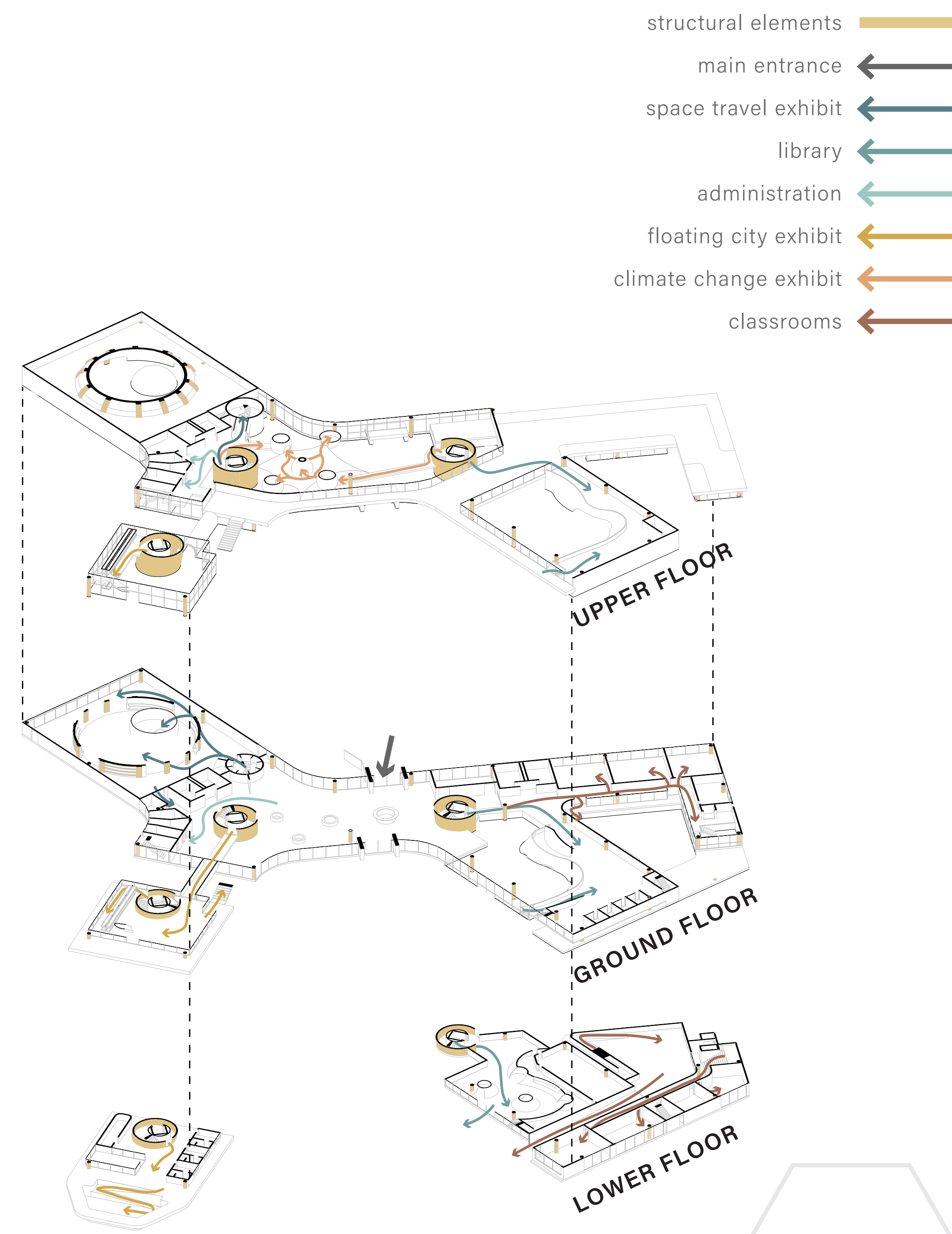


FIGURE 83 | CIRCULATION PATHS

SUPPORT SPACES

1 lobby
2 restroom
3 coat storage
4 flexible learning space
5 storage
6 office
7 conference room
8 mechanical
9 walkable roof
10 vegetated roof

CLASSROOMS

1 courtyard
2 classroom
3 storage

LIBRARY

1 flexible learning space
2 breakout pods
3 robot track
4 computer / 3D printers
5 VR studio

CLIMATE CHANGE EXHIBIT

exhibit pods 1
suspended net 2
water feature 3

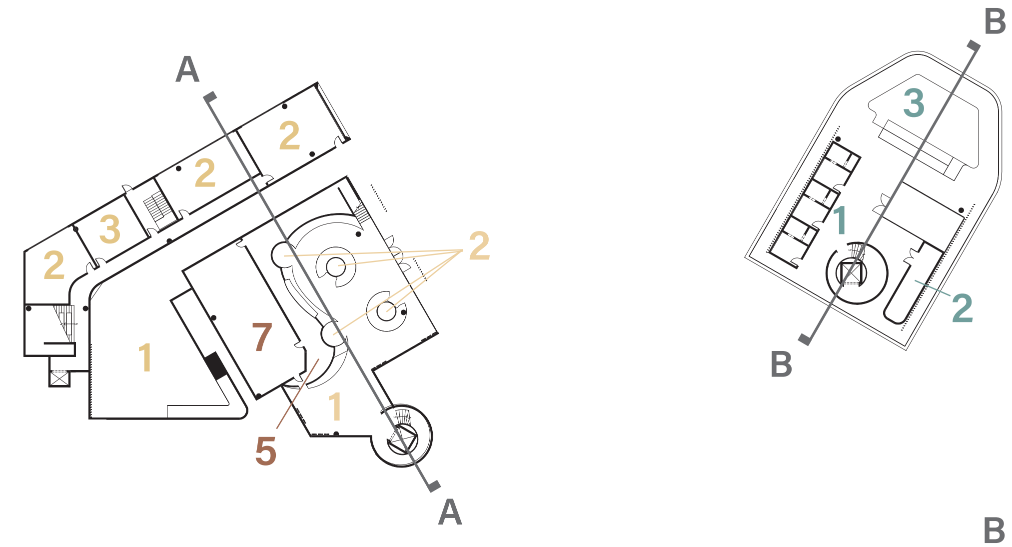
FLOATING CITY EXHIBIT

living pods 1
robot station 2
underwater viewing deck 3
VR work pods 4
drone landing 5
vertical farm walkway 6

SPACE TRAVEL EXHIBIT

crew living pods 1
flexible exhibit space 2
Mars habitat 3

FIGURE 84 | LOWER FLOOR PLAN



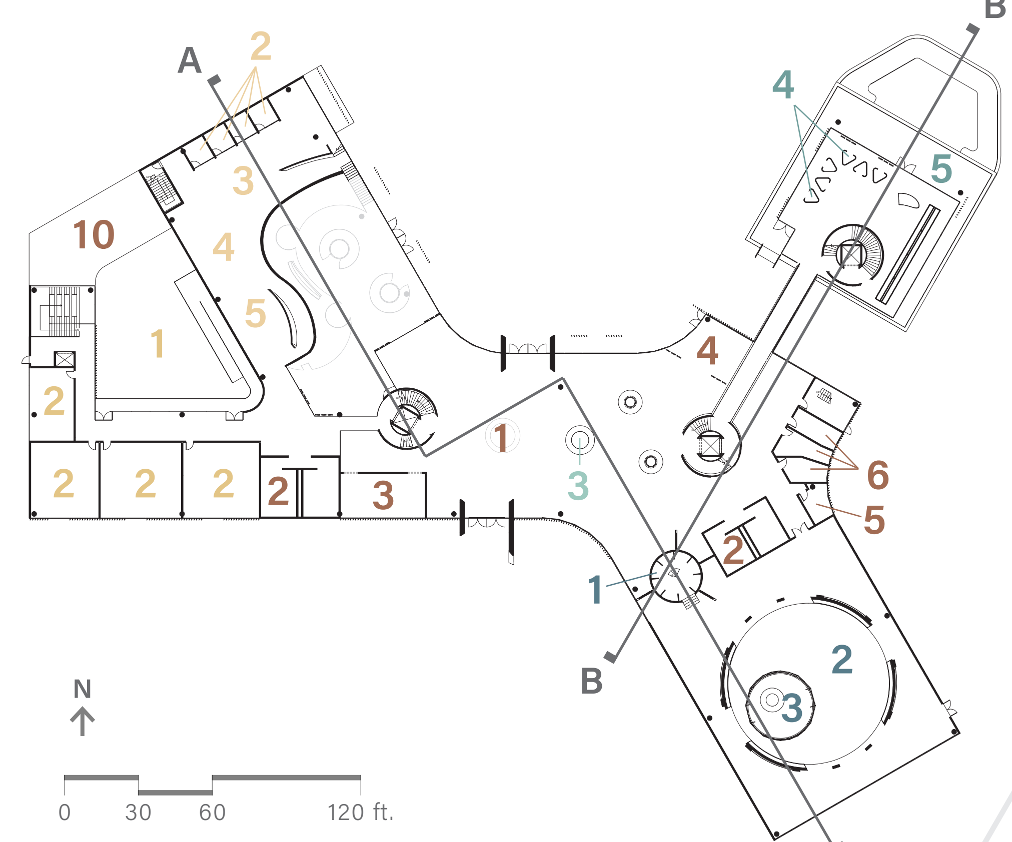


FIGURE 85 | GROUND FLOOR PLAN

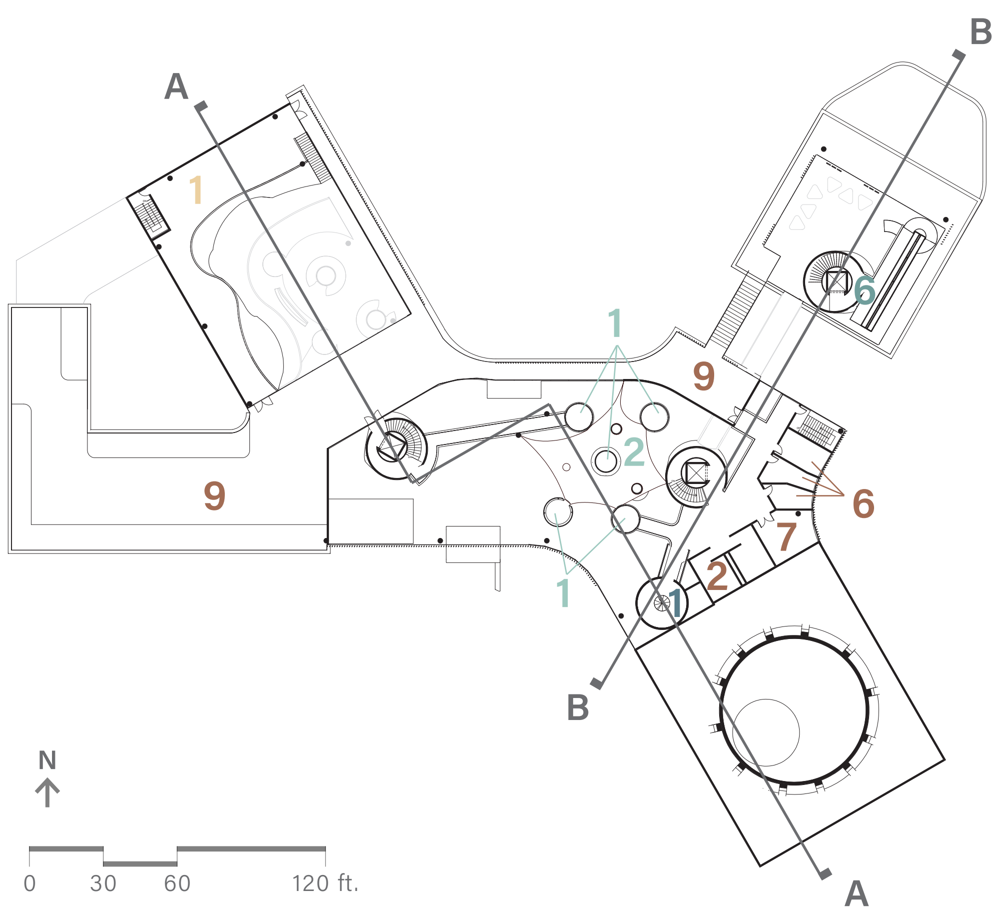


FIGURE 86 | UPPER FLOOR PLAN

FIGURE 87 | LIBRARY

LIBRARY

The library design uses natural tones with accent colors to achieve a soft, non-distracting space for children to learn. The organic forms create different opportunities for user experience, becoming an interactive element in the space. Alcoves and breakout spaces offer more secluded, comforting spaces for children to learn. Large curtain walls provide daylighting into the space to improve the learning experience while also providing transparency and views to the outdoors.

CLASSROOMS

Initially, during the research phase of this thesis project, the program included three classrooms to offer events or structured activities. Later in the design process, an additional three classrooms were added to accommodate more children, supporting an equal opportunity learning center model. The addition also created more separation between the exhibits and the classrooms, increasing privacy. The classrooms wrap around a courtyard to encourage the use of an indoor/outdoor learning style.

FIGURE 88 | CLASSROOM COURTYARD

FIGURE 89 | CLIMATE CHANGE EXHIBIT

CLIMATE CHANGE EXHIBIT

The climate change exhibit sits directly adjacent to the lobby, encouraging users to visit it first in their exploration through the center, as it provides a basis of knowledge for the exhibits to come. Interactive bubbles, connected through a suspended net, achieve interactivity between design and user. As users make their way through each pod, they use VR and AR technologies as controllable variables that teach the interdependencies of our world. Integration of water and vegetation act as physical textures of these concepts.

SPACE TRAVEL EXHIBIT

The space travel exhibit uses a dome as an integrated element in the visitor experience. A larger dome with technology integration provides the opportunity for continuously updated information to be displayed as we learn more about space travel. At eye level, this dome becomes interactive with the user, allowing for individual exploration through media diversity. An exposed 3D printed structure supports this dome, demonstrating the technologies that have been utilized during space travel missions.

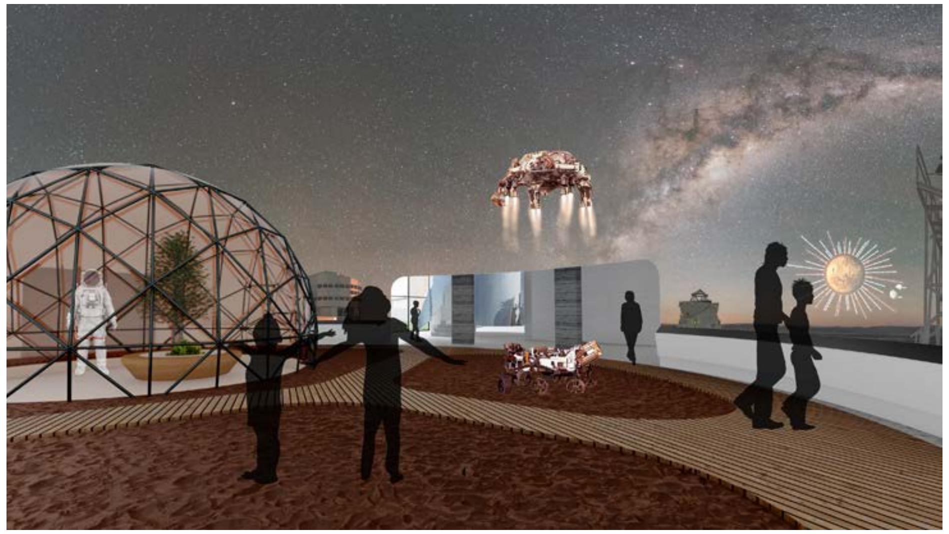


FIGURE 90 | SPACE TRAVEL EXHIBIT

FIGURE 91 | FLOATING CITY EXHIBIT

FLOATING CITY EXHIBIT

The floating city exhibit offers a glimpse into social changes that could be an outcome of evolving technology and the effects of climate change. An open concept model of this space allows for transparency of activities, encouraging socialization between visitors. Elevated/depressed platforms, ramps, and slides are used as playful elements of circulation, stimulating interaction with elements/concepts along the way. The placement of a vertical farm on the southwest edge of the exhibit demonstrates a futuristic concept of growing food, while diffusing daylight and minimizing solar heat gain.

PERFORMANCE ANALYSIS: RESPONSE TO GOALS AND PROJECT EMPHASIS

DESIGN GOALS

1 Create an inclusive design that addresses the learning needs of all children.

Using Anne Taylor's whole learner approach, the project implements strategies to support the physical and psychological needs of children. Attention to color, daylighting, technology, socialization, structure, flexibility, and ventilation to achieve these goals can be seen through the spaces detailed on the previous pages

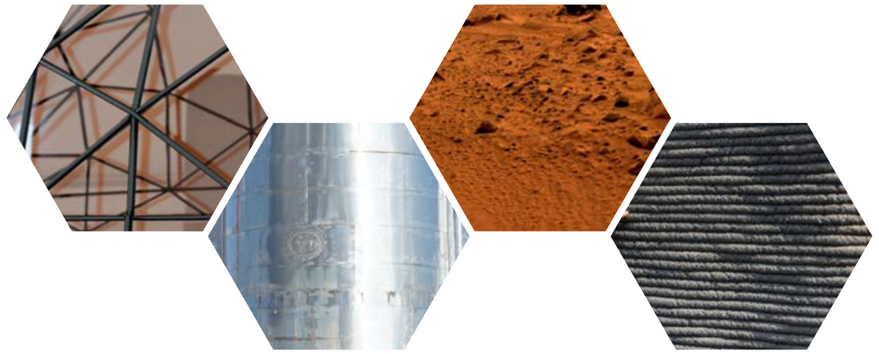


FIGURE 92 | SPACE TRAVEL EXHIBIT TEXTURES

Directing each exhibit space toward a different learning environment philosophy allows for a range of learning experiences. The climate change exhibit follows an ecologically responsive learning philosophy that focuses on the interconnectivity of our world, our impact, and sustainable solutions. The floating city follows the experimentalism and existentialism learning philosophies by creating a flexible exhibit environment. The exhibit uses technology, like virtual reality, to create constantly changing possibilities and combinations of the user experience. The exhibit aims to leave open-ended questions for visitors to consider these social movements to come. The space travel exhibit has a focus on a realism philosophy of learning, providing a multi-sensory space with a diverse texture pallet and media integration. Figure 92 highlights some of these textures as they are used to create soft and hard play areas.

2 Better understand how architectural form and elements can enhance child engagement within a space.

The understanding of scale and the proportions of children was emphasized through the project design. As seen through Figure 93, more personal, intimate spaces are achieved by lowering ceiling heights and breaking down spatial volumes.

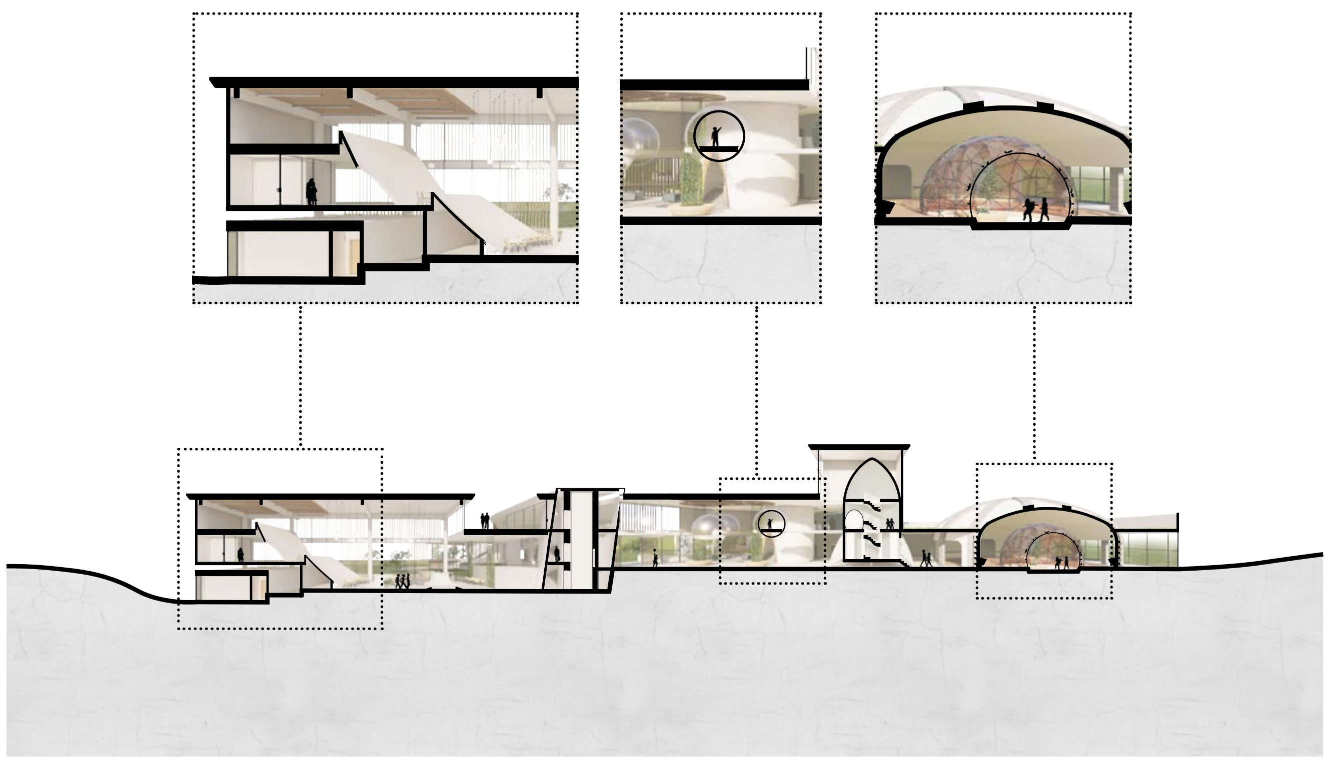


FIGURE 93 | SECTION A: RESPONSE TO SCALE

3 Form spaces that prepare children for situations that are currently unknown.

The project program is derived from predicted futuristic situations, including social and cultural changes and advancements in technology. Although the exhibits offer specific scenarios, the experience targets soft, transferable skills that aim to create a more flexible, resilient generation for whatever their world might look like. Technology integration and collaboration opportunities are a couple of the ways these spaces accomplish this.

4 Produce an environmentally conscious project through integration of sustainable strategies.

To achieve an environmentally conscious project and promote the well-being of occupants, LEED Gold is predicted to be achieved through the project. Figure 94 shows the LEED score card and point distributions the final design aims to attain.

LEED v4.1 BD+C
Project Checklist

Y			
1	Credit	Integrative Process	1

10	Location and Transportation		16
0	Credit	LEED for Neighborhood Development Location	16
1	Credit	Sensitive Land Protection	1
1	Credit	High Priority Site and Equitable Development	2
2	Credit	Surrounding Density and Diverse Uses	5
3	Credit	Access to Quality Transit	5
1	Credit	Bicycle Facilities	1
1	Credit	Reduced Parking Footprint	1
1	Credit	Electric Vehicles	1

10	Sustainable Sites		10
Y	Prereq	Construction Activity Pollution Prevention	Required
1	Credit	Site Assessment	1
2	Credit	Protect or Restore Habitat	2
1	Credit	Open Space	1
3	Credit	Rainwater Management	3
2	Credit	Heat Island Reduction	2
1	Credit	Light Pollution Reduction	1

7	Water Efficiency		11
Y	Prereq	Outdoor Water Use Reduction	Required
Y	Prereq	Indoor Water Use Reduction	Required
Y	Prereq	Building-Level Water Metering	Required
1	Credit	Outdoor Water Use Reduction	2
4	Credit	Indoor Water Use Reduction	6
1	Credit	Optimize Process Water Use	2
1	Credit	Water Metering	1

18	Energy and Atmosphere		33
Y	Prereq	Fundamental Commissioning and Verification	Required
Y	Prereq	Minimum Energy Performance	Required
Y	Prereq	Building-Level Energy Metering	Required
Y	Prereq	Fundamental Refrigerant Management	Required
4	Credit	Enhanced Commissioning	6
9	Credit	Optimize Energy Performance	18
1	Credit	Advanced Energy Metering	1
0	Credit	Grid Harmonization	2
3	Credit	Renewable Energy	5
1	Credit	Enhanced Refrigerant Management	1

FIGURE 94 | LEED SCORE CARD

10	Materials and Resources		13
Y	Prereq	Storage and Collection of Recyclables	Required
3	Credit	Building Life-Cycle Impact Reduction	5
2	Credit	Environmental Product Declarations	2
2	Credit	Sourcing of Raw Materials	2
2	Credit	Material Ingredients	2
1	Credit	Construction and Demolition Waste Management	2

14	Indoor Environmental Quality		16
Y	Prereq	Minimum Indoor Air Quality Performance	Required
Y	Prereq	Environmental Tobacco Smoke Control	Required
2	Credit	Enhanced Indoor Air Quality Strategies	2
3	Credit	Low-Emitting Materials	3
1	Credit	Construction Indoor Air Quality Management Plan	1
2	Credit	Indoor Air Quality Assessment	2
1	Credit	Thermal Comfort	1
1	Credit	Interior Lighting	2
2	Credit	Daylight	3
1	Credit	Quality Views	1
1	Credit	Acoustic Performance	1

0	Innovation		6
0	Credit	Innovation	5
0	Credit	LEED Accredited Professional	1

4	Regional Priority		4
1	Credit	Regional Priority: Specific Credit	1
1	Credit	Regional Priority: Specific Credit	1
1	Credit	Regional Priority: Specific Credit	1
1	Credit	Regional Priority: Specific Credit	1

74	TOTALS	Possible Points:	110

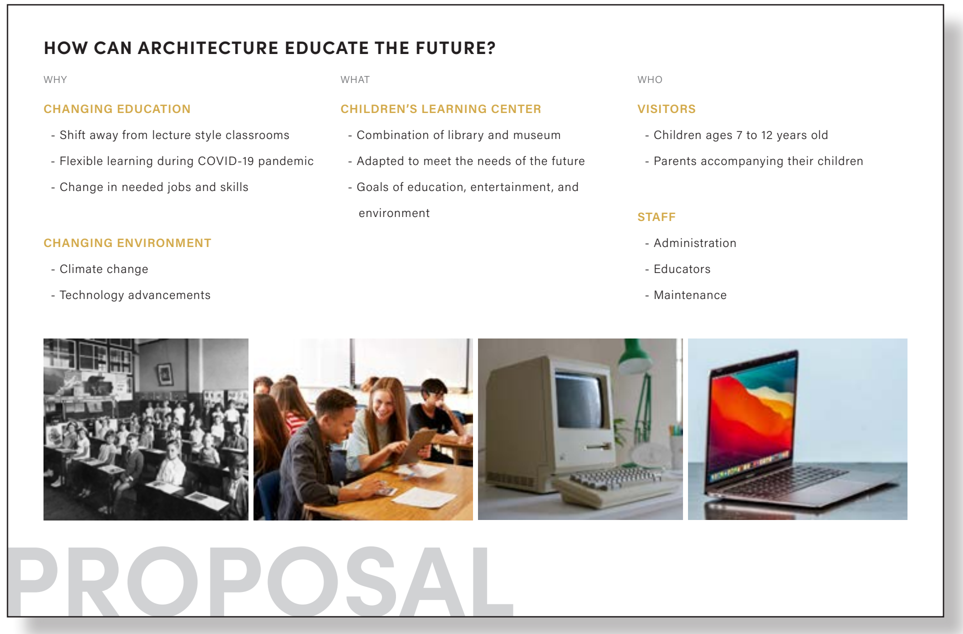
Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

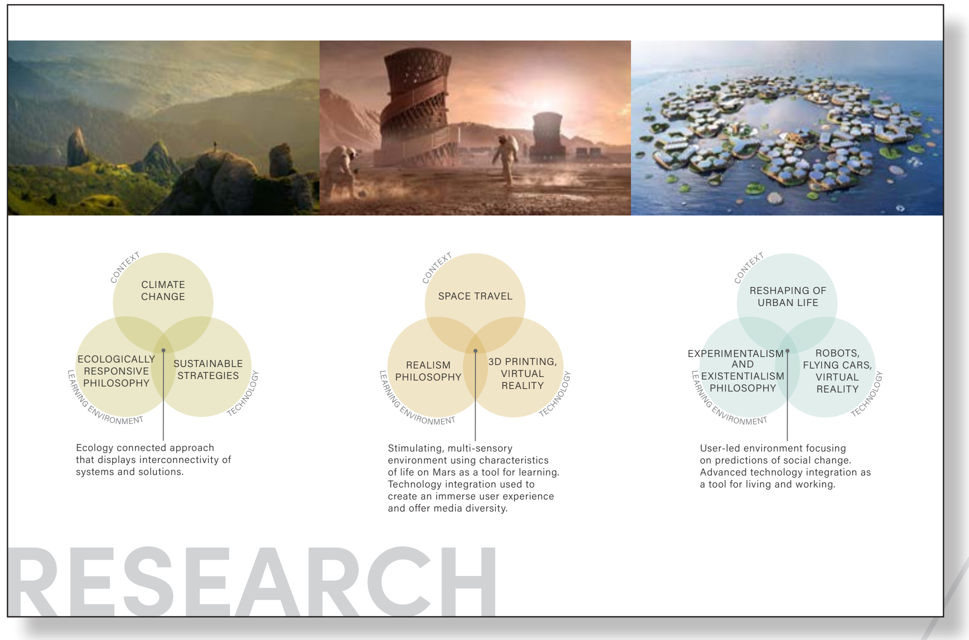
FIGURE 94 | LEED SCORE CARD

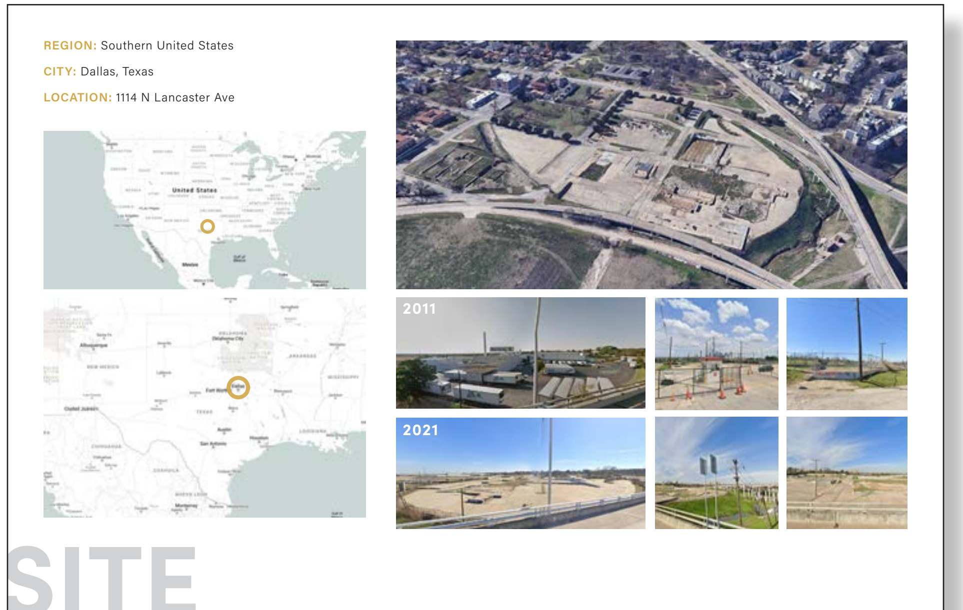
CRITIQUE OF APPLIED RESEARCH METHODS

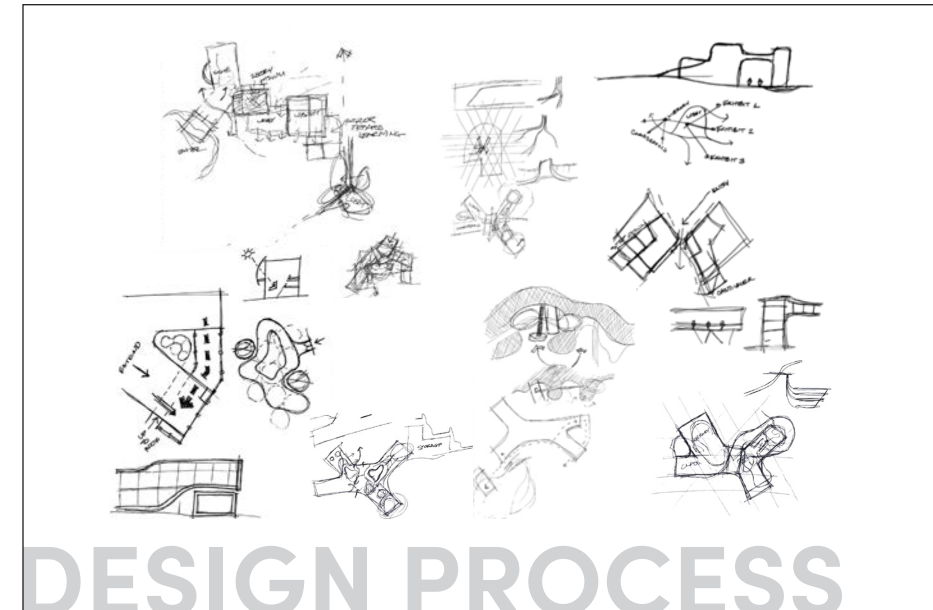
The research methods used provided an excellent understanding of learning environment design, as well as a glimpse of the potential challenges and changes society may experience. The typological research explained design as it relates to the learning experience. It would have been beneficial to hear from the users of these spaces to understand the effectiveness of the design strategies. The diversity of professional opinions in the literature review and media research offered a well-rounded understanding of the concepts at hand. Futurists, designers, storytellers, and other professionals pieced together a view of the future and the impact it will have on a future generation.

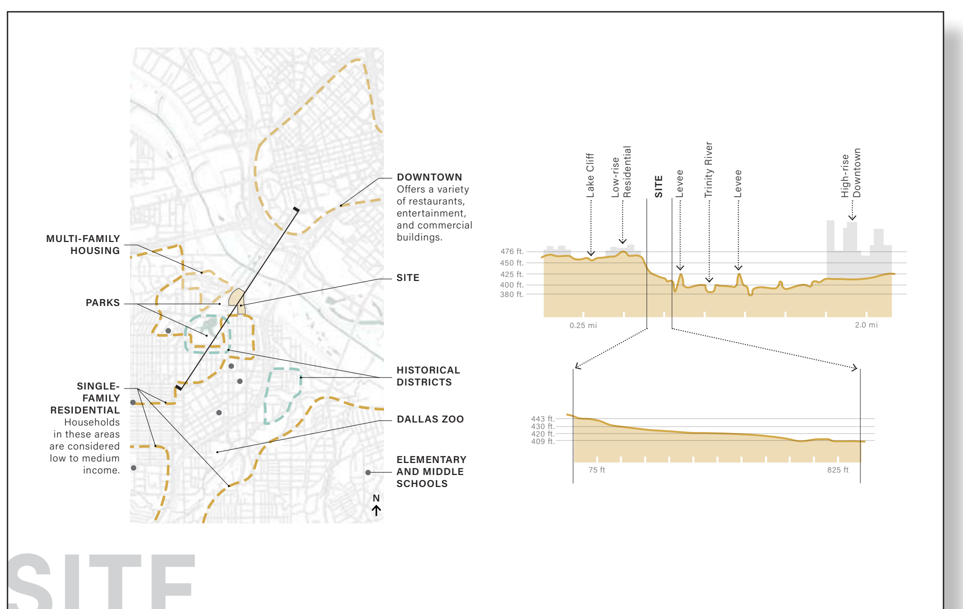
DIGITAL PRESENTATION

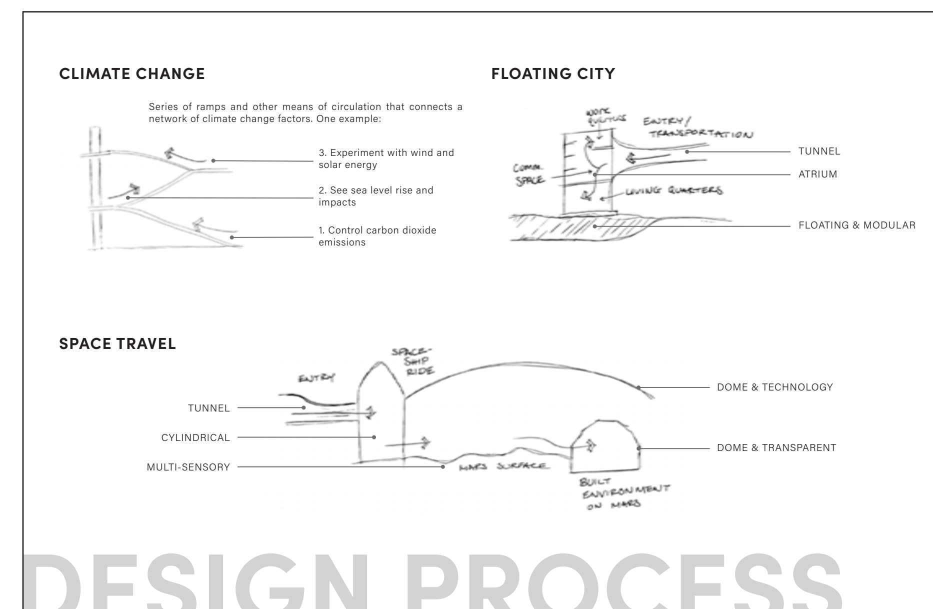


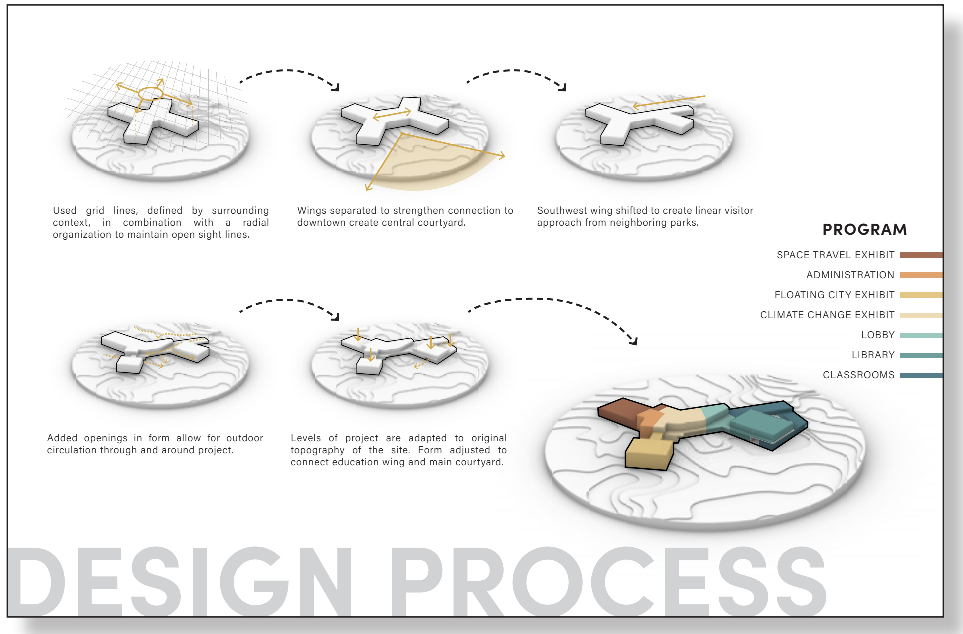


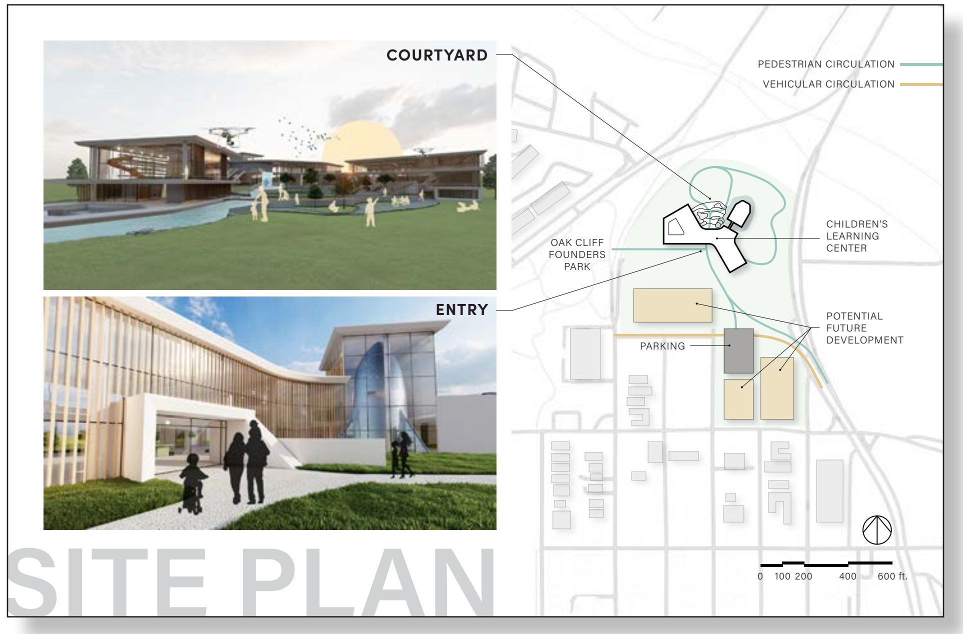

REGION: Southern United States
CITY: Dallas, Texas
LOCATION: 1114 N Lancaster Ave
2011
2021
SITE

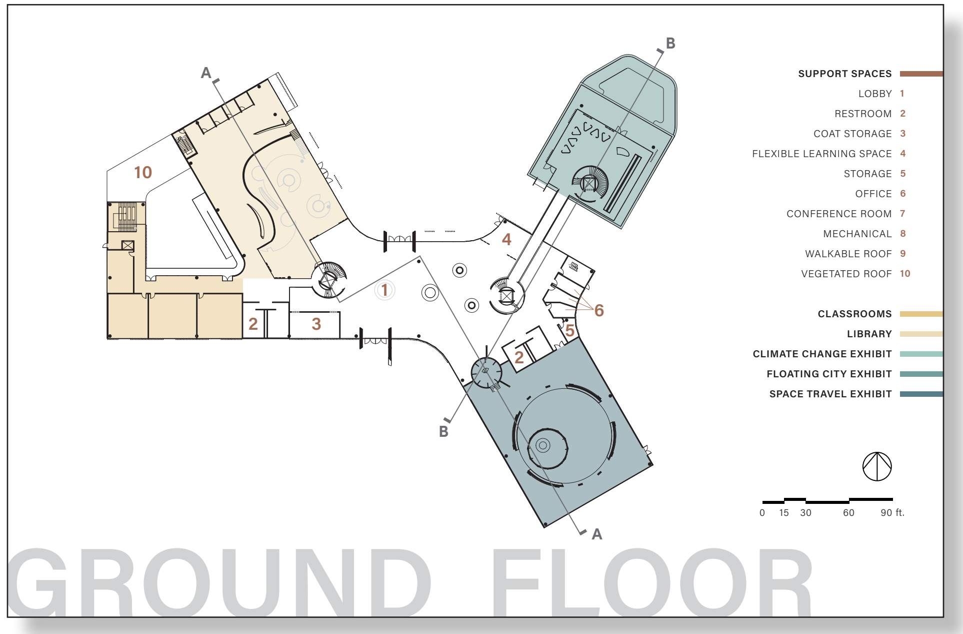

DESIGN PROCESS

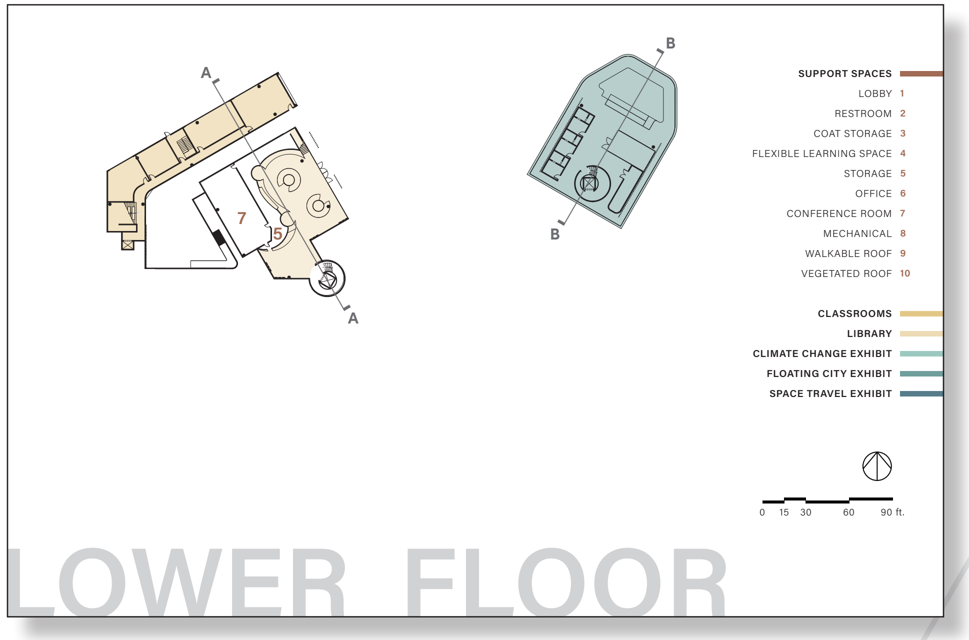

MULTI-FAMILY HOUSING
PARKS
SINGLE-FAMILY RESIDENTIAL
Households in these areas are considered low to medium income.
DOWNTOWN
Offers a variety of restaurants, entertainment, and commercial buildings.
SITE
HISTORICAL DISTRICTS
DALLAS ZOO
ELEMENTARY AND MIDDLE SCHOOLS
N
Lake Cliff
Low-rise Residential
SITE
Levee
Trinity River
Levee
High-rise Downtown
476 ft.
450 ft.
425 ft.
400 ft.
380 ft.
0.25 mi
2.0 mi
443 ft.
430 ft.
420 ft.
409 ft.
75 ft
825 ft
SITE

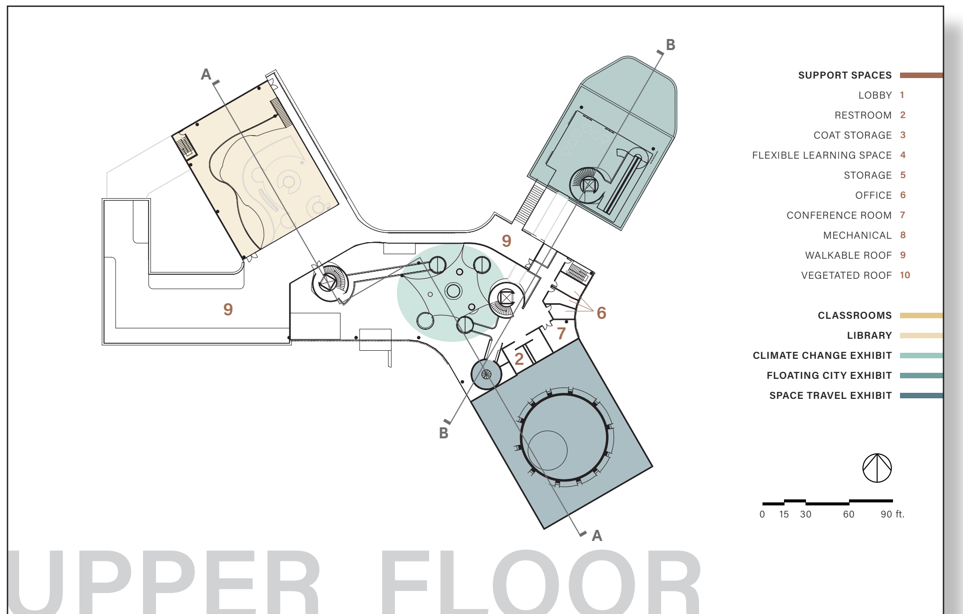

CLIMATE CHANGE
Series of ramps and other means of circulation that connects a network of climate change factors. One example:
3. Experiment with wind and solar energy
2. See sea level rise and impacts
1. Control carbon dioxide emissions
FLOATING CITY
ENTRY/ TRANSPORTATION
COMM. SPACE
LIVING QUARTERS
TUNNEL
ATRIUM
FLOATING & MODULAR
SPACE TRAVEL
ENTRY
SPACE-SHIP RIDE
TUNNEL
CYLINDRICAL
MULTI-SENSORY
MARS SURFACE
BUILT ENVIRONMENT ON MARS
DOME & TECHNOLOGY
DOME & TRANSPARENT
DESIGN PROCESS

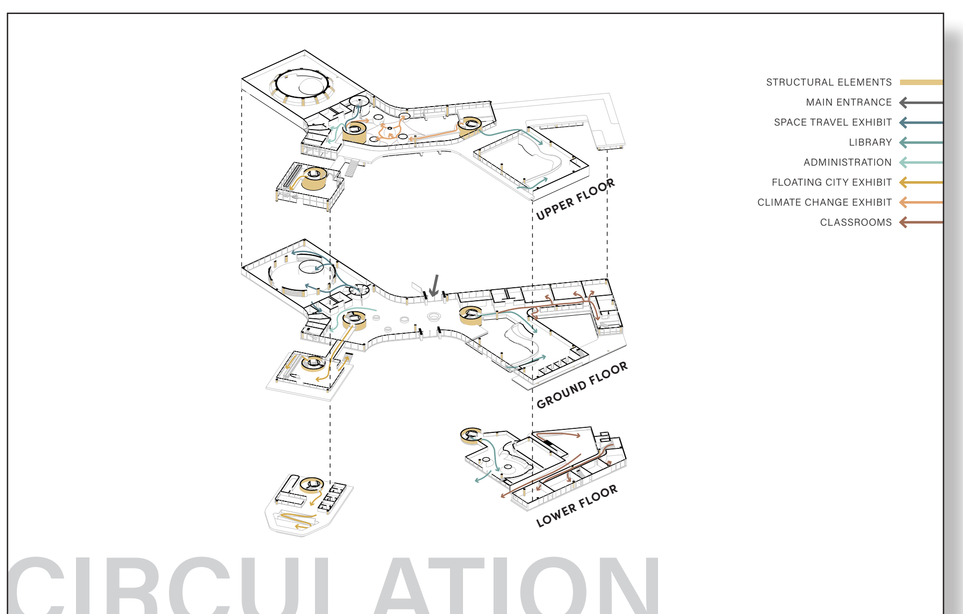

Used grid lines, defined by surrounding context, in combination with a radial organization to maintain open sight lines.
Wings separated to strengthen connection to downtown create central courtyard.
Southwest wing shifted to create linear visitor approach from neighboring parks.
PROGRAM
SPACE TRAVEL EXHIBIT
ADMINISTRATION
FLOATING CITY EXHIBIT
CLIMATE CHANGE EXHIBIT
LOBBY
LIBRARY
CLASSROOMS
Added openings in form allow for outdoor circulation through and around project.
Levels of project are adapted to original topography of the site. Form adjusted to connect education wing and main courtyard.
DESIGN PROCESS

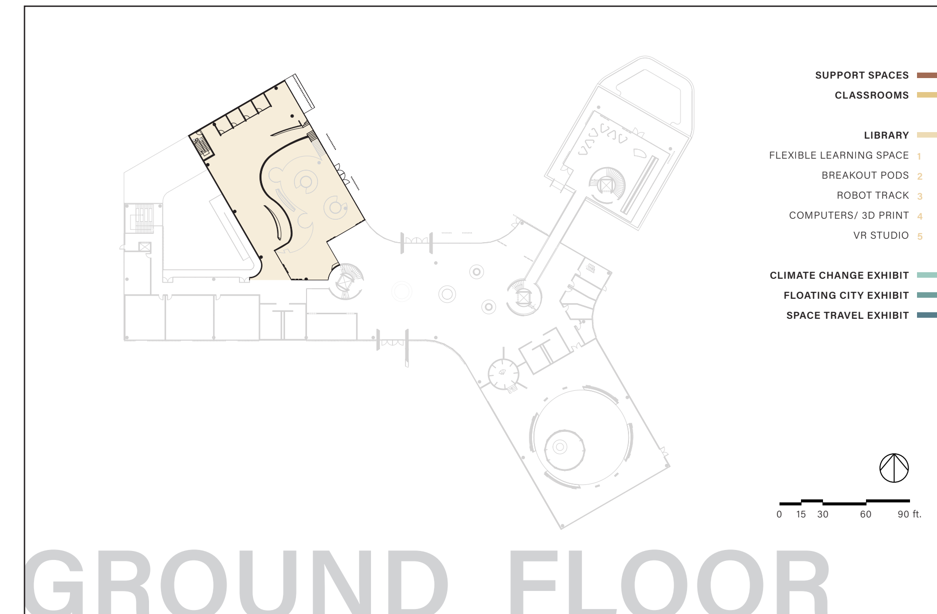

COURTYARD
ENTRY
PEDESTRIAN CIRCULATION
VEHICULAR CIRCULATION
OAK CLIFF FOUNDERS PARK
CHILDREN'S LEARNING CENTER
PARKING
POTENTIAL FUTURE DEVELOPMENT
0 100 200 400 600 ft.
SITE PLAN

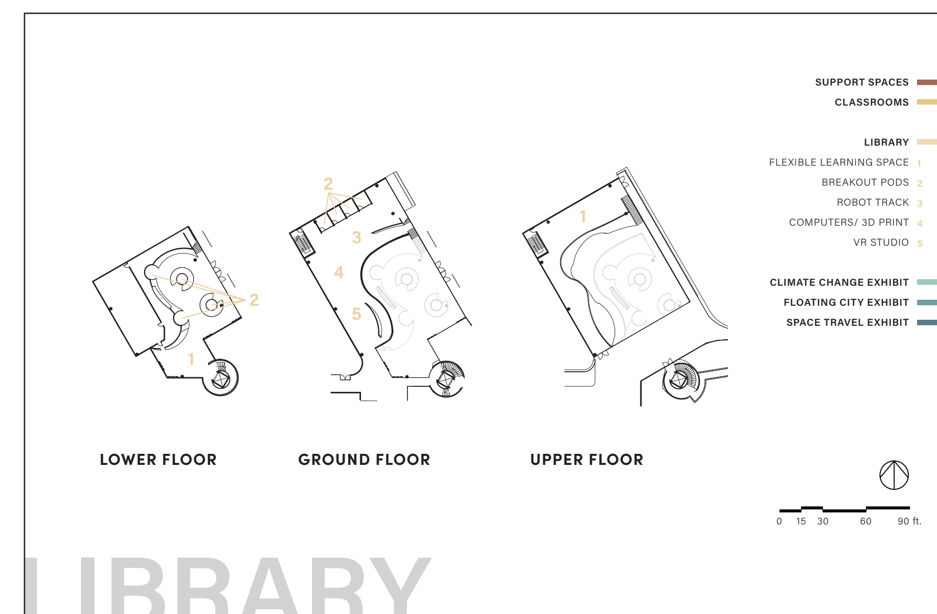

SUPPORT SPACES
LOBBY 1
RESTROOM 2
COAT STORAGE 3
FLEXIBLE LEARNING SPACE 4
STORAGE 5
OFFICE 6
CONFERENCE ROOM 7
MECHANICAL 8
WALKABLE ROOF 9
VEGETATED ROOF 10
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.
GROUND FLOOR


SUPPORT SPACES
LOBBY 1
RESTROOM 2
COAT STORAGE 3
FLEXIBLE LEARNING SPACE 4
STORAGE 5
OFFICE 6
CONFERENCE ROOM 7
MECHANICAL 8
WALKABLE ROOF 9
VEGETATED ROOF 10
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.
LOWER FLOOR

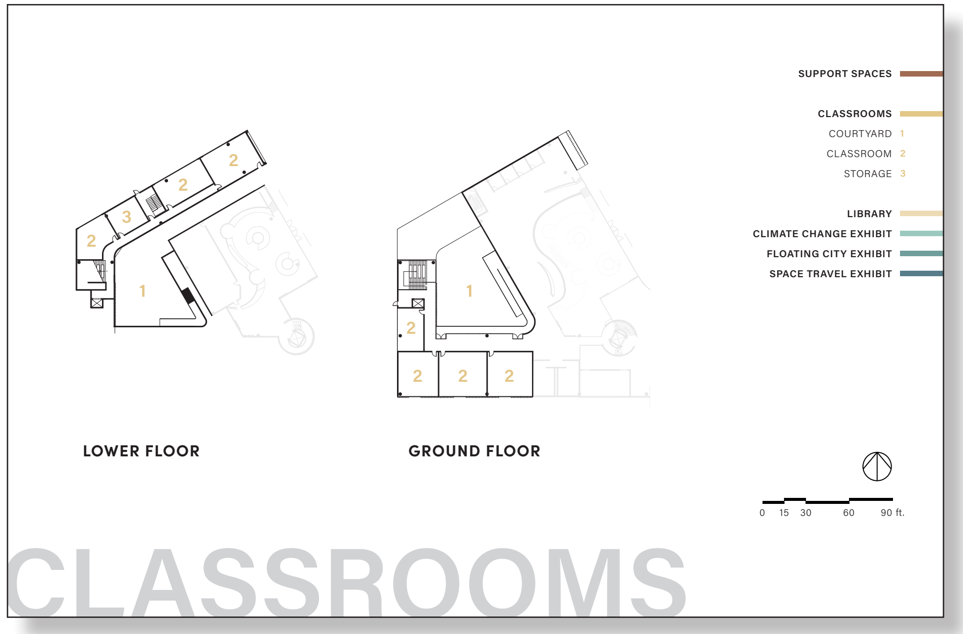

UPPER FLOOR
SUPPORT SPACES
LOBBY 1
RESTROOM 2
COAT STORAGE 3
FLEXIBLE LEARNING SPACE 4
STORAGE 5
OFFICE 6
CONFERENCE ROOM 7
MECHANICAL 8
WALKABLE ROOF 9
VEGETATED ROOF 10
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.

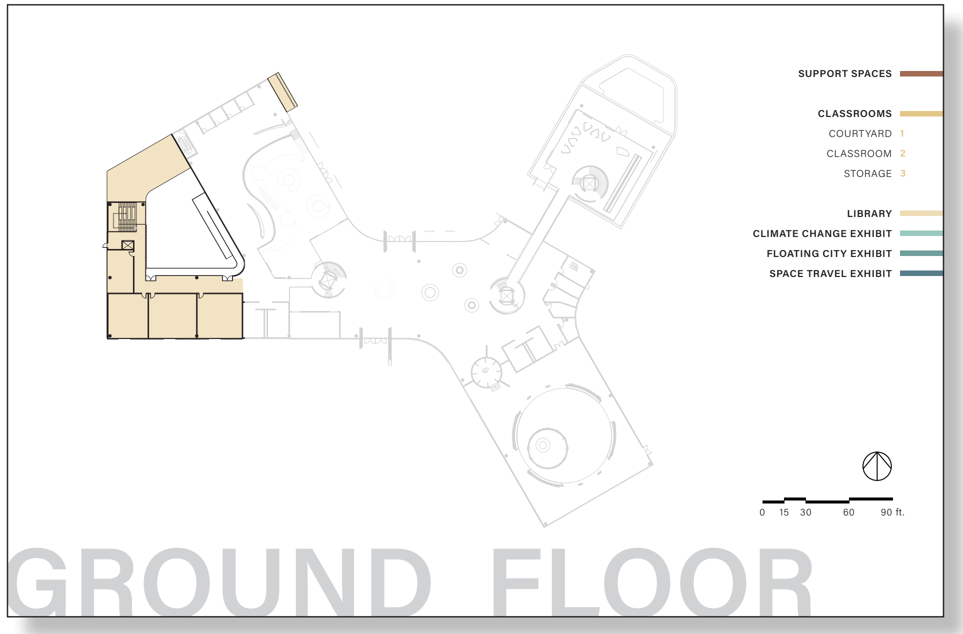

CIRCULATION
STRUCTURAL ELEMENTS
MAIN ENTRANCE
SPACE TRAVEL EXHIBIT
LIBRARY
ADMINISTRATION
FLOATING CITY EXHIBIT
CLIMATE CHANGE EXHIBIT
CLASSROOMS
UPPER FLOOR
GROUND FLOOR
LOWER FLOOR


GROUND FLOOR
SUPPORT SPACES
CLASSROOMS
LIBRARY
FLEXIBLE LEARNING SPACE 1
BREAKOUT PODS 2
ROBOT TRACK 3
COMPUTERS/ 3D PRINT 4
VR STUDIO 5
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.

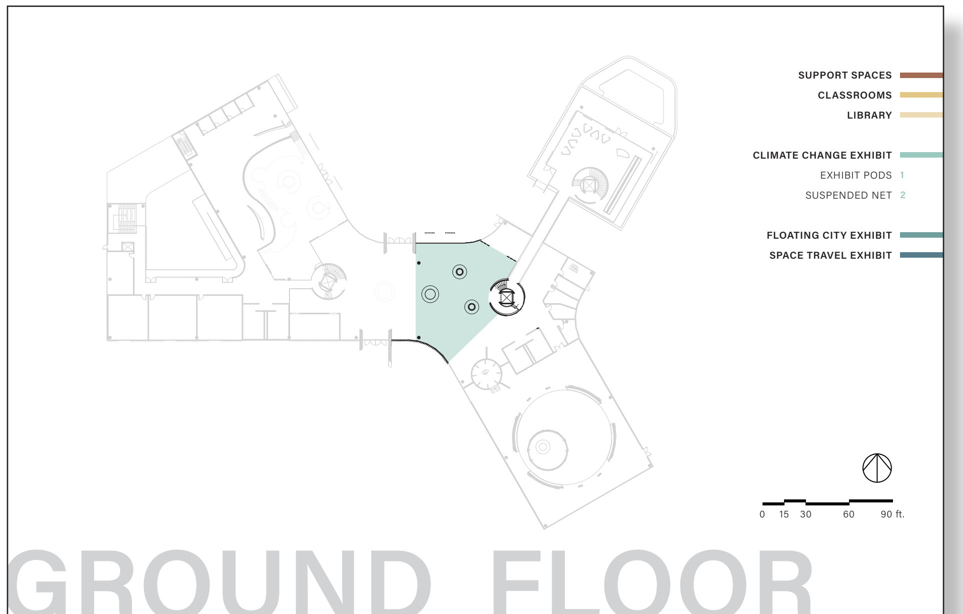

LIBRARY
SUPPORT SPACES
CLASSROOMS
LIBRARY
FLEXIBLE LEARNING SPACE 1
BREAKOUT PODS 2
ROBOT TRACK 3
COMPUTERS/ 3D PRINT 4
VR STUDIO 5
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
LOWER FLOOR
GROUND FLOOR
UPPER FLOOR
0 15 30 60 90 ft.


LIBRARY

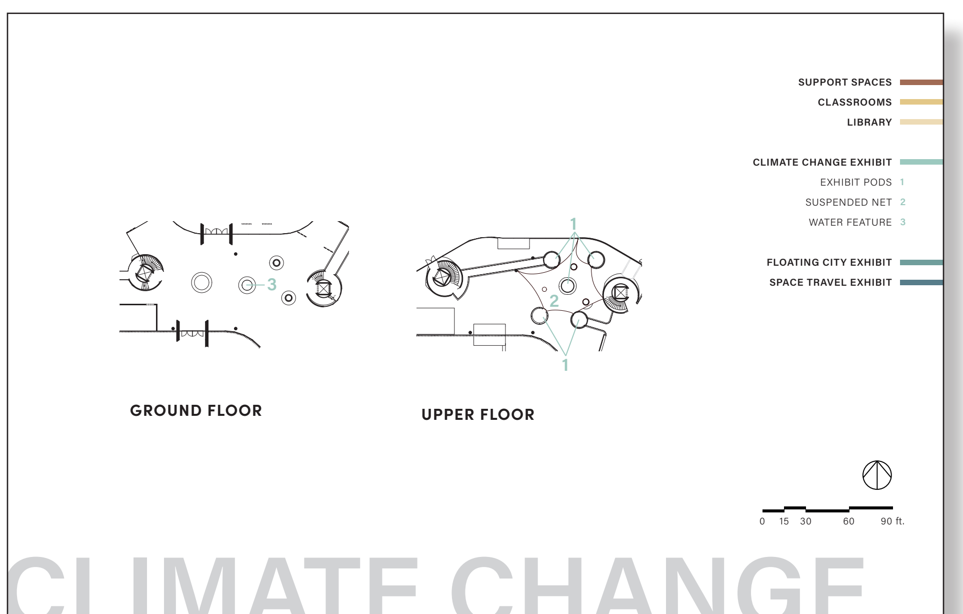

SUPPORT SPACES
CLASSROOMS
COURTYARD 1
CLASSROOM 2
STORAGE 3
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
LOWER FLOOR
GROUND FLOOR
0 15 30 60 90 ft.
CLASSROOMS

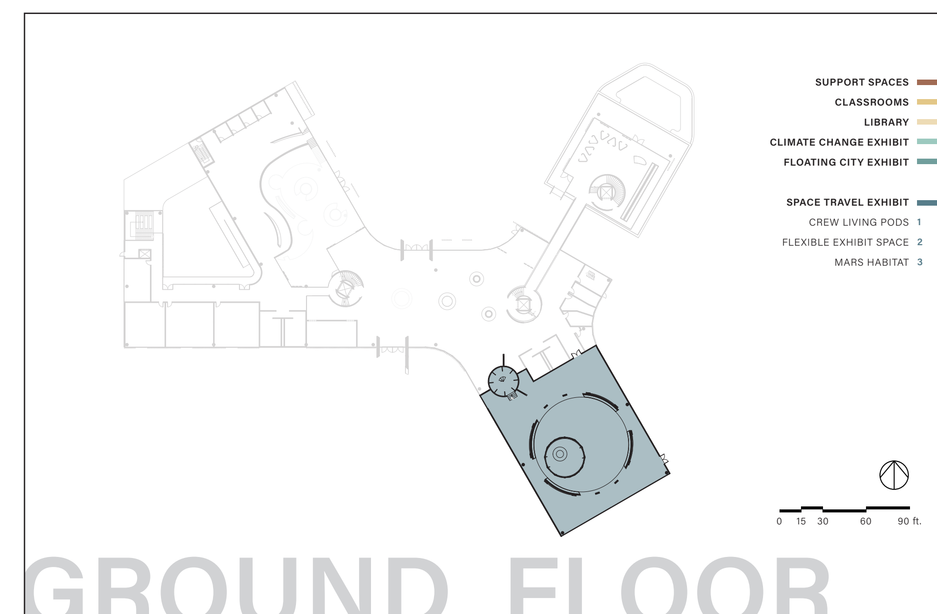

SUPPORT SPACES
CLASSROOMS
COURTYARD 1
CLASSROOM 2
STORAGE 3
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.
GROUND FLOOR

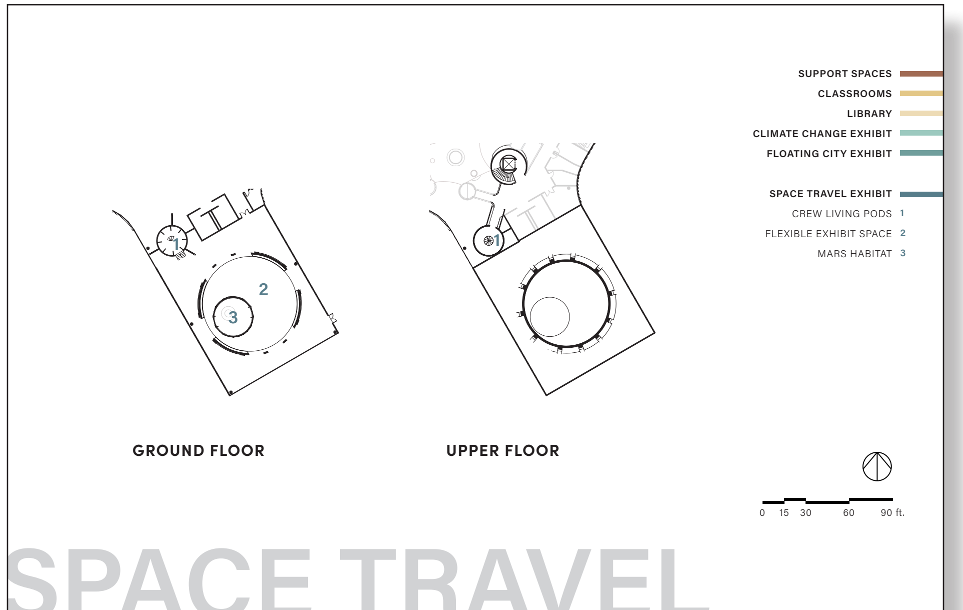

CLASSROOMS


SUPPORT SPACES
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
EXHIBIT PODS 1
SUSPENDED NET 2
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.
GROUND FLOOR

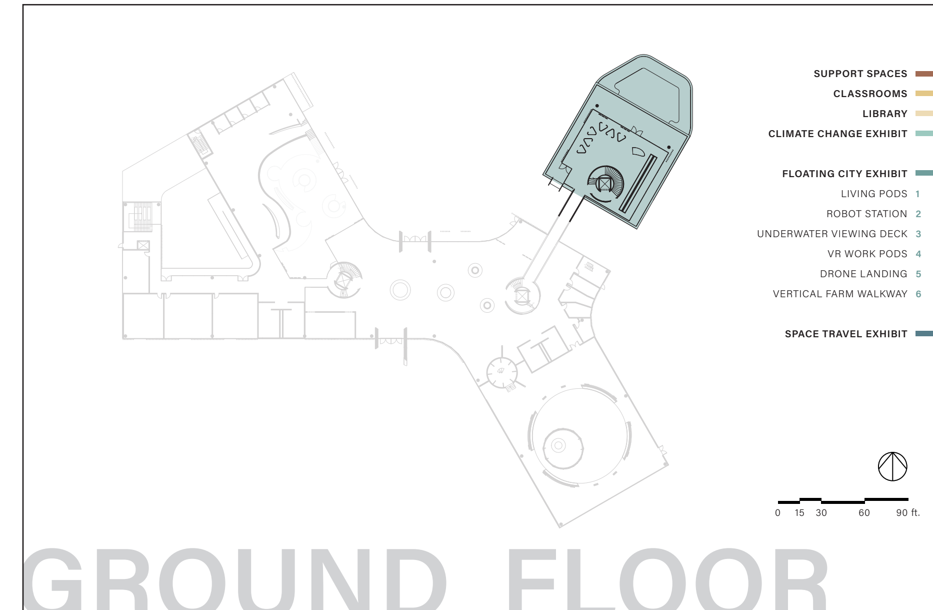

SUN
CLIMATE CHANGE

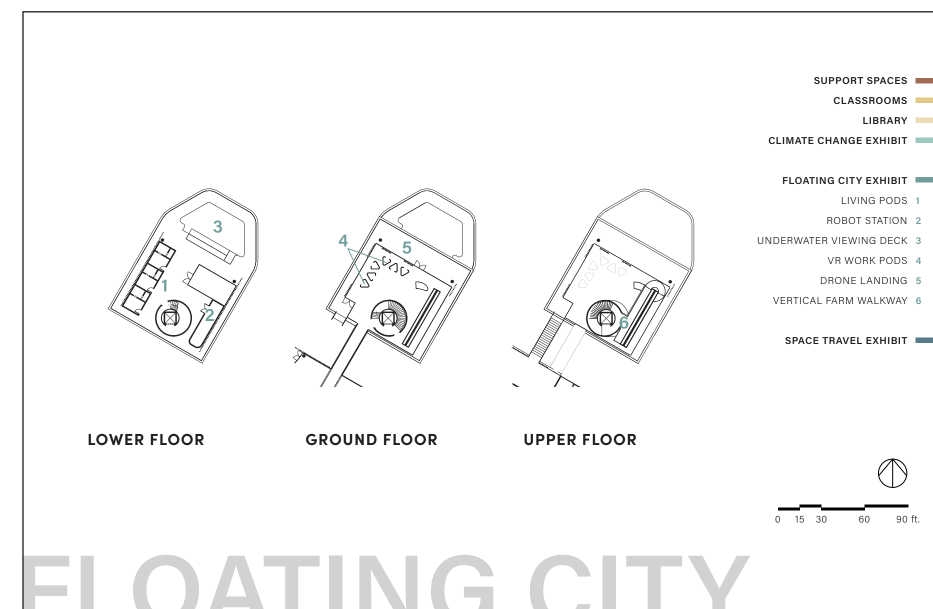

SUPPORT SPACES
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
EXHIBIT PODS 1
SUSPENDED NET 2
WATER FEATURE 3
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
GROUND FLOOR
UPPER FLOOR
0 15 30 60 90 ft.
CLIMATE CHANGE


SUPPORT SPACES
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
CREW LIVING PODS 1
FLEXIBLE EXHIBIT SPACE 2
MARS HABITAT 3
0 15 30 60 90 ft.
GROUND FLOOR

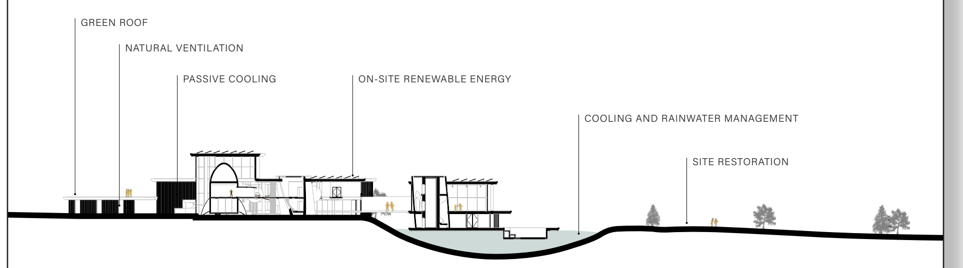

SUPPORT SPACES
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
SPACE TRAVEL EXHIBIT
CREW LIVING PODS 1
FLEXIBLE EXHIBIT SPACE 2
MARS HABITAT 3
GROUND FLOOR
UPPER FLOOR
0 15 30 60 90 ft.
SPACE TRAVEL


SPACE TRAVEL

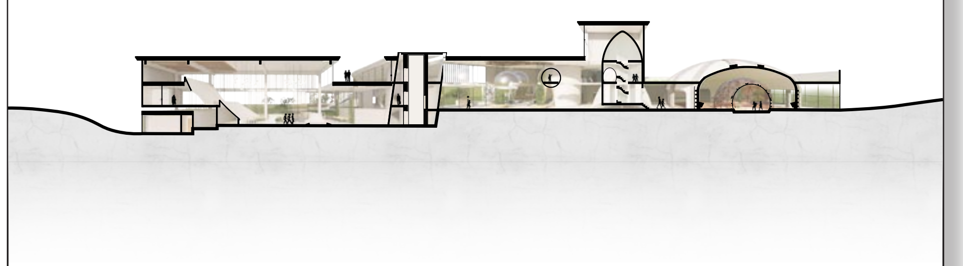

SUPPORT SPACES
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
LIVING PODS 1
ROBOT STATION 2
UNDERWATER VIEWING DECK 3
VR WORK PODS 4
DRONE LANDING 5
VERTICAL FARM WALKWAY 6
SPACE TRAVEL EXHIBIT
0 15 30 60 90 ft.
GROUND FLOOR


SUPPORT SPACES
CLASSROOMS
LIBRARY
CLIMATE CHANGE EXHIBIT
FLOATING CITY EXHIBIT
LIVING PODS 1
ROBOT STATION 2
UNDERWATER VIEWING DECK 3
VR WORK PODS 4
DRONE LANDING 5
VERTICAL FARM WALKWAY 6
SPACE TRAVEL EXHIBIT
LOWER FLOOR
GROUND FLOOR
UPPER FLOOR
0 15 30 60 90 ft.
FLOATING CITY

FLOATING CITY



SUSTAINABILITY



SECTION

THANK YOU

PROJECT INSTALLATION

FIGURE 95 | PROJECT INSTALLATION

APPENDIX

REFERENCE LIST

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PREVIOUS DESIGN STUDIO EXPERIENCE

SECOND YEAR

2018 Fall - Professor Darryl Booker

Projects: Breathing Room (Moorhead, Minnesota)

Boathouse (Minneapolis, Minnesota)

2019 Spring - Professor Charlott Greub

Projects: Single Family Dwelling (Cripple Creek, CO)

Mixed-use Complex (Moorhead, Minnesota)

THIRD YEAR

2019 Fall - Professor Bakr Aly Ahmed

Projects: Olympic Aquatic Stadium (Los Angeles, CA)

Beach Resort (Manarola, Italy)

2020 Spring - Professor Regin Schwaen

Projects: Single Family Dwelling (Fargo, North Dakota)

Landscraper (Bismarck, North Dakota)

FOURTH YEAR

2020 Fall - Professor Cindy Urness

Project: High-rise (Miami, Florida)

2021 Spring - Professor Mark Barnhouse

Projects: Single Family Dwelling (Fargo, North Dakota)

Sponge City Urban Design (Miami, Florida)

FIFTH YEAR

2021 Fall - Professor Ganapathy Mahalingam

Project: Concert Hall (Moorhead, Minnesota)