



MODULAR MONTESSORI

EDUCATING TOWARDS ECOLOGICAL SUSTAINABILITY

ARCHITECTURE THESIS
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SIGNATURE PAGE

MODULAR MONTESSORI: EDUCATING TOWARDS ECOLOGICAL SUSTAINABILITY

A Design Thesis Submitted to the Department of
Architecture and Landscape Architecture of North
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degree of Masters of Architecture



Primary Thesis Advisor



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This book and thesis project is dedicated to my late grandfather, Melvin Schmidt, who passed away on February 10, 2016. He always told me to do my best, and I would never regret it.

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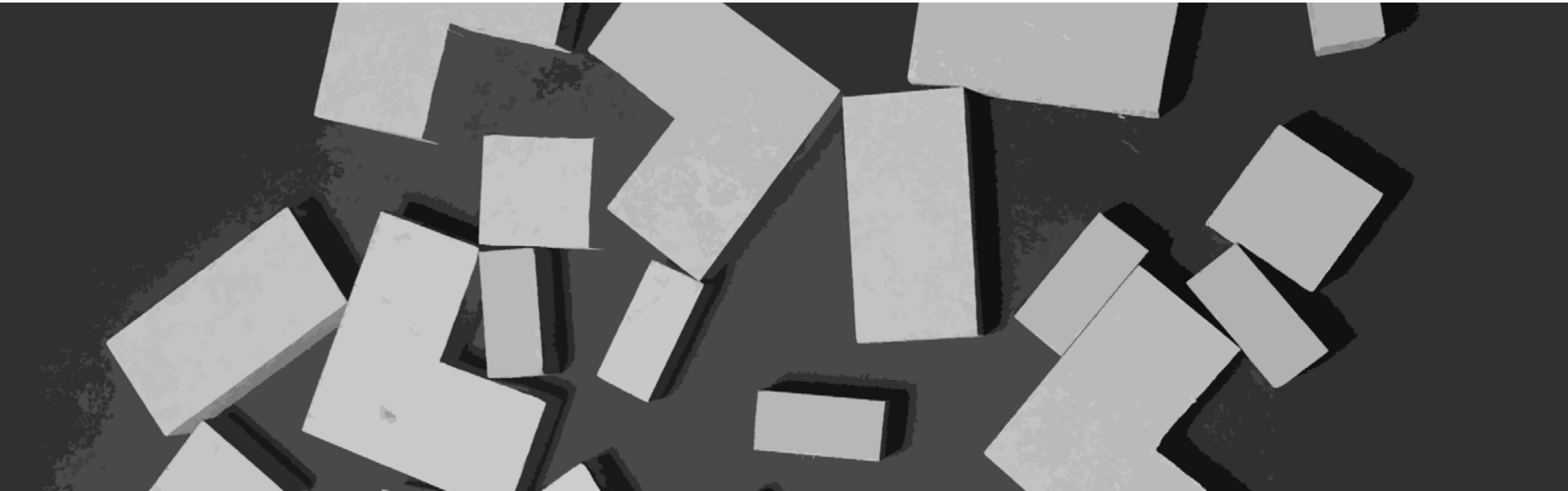
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ABSTRACT

The world has experienced rapid change in the last fifty years. Though most change can be counted as good, there has been a fair amount of negative changes happening that continue to be major issues today. Issues such as climate change and social differences are more than ever becoming issues that need to be addressed as significant threats to our continual existence as a culture. An opportunity exists right in front of us to help fix these problems: children. Our society's children hold the key to helping solve our world's greatest issues, and that key is their education. If education can take an Eco-literate approach to teaching our children about these issues, they will be more equipped to handle them as they grow older. Education, as well as the facilities that house these places of learning, must respond to the changing landscape of our environmental and social world and do their part to prepare our children to face these issues.

THESIS NARRATIVE

The following section will go into details about the direction that this design thesis will take. Topics discussed will discuss user groups, project justification, goals, and a research design plan. This is a pre-design look into the thesis development, and will be expanded upon as the thesis progresses.



THESIS NARRATIVE

STATEMENT

A sustainable future begins with educating our children. Lessons learned in early years of education have been proven to be responsible for molding much of how we view the world, and the opportunity this presents for teaching this world's issues is invaluable. An eco-literate approach to school design and curriculum would best prepare our children to handle the problems that they will face later in life by providing young children the opportunity to forge these relationships with the environment and others at an early age.

A CHANGING WORLD

In today's rapidly changing world, many issues have started to become more apparent than ever before. Social difference and acceptance, and environmental issues seem to plague our news and media on a daily basis, and these issues are only seeming to become more relevant. Even with the issues right in front of us, many of them are not getting addressed as urgently as they should. The decisions that are being made today on these issues will ultimately be the reality of the children who are being raised to have to deal with the repercussions once they are the leaders of this world. These issues will soon be their responsibility to address, and much of it is not their fault.

EDUCATION AS A TOOL

Nelson Mandela once said that "education is the most powerful tool you can use to change the world." The opportunity that primary education presents to handle the world's issues is invaluable. As children develop, the years spent in primary education (kindergarten through 5th grade) have been proven to be most influential on how they view the world. If we can use this as an opportunity to teach them how to be mindful of each other and the environment in a way that offers solutions to the mentioned issues, then we must take it. Currently, the educational model in the United States has been slow to adapt to what is most relevant to the world today.

ARCHITECTURE'S ROLE

The modern learning facility should be equipped to address what is most relevant to today's issues. An emphasis on collaborative, social, and environmental learning can provide children and users of the schools an opportunity to learn about what will be most influential on developing solutions for some of this world's pressing issues. Architecture must respond to this by finding a way to promote these lessons and respond to an ever changing world.

PROJECT TYPOLOGY & PRECEDENT

TYOLOGY

The design proposal is, essentially, a re-imagined idea of what a school portable classroom may be. These modular and portable classrooms and units will create a learning environment that promotes socially conscious learning techniques, enhanced emphasis on a connection to nature, and be affordable and flexible for public schools around the country. The Kit of Parts will consist of a classroom, flexible space, node, and corridors to connect them all together. Each piece has been carefully designed and programmed based off of achieving the goals of ecological sustainability and each has been influenced by the Montessori approach to learning and teaching.

PRECEDENTS

School portables exist all over the world, but few were examined as case studies for an ecologically sustainable model. A precedent analysis was conducted, however, on more permanent structures and school that exhibited positive ecological sustainability practices. Montessori Schools played a major role in the development of spaces and programming, so schools of this type were also examined.

Case studies that were examined are discussed later in this book with an analysis of the buildings and their programs that were beneficial to furthering this project. The specific examples are:

- Nature & Environment Learning Centre
- Nursery in the Park
- Farming Kindergarten



Example of a typical portable classroom located on a school yard.



PRECEDENT

ANALYSIS

Before design work is to begin, a thorough look into case study projects has been completed for similar programs. Many aspects were explored in each precedent, including a study on materiality, program, site, space, and scale. The following case studies will explore in depth some of these different focuses.

NATURE & ENVIRONMENT LEARNING CENTRE

PRECEDENT ONE:

PROJECT NAME:


NATURE & ENVIRONMENT LEARNING CENTER

LOCATION:

AMSTERDAM, THE NETHERLANDS

TPOLOGY:

ACADEMIC
PRIMARY SCHOOL
GREENHOUSE



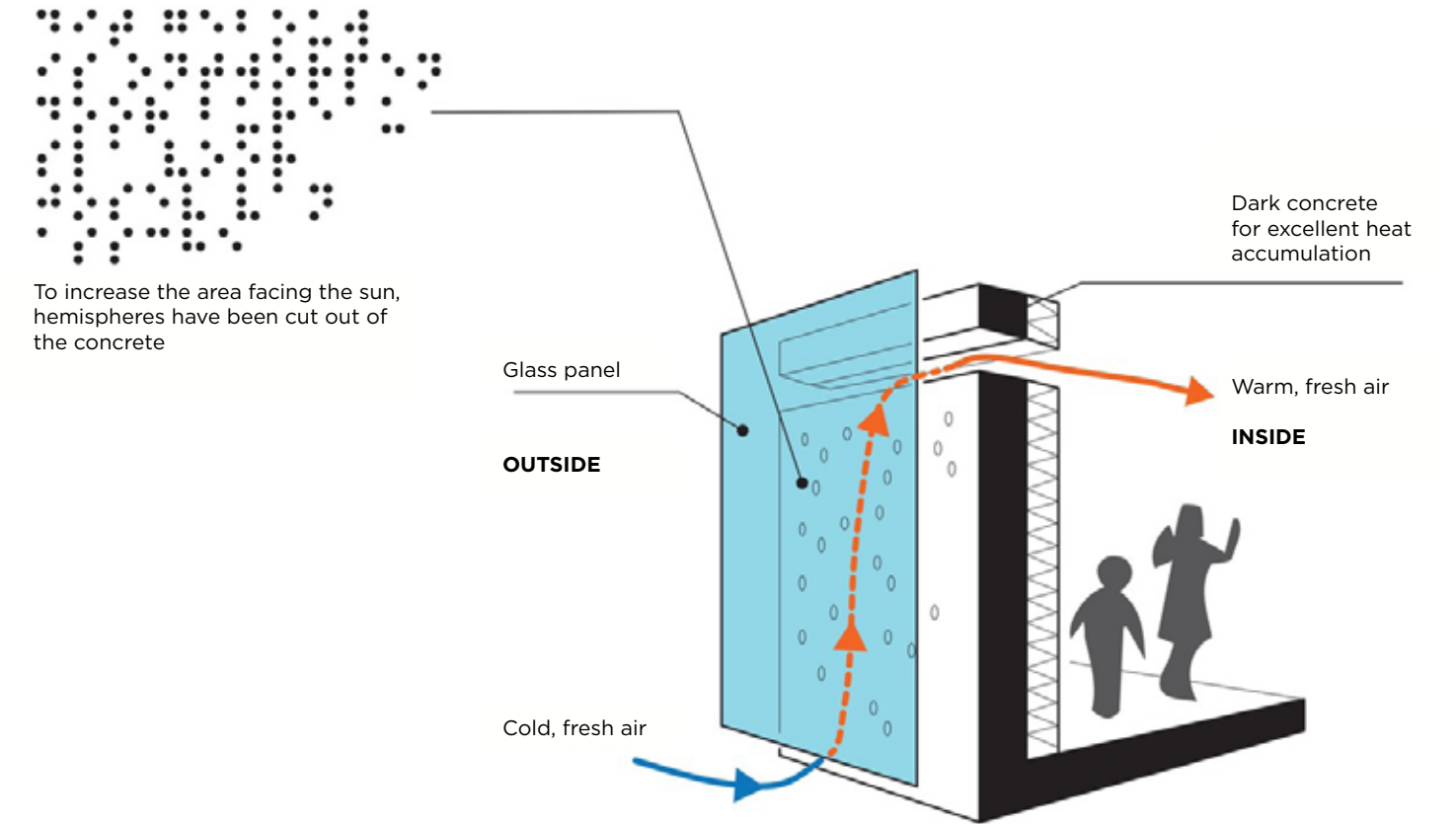
The Nature and Environment Learning Centre located in Amsterdam is a supplementary academic building for children in The Netherlands. All primary schools in Amsterdam have a special education program about nature and the environment. At this center, students are given a 6 m² garden in which they are to care for with the help of their classmates. This is to teach the children more than just how to grow a garden, but it also teaches collaboration, patience, respect for nature, and curiosity in a project-based learning environment. The building itself is also an example of sustainable learning as it is energy neutral, and contributes no harmful emissions to the environment.

MATERIALITY

Materiality at the Nature and Environment Learning Centre consists of a palette of concrete, wood, glass, and solar panels. The glass and concrete work together to create a sustainable approach to warming the building. Illustrated on the next page, the glass panel amplifies the solar radiation that hits the concrete wall which in turn acts as a trombe wall, storing and releasing hot air into the interior space.

CONCLUSIONS

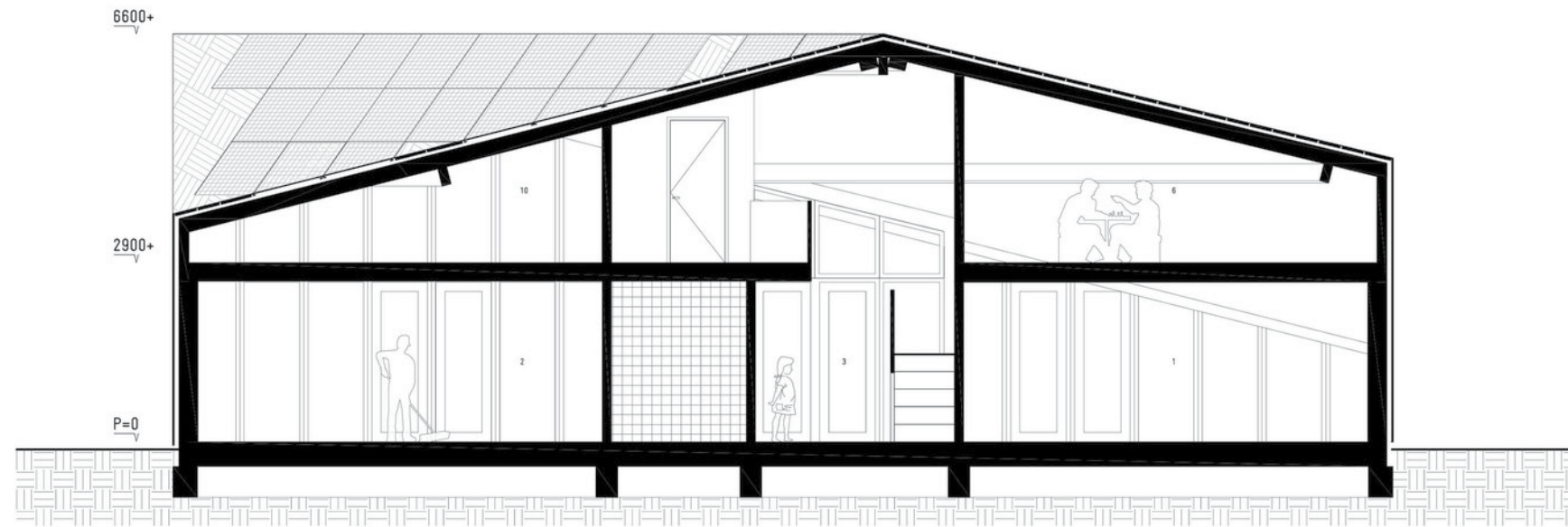
A material palette that works to make the building more sustainable is desirable. Natural tones and materials will make a more inviting, active space for all users.



SCALE

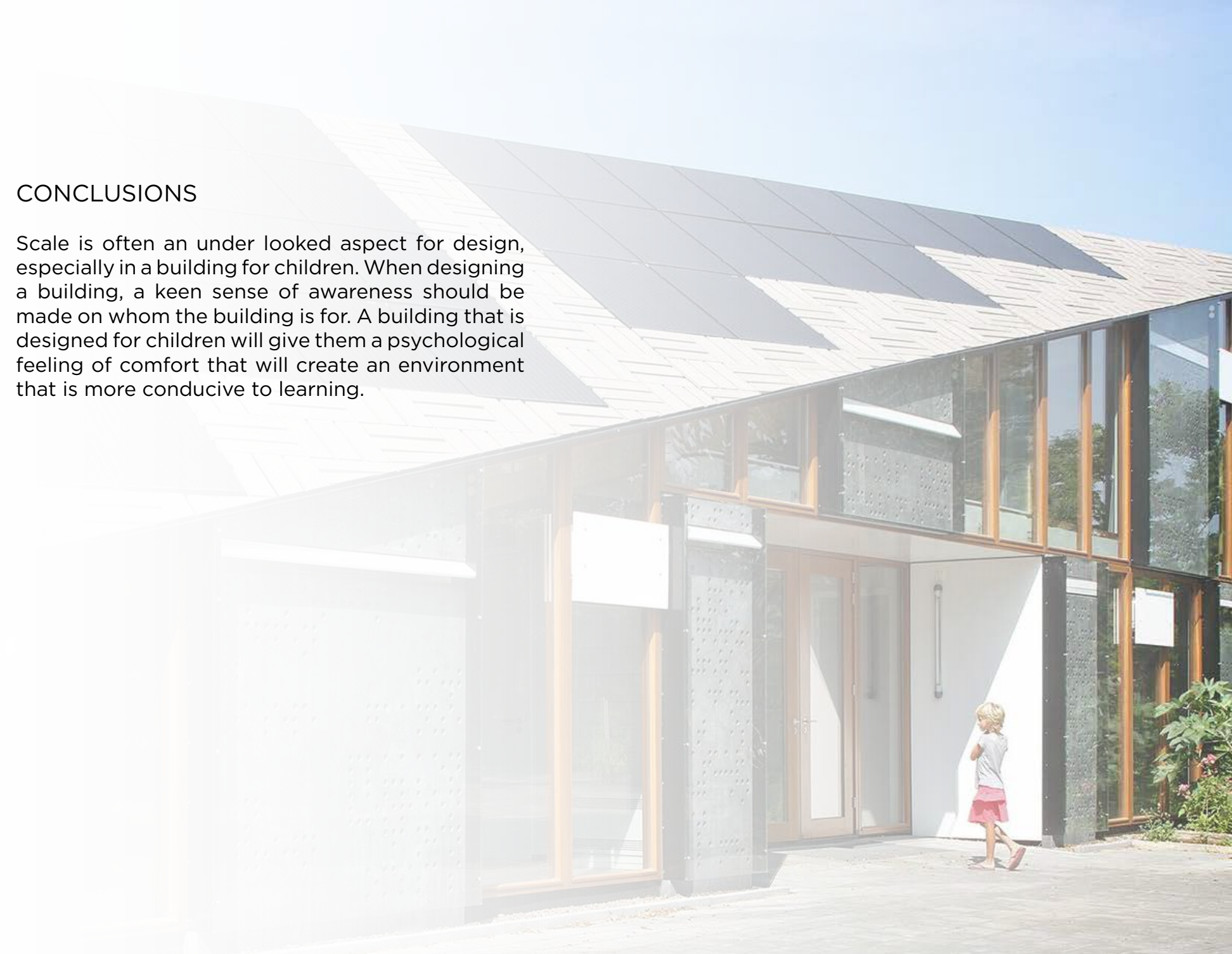
Human scale for a child is much different than for an adult. The Nature and Environment Learning Centre handles this condition quite well. The small footprint of the building gives a feeling of compactness to the project and the low ceiling heights in the classrooms of the second floor are more suitable for children.

This is also a strategy for a more sustainable building design, as a smaller building would have a smaller heating and cooling load compared to much larger education centers. A strong presence of child scale makes this center a more suitable of a learning space for children.



CONCLUSIONS

Scale is often an under looked aspect for design, especially in a building for children. When designing a building, a keen sense of awareness should be made on whom the building is for. A building that is designed for children will give them a psychological feeling of comfort that will create an environment that is more conducive to learning.





NURSERY IN THE PARK

PRECEDENT TWO:

PROJECT NAME:
NURSERY IN THE PARK

LOCATION:
ZARAGOZA, SPAIN

TPOLOGY:
ACADEMIC
CHILDCARE

Nursery in the Park is a childcare and elementary school in the growing city of Zaragoza, Spain. This community has seen a substantial rise in the population of children, however without much of an expansion in childcare facilities. This building, located in the heart of old town, provides an area for the youth to gather and learn in an environment that is closely connected to nature. The site around the school is heavily forested, creating an outdoor oasis in the heart of the city. With green features such as an accessible green roof, children are taught early the benefits of connecting with the natural environment.



PLAYFULNESS

Playfulness, especially in a building designed for children, is crucial. Children are curious, and often their curiosity is when they discover and learn the most about the world. The materials and colors used in the building have been thoroughly thought out to be interactive and intriguing for the children. Bursts of translucent color makes the windows glow, contrasting with the stark whiteness of the walls surrounding the windows. Circular windows in the play space are to remind the children of bubbles floating into the sky while also bringing in light into the area. A building that is playful and fun will help engage the children and make them want to stay there.

CONCLUSIONS

Using playfulness in a building for children is important. This goes back to discussing scale, and who the building is designed for. A child does not care if the building is functional and smart, they care about whether it is fun. Colors, shapes, objects, feelings, and much more should be implemented in a building that is designed for children.



FARMING KINDERGARTEN

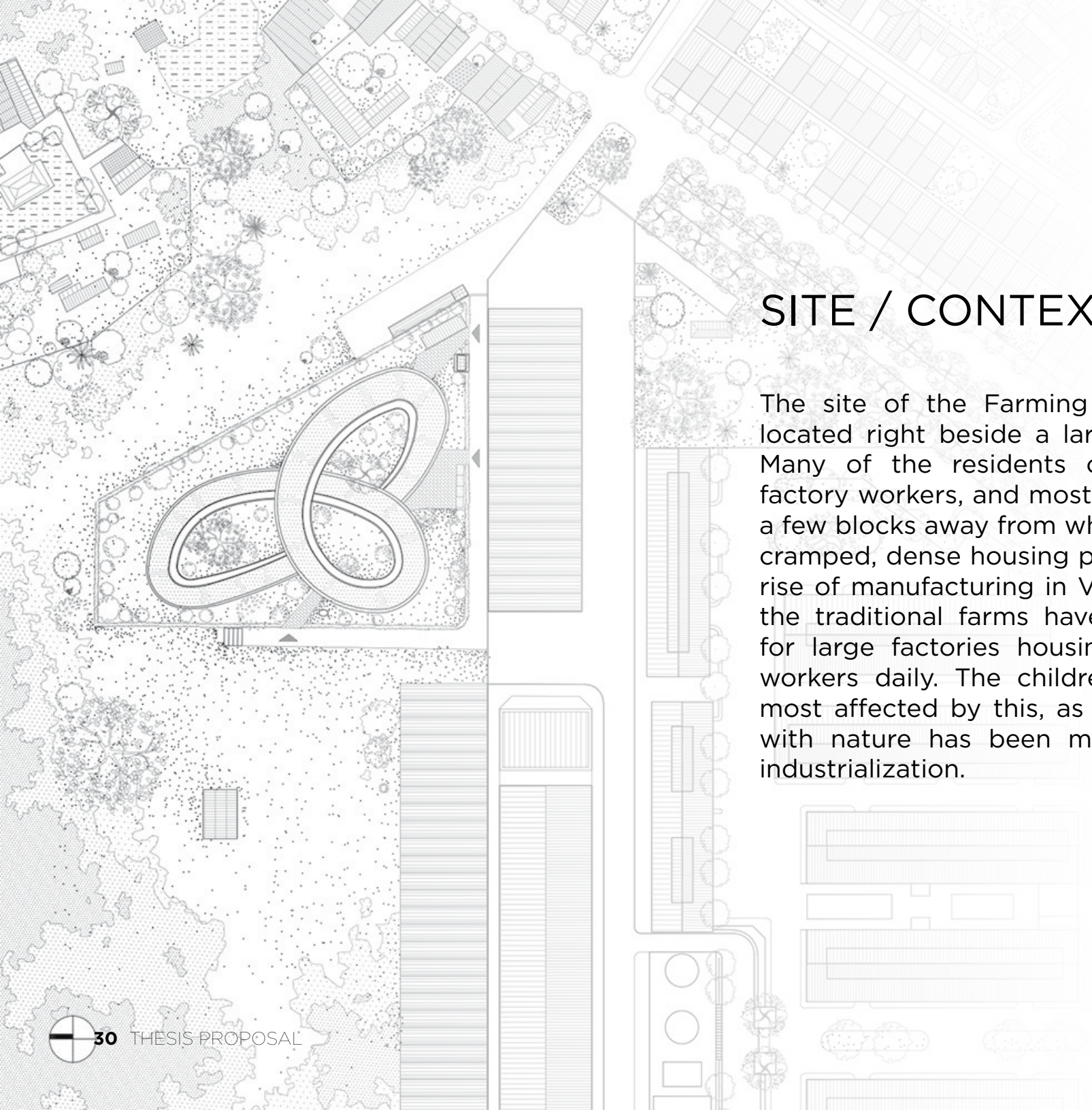
PRECEDENT THREE:

PROJECT NAME:
FARMING KINDERGARTEN

LOCATION:
Biên Hòa, Dong Nai, Vietnam

TYOLOGY:
ACADEMIC
PRIMARY SCHOOL

Vietnam is a country of change. Historically, it has been mainly an agricultural country, however manufacturing has quickly transformed everything. Farmland all over the country has become transformed into manufacturing plants with little green space for children to enjoy and play in. The Farming Kindergarten was created to reconnect children in a highly industrial area to nature and the lessons taught in traditional gardening and farming.



SITE / CONTEXT

The site of the Farming Kindergarten is located right beside a large shoe factory. Many of the residents of the area are factory workers, and most of them live just a few blocks away from where they work in cramped, dense housing projects. With the rise of manufacturing in Vietnam, much of the traditional farms have been removed for large factories housing thousands of workers daily. The children are the ones most affected by this, as their connection with nature has been minimized due to industrialization.

Farming Kindergarten can be seen as an oasis in an ever increasing industrial scene in Vietnam. The lawns are large and full of vegetation that allows the children to run and explore much greater area than the streets around their homes.

The building form follows a snaking path that increases in height slowly for the children to run up and down. Rooftop space has also been utilized to accommodate gardens and classrooms for the children.

Have an intimate and appropriate relationship to its surroundings. Context must consider the history, demographics, culture, and opportunity that the site presents.

CONCLUSIONS

Careful consideration must be made towards the context of any project site. Like the Farming Kindergarten, a project must





PROGRAM

At the Farming Kindergarten, children have a firm understanding of the value of play and interaction, because the school promotes it in every facet. Specifically, the children have classes that deal with gardening. This approach teaches them many things, such as human interaction, science, biology, and perhaps most importantly caring for all life on this world. A true sustainable learning approach has been followed at the Farming Kindergarten, and it has resulted in happier, healthier children.

CONCLUSIONS

Designing a building is much more than putting up walls, roofs, and floors. The activities that take place inside the building

are what matter most. A building must supplement and enhance these functions. The program that the building meets must be fully ingrained into the building's design at the earliest stage, so that the building may respond in the most appropriate way.

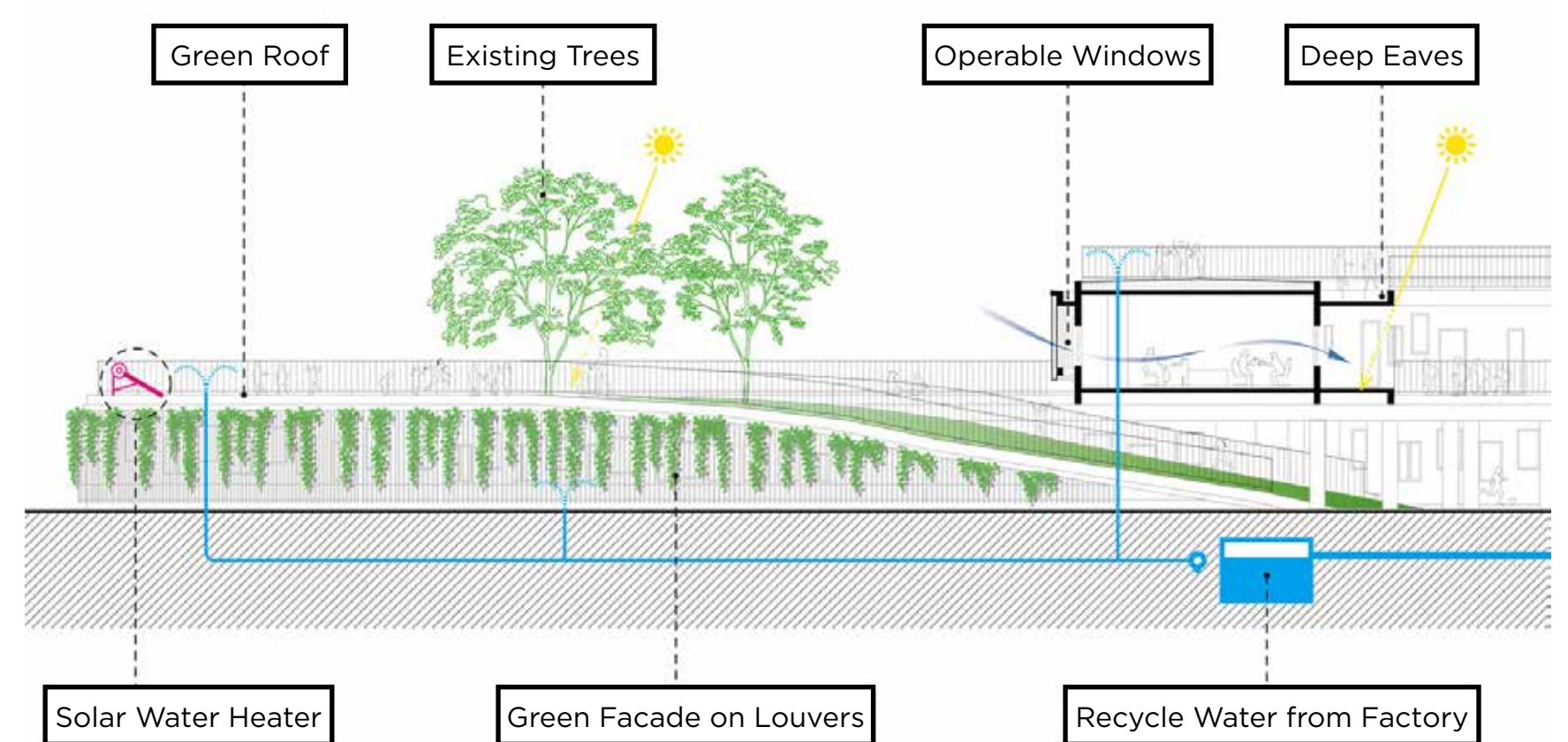


SUSTAINABILITY

Sustainable building principles should be at the forefront of all new building design. The Farming Kindergarten utilizes many sustainable design techniques in its building design. The nearby factory has its water recycled on the site of the school, and that water is then used as irrigation for the sites many forms of vegetation. The green roof acts as an insulating factor to the warm Vietnam summers, as well as filters the rainwater to cleanse it before absorbing back into the Earth. Many of these sustainable design features help create an environment of Earthly stewardship which can become ingrained into the children at their young ages to lead them into living a more sustainable life in their futures.

CONCLUSIONS

A new building built to accommodate children should be designed to be sustainable. The children for whom the building is designed for will be the ones to inherit this world once their parents and elders are gone, so it is of the utmost importance to act now to make sure the world is not in a worse place for them. Green building practices are a good way to start to teach our children the importance of caring for this Earth.





PROJECT EMPHASIS

SUSTAINABILITY

We live in a world of growing environmental issues, and sustainable design has been growing as the preferred building method for good reason. This project will emphasize sustainable building practices in many facets of the design. After having recently gained LEED Green Associate status, I would like to implement my newfound knowledge on the subject to affect the environmental stewardship of the project as much as possible. Design decisions will be directed first and foremost based off of environmental effects.

SPATIAL INTERACTION

A building is only as successful as how well the spaces interact with each other and the users who occupy them. The phrase “form follows function” will be taken in a highly detailed and integral way, as each space will be highly evaluated to be placed and formed technically and purposefully for the function and users of the space and the specific requirements that follow.

DESIGN AESTHETIC

Each new project offers a new opportunity to hone materiality, composition, and form in a new, more enlightened way. This project will emphasize aesthetic in a way that it would become a landmark of the area, further allowing me to improve my sense of architecture and design.

PROJECT GOALS

ACADEMIC

Academically, I hope to continue to grasp new concepts in design and process that will help me further in my architecture career. Having a highly personal relationship with my thesis advisor will help me learn from someone who has done this many years and can offer much advice on how to have a successful and important thesis design project.

PROFESSIONAL

The lessons learned from this thesis will, hopefully, translate into a higher design vocabulary for me as I enter the workforce. My typology in which I am studying (elementary education) will be something that I am interested in continuing to work in, so by gaining this experience in school, I

will have a firm grasp on what the general requirements and needs of the typology are. This would be advantageous to potential hiring firms that I would already have a thorough experience in this topic.

PERSONAL

Having a project that I can be proud of would be the best accomplishment I could ask for from my academic experience. This project inherently is a cumulation of the last five years of work, so it must reflect everything I have learned thus far. Being able to show the project off as an fine example of the NDSU Architecture Program would make for a worthy thesis design project.

MAJOR PROJECT ELEMENTS

The major project elements will be dubbed the 'Kit of Parts' which will be explained later in this book. This 'Kit of Parts' will consist of:

- Classroom piece
- Node piece
- Flex piece
- Corridor piece

Each of these pieces, as well as their configuration and application to a test site, will be the major project elements.

SITE

The project is being developed as a universal solution to a global problem, yet to be a successful project it needs to be shown as applicable. The test site for this project will be located in Minot, North Dakota. This test site was specifically chosen, and will be explained later in the book.





USER/CLIENT

CHILDREN AGES 5-12

This will be the primary user of the building. They will account for the majority of the building's occupants during a normal operating day. The preferred child:teacher ratio would be 12:1.

TEACHERS

Teachers would be the second major user group. The teachers of the center would need to have efficient and engaging space to teach their students as well as convene with each other to gather ideas and learn themselves.

ADMINISTRATION

Several administration staff would be needed to serve the building's staff and visitors.

SPECIALIZED TEACHERS

For spaces such as the green house and the labs, specialized teachers will make up a smaller user group than typical teachers. The spaces for them will be dependent on the function they are serving.

MAINTENANCE

Maintenance such as custodians, mechanics, and landscapers/gardeners will be present on site but require far less space than other major users.

METHODOLOGY

RESEARCH METHODOLOGY

The following research methodologies will be used to explore the design thesis in the spring semester:

- Qualitative
- Interpretive
- Correlation

Perhaps the most used of the three methodologies listed would be the interpretive and correlational methods of research. There have been many tests done that show correlations between educational performance and connectivity to nature, and many of these tests have and will be tested by myself for use in the design thesis.

Much of the research that will be done will be used in a way to further my design thesis project's argument and to also justify certain design decisions in the project.

DESIGN RESEARCH METHODOLOGY

As far as an approach to design, the main school of architectural theory that will be used is the eco-social design theory, or better known as the theory of sustainable design. The sustainable design theory argues that design should be to “eliminate negative environmental impact completely through skillful, sensitive design” (McLennan, J. F., 2004).

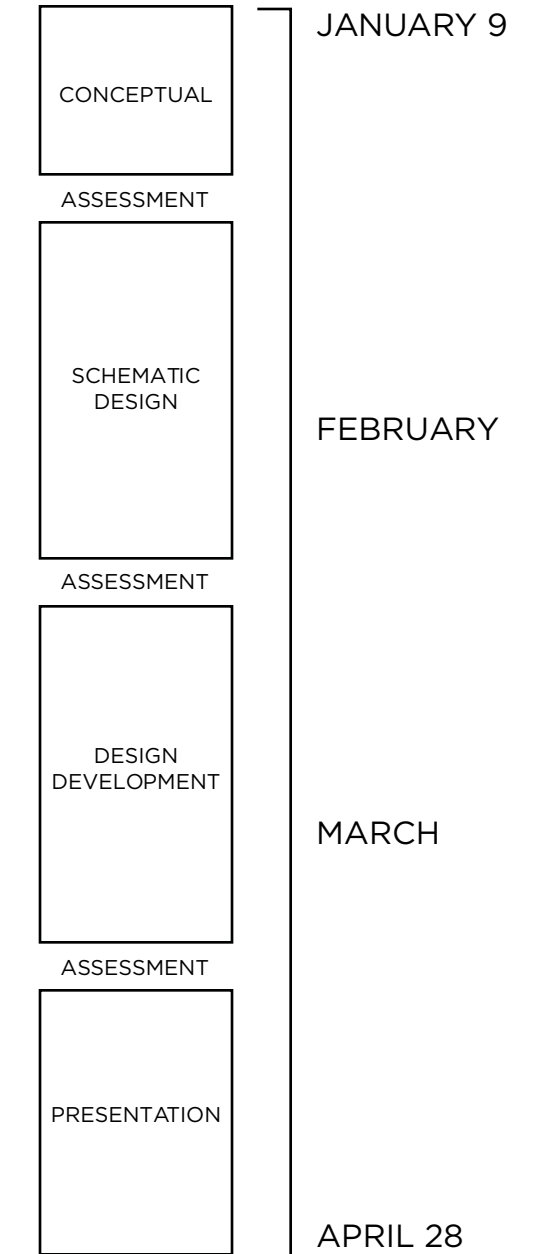
Throughout the entire design process, thoughtful consideration will be made for each aspect of space and building so that it fits in line with the eco-social school of thought. Environmentally friendly building techniques will be implemented, and thoughtful space design will be utilized to encourage human interaction.

DOCUMENTATION

Thorough documentation will be utilized on this project to not only keep the process organized, but to also make for an easier finish to the project. A detailed and organized folder structure has been created and will be utilized as the design process officially begins. The folder structure will be based off of the major phases of the project; conceptual, schematic, design development, and presentation. Besides the phases, two major stages will be used that each phase will fall into; process and final. Each of these phases will include deliverables to the project in the form of drawings, narratives, and research. Where these phases overlap will be major project assessments where the entire project will be reviewed both individually and with the thesis advisor.

PROCESS STATE MAJOR DELIVERABLES:
Thesis Prep Book, Conceptual Phase, Schematic Phase, Design Development

FINAL STATE MAJOR DELIVERABLES:
Boards, Models, Presentation



PLAN FOR PROCEEDING

RESEARCH DIRECTION

Throughout the next semester, research will be focused mainly around the correlation of educational spaces and child development. Research will look into the most proven ways to engage elementary aged children to forge strong relationships with each other and their physical environment. Research will also happen in the form of additional case studies of similar typologies, specifically case studies in Scandinavian countries where their educational model has shown data that aligns with my design thesis project.

DESIGN METHODOLOGY

The design methodology for the project will follow closely with the eco-social theory of architecture that design should be to relate users with each other and their environmental to have no adverse effects on each other. Design will also follow the research that is being conducted throughout

the project. Research will be analyzed both quantitatively and qualitatively to see what their effect on the architecture of the design thesis project will be.

During the design process, the use of sustainability analysis, physical modeling, group critiques, and other methods will be used to analyze the project and keep it aligned with the goals of the project.

DOCUMENTATION

The project will be thoroughly documented in an organized and detailed folder system developed specifically for this project. An InDesign document of the thesis book will be added to and updated frequently to keep all of the latest information on it.

THESIS SCHEDULE





THESIS RESEARCH

Before design work is to begin, a thorough look into case study projects has been completed for similar programs. Many aspects were explored in each precedent, including a study on materiality, program, site, space, and scale. The following case studies will explore in depth some of these different focuses.

QUESTION

How can **modular architecture** help promote **ecological sustainability** in a **traditional public school environment**?

RESEARCH & FINDINGS

SYSTEM OF INQUIRY	EMANCIPATORY		
STRATEGIES	INTERPRETIVE	QUALITATIVE	LOGICAL ARGUMENT
TACTICS	LITERATURE REVIEW PERSONAL INTERVIEWS	LITERATURE REVIEW PERSONAL INTERVIEWS	LOGICAL ITERATIONS

RESEARCH PAPER

INTRODUCTION

The world is a much different place today than it was a generation ago, a decade ago, and even a year ago. The idea that we live independently in the modern world is an idea of the past, as nearly everything is interconnected on a truly global scale. People of all cultures and backgrounds can be found in nearly every community, and the world has been opened up to nearly everyone by just clicking a button on the object in nearly everyone's pockets. These advances, however, have not come smoothly, and while there are many positives to be taken from this, there are plenty of hurdles yet to be crossed. Social justice and equality have polarized many parts of the world, creating hostility, prejudice, and violence. Economic equality is as lopsided in the United States as it has ever been in the country's history (Long, H). And, the climate is changing at such a rapid pace that the human race may not be able to do anything to combat its horrible

effects. Modernization of the world has been the most important change to this planet, both negatively and positively.

There is, however, an answer to many of these problems our world faces today, and it may lie with a group of people who hold very little responsibility to the cause of these issues; children. Creating a learning experience revolving around ecological literacy will create a sustainable society. This idea will be explored in this paper by expanding on a few different topics that all strengthen the idea that a learning environment around ecological literacy to young children will create a sustainable society. The first topic will explain the unsustainable educational model we currently have in the United States, followed by a look into what sustainable development is, and finally looking at the benefits that this type of learning can bring to our children and ultimately our society.

UNSUSTAINABLE EDUCATIONAL MODEL

Education in America is a right that is granted to each and every citizen in the form of tax payer funded public education. This model of schooling has been around for over a century, and has been a catalyst to creating the great minds and achievements this world and country has seen. However, it has largely not caught up to the current technological advances. The classroom may look different today than it did in the early 1900's, or even ten years ago. Smart boards have replaced chalkboards; iPads have replaced notebooks, however, breaking down a classroom to its core elements it is still largely the same as the 1900's. A teacher stands at the front of the room and teaches to a class full of children and assigns work that is largely based around memorization and facts. Here lies one of the biggest problems in modern schools: educating for knowledge is different from educating to learn. Rather than a steady

curriculum of facts from a book, an emphasis on experiential learning should be adopted. Young children have a sense of wonder. "Their desire to explore the real world [,] are the perfect vehicles for absorbing fundamental understanding about the Earth's cycles. . . how living and non-living worlds are interconnected" (Herbert, T. 2008). A change in the way education is presented to young children involves a complete understanding of how children learn, and what is most important for them to learn in the current atmosphere of our world.

Learning today has also carved out much of the time that children get to play outside. Children today spend nearly five more hours in school a week as opposed to 1981 (White, B. R. 2004). The effects of intentional outdoor time during the school day have tremendous benefits. Learning on the playground teaches many children

valuable social skills, and gives them an opportunity to interact with the nature around them. Unfortunately, educational institutions around the country have instead seen this recess time as a way for children to simply “burn off steam” (White, B. R. 2004), thus resulting in increased aggression and anxiety in children who do not have the opportunity to interact with their outdoor environment. What follows this new trend is reduced outdoor time which results in lower quality play equipment with little value, and a student body with social and physical frustration. The educational system that is created with little outdoor time and a curriculum on knowing rather than learning has become stagnant and is no longer sustainable for our current generation of children who will grow up facing many of our world’s problems with little preparation in knowing how to deal with them.

Education for sustainable development of our children and environment must begin at an early age for its greatest impact to be felt, and much of that opportunity is lost in the current educational model. An intimate connection with culture, diversity, and the natural world is best formed in early and middle childhood. This window of development forms the greatest positive attitudes towards the natural environment and cultural differences among people (Norddahl, K. 2008).

“*An intimate connection with culture, diversity, and the natural world is best formed in early and middle childhood*”

CURRICULA OF ECO-INTELLIGENCE

Tricia Herbert writes in her article Eco-Intelligent Education for a Sustainable Future, that “learning for life, as opposed to learning in order simply to learn further in school” is the most important component in education for children (Herbert, T. 2007). This idea is the basis of what is called eco-intelligence. Eco-intelligence is: founded upon a trust and respect for children as competent learners able to know themselves-their abilities and limitations, and gain that valuable ‘sense of place’ in a natural and meaningful way. This is learning for life, as opposed to learning in order simply to learn in school (Herbert, T. 2007).

Traditional schools should understand the difference between the traditional education and education for sustainable development (Siddiqui, D. S., & Aqil, D. Z. 2014). Table 1 (right) shows the differences between a traditional educational model and a sustainable educational model.

Traditional Educational Model	Sustainable Educational Model
Practical and theoretical learning for basic survival and synergy with various aspects of development	Basic education that focuses on imparting knowledge skills, values and perspectives that lead to supporting people to lead sustainable lives
Value based learning with emphasis on principles of sustainability in all spheres of life	Includes principles, skills, perspectives and values related to sustainability in social, environmental, and economic realms for lifelong learning
Transmission of information on matters of concern to communities through council meetings and role play etc.	Informed citizens and knowledgeable communities
Apprenticeship to enhance knowledge and skills in different professions	Training all sectors of the work force to impart knowledge and skills necessary to perform work in a sustainable manner
Strong roots in indigenous knowledge systems, tried and tested over time and dynamic to incorporate emerging issues	Meet diverse, social, economic and environmental conditions in relevant and culturally appropriate ways, taking into account indigenous cultures and knowledge systems

Table 1. Note. Reprinted from “Building Up an Ecologically Sustainable Society by Inculcating Environmental Ethics and Values in Children,” by Dr. Saba Siddiqui and Dr. Zeba Aqil, 2014, *IOSR Journal of Humanities and Social Science*, 19(3)

Eco-intelligent education is most crucial to teach children in their early development, as this is the time when they absorb and retain that knowledge greatest, which develop into healthy habits when they grow older. The basis of what eco-intelligence is covers three basic principles; economic welfare, social justice, and environmental stewardship (Kaga, Y. 2008).

Economic disparity in America is increasingly growing, especially in urban areas (Veitch et al., 2014). What results from this is an increasingly segregated society based off of class. The wealthier children attend higher quality school and have access to resources that lower quality schools may not be able to afford. Imagine a scenario where this economic social barrier was blurred. Whether that be a school, a community center, or a park, having a place where different economic classes were more closely integrated with each other creates an atmosphere of connectivity, in which children will grow

their social bonds with each other regardless of class (White, B.R. 2004).

Social justice and equality is another principle of eco-intelligence, or as UNESCO has put it, education for sustainable development (UNESCO, 2007). The world is becoming increasingly more diverse, especially in areas that are not accustomed to change. Immigration and refugees from around the world are coming to the United States and beginning to assimilate with America, and in turn changing the fabric of American culture. Society has reacted, however, with many mixed feelings. The politically and social mood on the migrant situation in America is objectively uncomfortable, with many vocal members speaking out on the issue. The biggest victim in this situation is children, who have no say in how any of this happened to them in the first place. If children were step one into fixing this problem, the answer would be through eco-intelligence and sustainable education. Much like the social class integration stated above, a cultural

integration for youth would allow children to form bonds with their neighbors and classmates of many different backgrounds. From this they can open their minds up on many values on what it means to be human. This encourages “empathy, sharing, respect for others and diversity as positive richness,” says Yoshie Kaga. “Living sustainable requires understanding about different populations – their particular history, culture and traditions – and a desire to live together” (Kaga, Y. 2008).

Value driven education in regards to sustainable development needs to be taught at an early age. The future of children today depends on these skills, and if implemented early, their skill set will already be strong when they are ready to face the world’s cultural issues themselves. When we teach our children these traits, we enable them for the rights of their generation and future generations, their intergenerational responsibility, cultural diversity, and commitment to build peace (Pressoir, E. 2008).





The third pillar of education for sustainable development is environmental stewardship. Children are not responsible for the environmental problems that our world sees today, however they are the ones who are going to have to live through the ramifications of the past generations mistakes. The Earth's responses to exploitative human behavior have the potential to strain the very relationships among humans (Herbert, T. 2007). Tricia Herbert commented in her article Eco-Intelligent Education for a Sustainable Future that:

"The slow process of gaining a sense of belonging to a particular place in the world by watching the changes in seasons and weather, observing and caring for its plants and animals, eating its food crops, using its resources to build, to make art and to find secret places for play, allows a child to feel a curiosity about, and oneness with, the natural world that is denied to children who spend their days in hygienically scrubbed buildings filled with manufactured educational materials and organized schedules of show and tell, story times, centers and pre academic activities."

The world's environmental issues are staggering, yet the current educational model does not make nearly enough of an emphasis on the effect that this is having on the world. Today, children's lives are disconnected with the natural world with much of what they learn about it coming from media, written language, and visual images (White, B.R. 2004). Learning about the world's environmental issues takes a direct connection, and children are the perfect candidate for that effect to be most powerful. If a curriculum that included an emphasis on teaching sustainability and connecting children to nature, they will develop a greater appreciate for the place they live in, and in turn become greater stewards to their environment in their future (Kaga, Y. 2008).

Nature's Effect on Creating Sustainable Development through Children

The positive effect that nature has on children in early development has been documented extensively, yet we still see the trends where that connection to nature is taken for granted and children's time spent in the outdoors is lowering (White, B.R. 2004). One of the reasons for this happening in school is premature abstraction, which is introducing complex ideas to children at an age when most children cannot grasp complex concepts. Teaching children the problems of rainforest deforestation, or ozone depletion is just too abstract and complex of subject matter for young children. These children learn through experience, and trying to instill abstract concepts in them early can create a discomfort for the environment. They may not necessarily understand what their actions are doing, so they will not consider it in their future habits (White, B.R. 2008).

According to researchers, this sort of behavior towards the environment is called biophobia – the fear of the natural world and ecological problems (Davis, J. 2008).

Children playing and learning in the outdoors used to be much more common than it is today, and this may not be because of a change in the minds of children. A 2004 study found that 82% of mothers with children between ages 3 and 12 identified crime and safety concerns as one of the primary reasons that parents will not allow their children to play outdoors (White, B.R. 2004). This, coupled with the rise of entertainment pertaining to technology such as media, video games, television, etc., has seen a major decrease and void in children’s personal connection with nature.

Studies have shown that when a connection to nature is present in the lives of children, positive effects can be found. In California, 40 schools implemented a

program developed around “an integrated context of learning” with a focus on sustainability and project-based learning. These schools yielded results of increased test scores, problem solving, and a reduction of anti-social behavior, littering, and skipping class (Davis, J. 2008). Research by Randy White of the White Hutchinson Leisure & Learning Group (White, B.R. 2004) have noted the following in his findings:

- Children who can visually see nature and have contact with it score higher on tests of concentration and self-discipline
- When children play in natural environments, their play is more diverse with imaginative and creative play which can increase language and collaborative skills
- Natural environments improve awareness, reasoning, and observational skills in children
- Nature can buffer the impact of stress in children
- Children who play in nature have more positive feelings towards one another
- Natural environments stimulate social interaction between children
- Children develop independence and autonomy when exposed to outdoor environments

“The values taught today will become a habit tomorrow” (Siddiqui, D. S., & Aqil, D. Z. 2014). In Norway, a program much like this has already begun and has proven to be successful. “Forester Schools”, as they are translated from Norwegian, are outdoor educational charter schools based off of sustainable teaching. The students there grow to have an intimate appreciation to the outdoors and the nature around them, and have since resulted in more environmental policies and nature conservation projects in the country. Since their inception a few years ago, they have grown enrollment to around 250 children a year, ten times the amount which the program started with (Norddahl, K. 2008).

CONCLUSION

Nelson Mandela once said, “Education is the most powerful weapon which you can use to change the world.” This could not be more relevant than today in the wake of the many problems in which this planet faces. The future and sustainability of this planet lies with our children. If they are taught at an early age the principles of living a sustainable life, environmentally, socially, and economically, they will be much better prepared to handle the world’s problems that have been left to them. Education for sustainable development must be the preferred form of teaching for the children in this world.

“*Education is the most powerful weapon which you can use to change the world*”
-Nelson Mandela

ECOLOGY

Relationship of organisms to one another and to their physical environment.

SUSTAINABILITY

Promotes equality between people of today and people of tomorrow. Creates balance between our ecological, social, and economic needs.

ECOLOGICAL SUSTAINABILITY

The promotion of equality amongst our people and their relationships with each other and their environment

ECOLOGICAL SUSTAINABILITY

The world has experienced rapid change in the last fifty years. Though most change can be counted as good, there has been a fair amount of negative changes happening that continue to be major issues today. Issues such as climate change and social differences are more than ever becoming issues that need to be addressed as significant threats to our continual existence as a culture. An opportunity exists right in front of us to help fix these problems: children. Our society's children hold the key to helping solve our world's greatest issues, and that key is their education. If education can take an Eco-literate approach to teaching our children about these issues, they will be more equipped to handle them as they grow older. Education, as well as the facilities that house these places of learning, must respond to the changing landscape of our environmental and social world and do their part to prepare our children to face these issues.

Ecological Sustainability is when the environment, economics, and social aspects of our world are aligned. If this can be applied in an educational format, this could be a way to help solve the many problems are world is facing.



MONTESSORI METHOD

Is there already a teaching method out there today that is aligned with an ecologically sustainable world? This led me to investigate both public and private education to compare them and see how they stack up to an eco-sustainable agenda.

On the private side, the Montessori Method of teaching appeared to be doing things that aligned well with ecological sustainability. Observations and findings for Montessori education can be found on the next page.

To help me understand what Montessori has to offer, I scheduled a tour of Dakota Montessori School in Fargo, North Dakota. I met with Ilene Cohen-Pearson, and she took me through the facility and educated me on how Montessori works.



CHILD DEVELOPMENT

Children develop under the Montessori Method of teaching much quicker than in public school. This is done through the idea of mixed age classrooms, where the children become teachers to each other. A six year old can teach a three year old how to do a task, and research has shown that this increases the development of community within the school.



NATURE

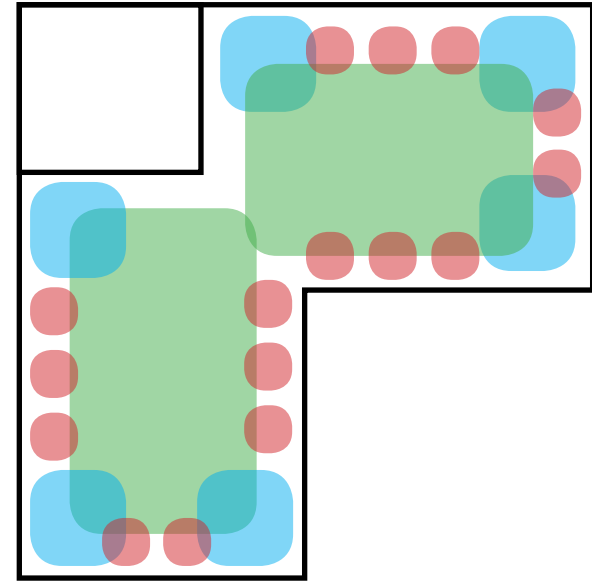
Nature, and a connection to nature, is a major component of Montessori education. Children are encouraged to explore and learn outdoors as much as possible. The teachers are there as facilitators rather than content providers, so teachers are available to push children into learning more about the world around them.



BUILT ENVIRONMENT

Montessori is developed around the concept of specific prepared environment. The built environment was carefully developed to encourage learning and stimulate children in both collaborative and individual settings. The built environment is one of the required components for Montessori education, and will be incorporated in the final design of this project.





“L” Shaped Classrooms

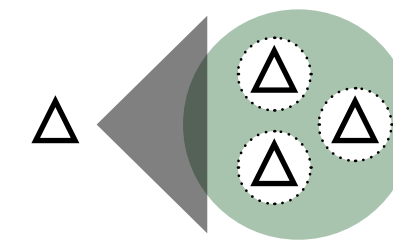
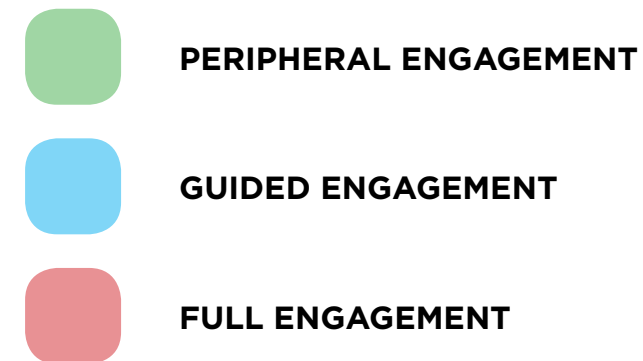
Guidelines, according to James Dyck, for the L shaped classroom include:

- It has to accommodate the formation and functioning of small learning groups while providing a sense of separation, because groups working together will experience distractions and non productive interaction
- It has to be flexible enough to allow the continual reorganization of the whole class into large and small learning groups. This means that the space must be as free as possible from permanent obstructions
- It has to be manageable by a single teacher who has command of the entire space. This means it must be compact and open. *(Dyck, 1994, p. 44)*

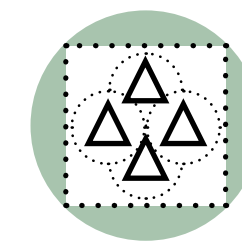
Learning in Zones

In school, the notion of learning revolves around a classroom and the teaching that takes place within its walls. Montessori classrooms take a more dynamic approach to layout with multiple zones of different activity and different learning styles. Traditional public school classrooms are largely the same layout with a series of desks faced toward a central element, such as a white board or the teacher at the front. However, research shows that learning is a complicated and varied operation that requires engagement in many different ways.

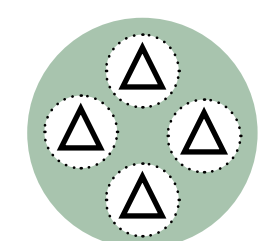
According to Peter Lippmann, learning and knowledge acquisition occurs in two basic ways: active and passive. Active learning requires direct engagement in an activity. Direct participation in an activity reinforces ideas and concepts and forms meaning with the individual. Passive learning can be considered the traditional way of teaching, which would involve a teacher facilitating learning by lecturing in a large group format. Lippmann argues for the active learning approach, which shows that children learn best in a variety of different ways and in direct engagement.



PERIPHERAL ENGAGEMENT



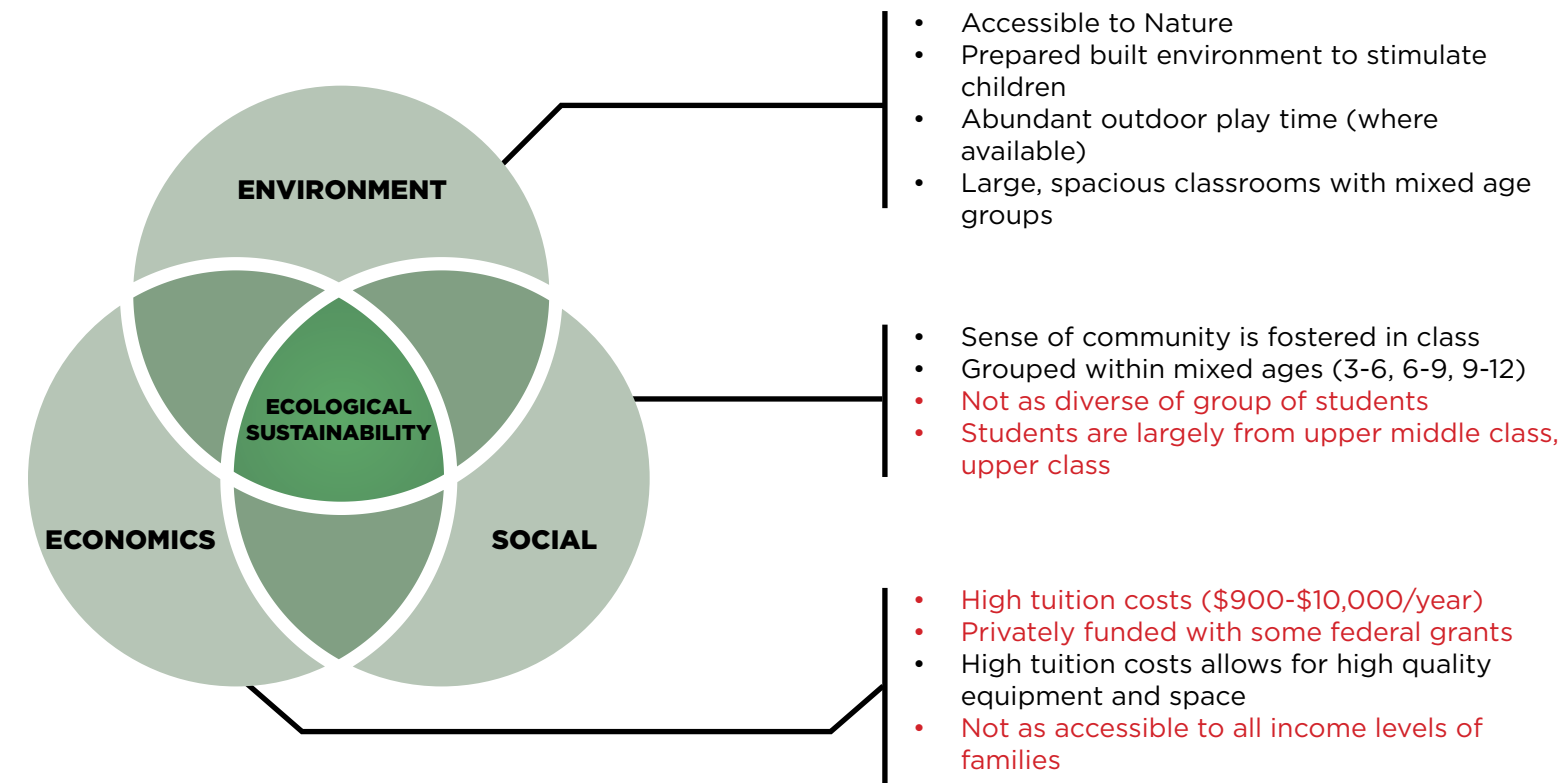
GUIDED ENGAGEMENT



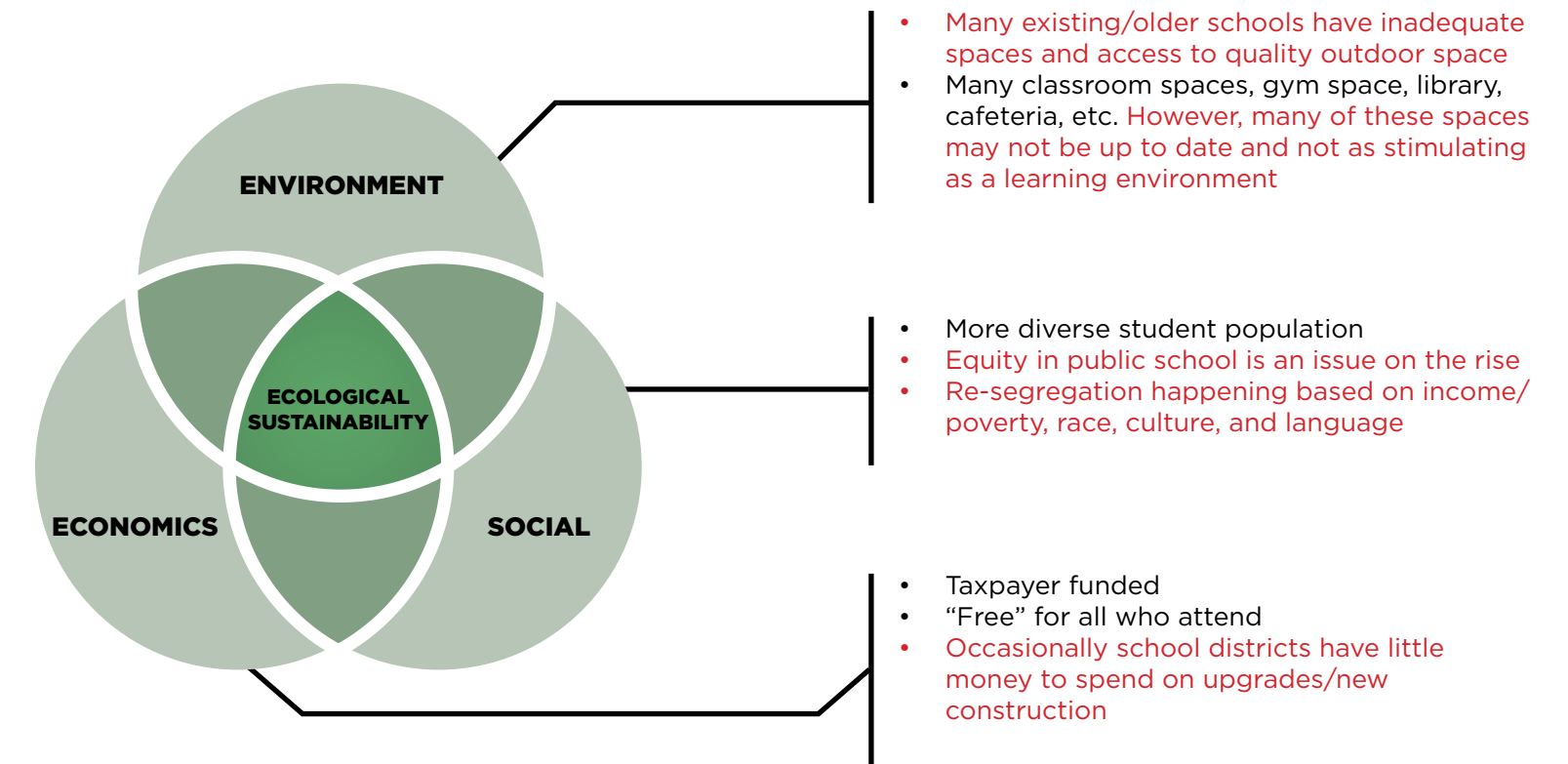
FULL ENGAGEMENT

How does Montessori match up with an ecologically sustainable model of education? After analysis, Montessori does not meet the requirements for ecological sustainability based off of a number of factors listed below. The next page lists an analysis of traditional public school, which also does not meet the goal of ecological sustainability.

MONTESSORI METHOD



TRADITIONAL PUBLIC SCHOOL



PROJECT JUSTIFICATION

The rate of change experienced in today's world is unlike any other time in history. Now, more than ever, the world is being challenged with issues ranging from environmental problems, social stigmas, and economic discrimination (Long, H.). Research has long pointed out that educating our youth is one of the best ways to combat many of these problems. However, standard primary educational models in the United States have not kept up with the rapid change of today's issues. This project would aim to address the problems that are most relevant to today's society to better equip our children with the tools they will need to solve these issues. Environmental stewardship and social interconnectivity will be main emphases of the function of the design project.

SOCIAL CONTEXT

Children, in today's world, are being taught nearly the same as they were fifty years ago save for major technological advances. Is this really the best way to view things when the world they are taught in is changing at such a rapid pace that it is hard to keep up? Education has long been lagging in a time when, more than ever, education should be at the forefront for preparing today's children with the tools they need to face this world's problems. This can be explained quite simply by a quick look at American education reform, and the resistance to change:

- o Educational reformers have often met strong opposition to their theories about how children should be taught what they need to know to succeed in society
- o Even as new ideas are adopted, it often takes many years for the physical school setting to respond to changes in pedagogy

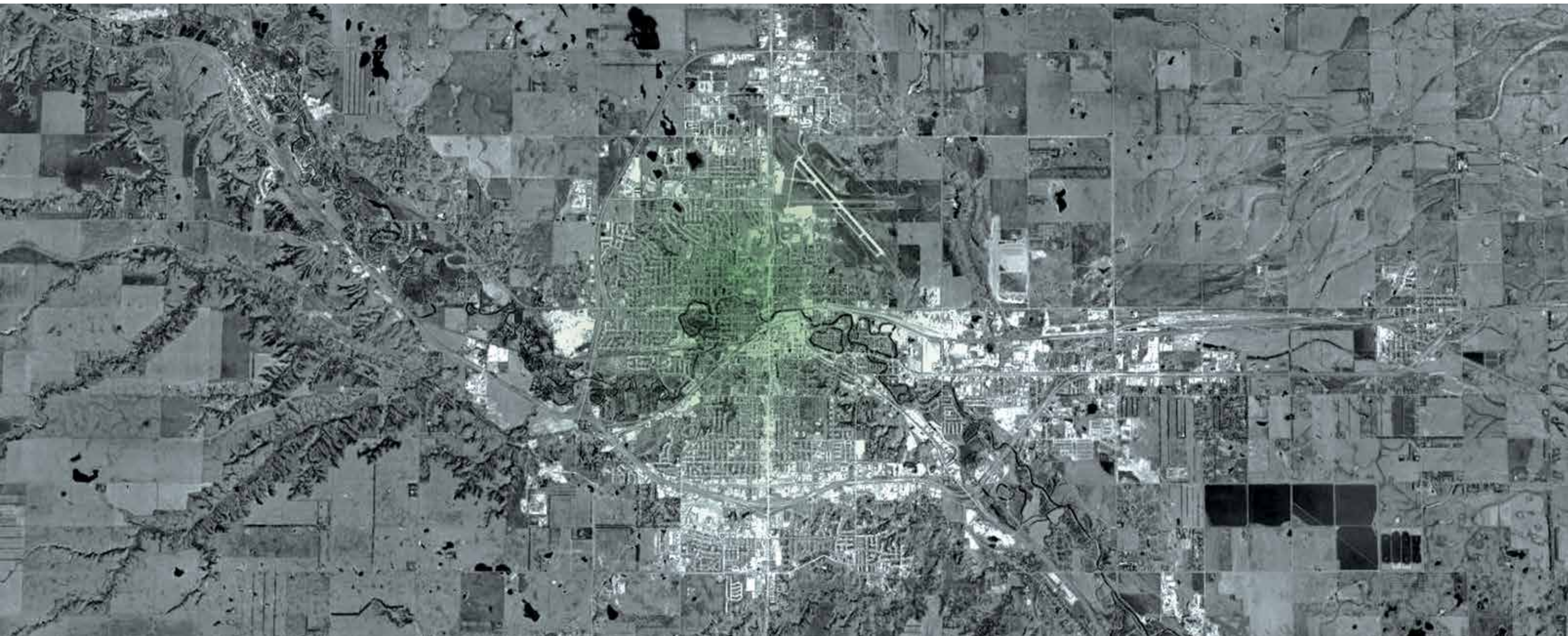
- o Unfortunately, when new ideas have been implemented and have seemingly failed, the design of a physical space returns to the traditional basics
- o When funding for new educational facilities is cut, costs are reduced by eliminating all but essential spaces in the design of learning environments

Students are also alienated from one another and individuated within their settings so that they compete with one another. Success is based on their ability in the classroom. Schools are organized to isolate individuals and groups from each other and from the everyday social contexts where many of their understandings about their environment have developed (Lippman). What if it were not this way? What if we aimed to bring students together to create balance in their social spheres? That is what this thesis aims to tackle.

SITE ANALYSIS

The idea of the project is to be a universal tool in solving the need for ecologically sustainable learning environments, however it is important to show how this sort of device can be used. In this case, a site needed to be picked. The following section will explain why Minot, North Dakota was chosen as the test site for the project.





SITE

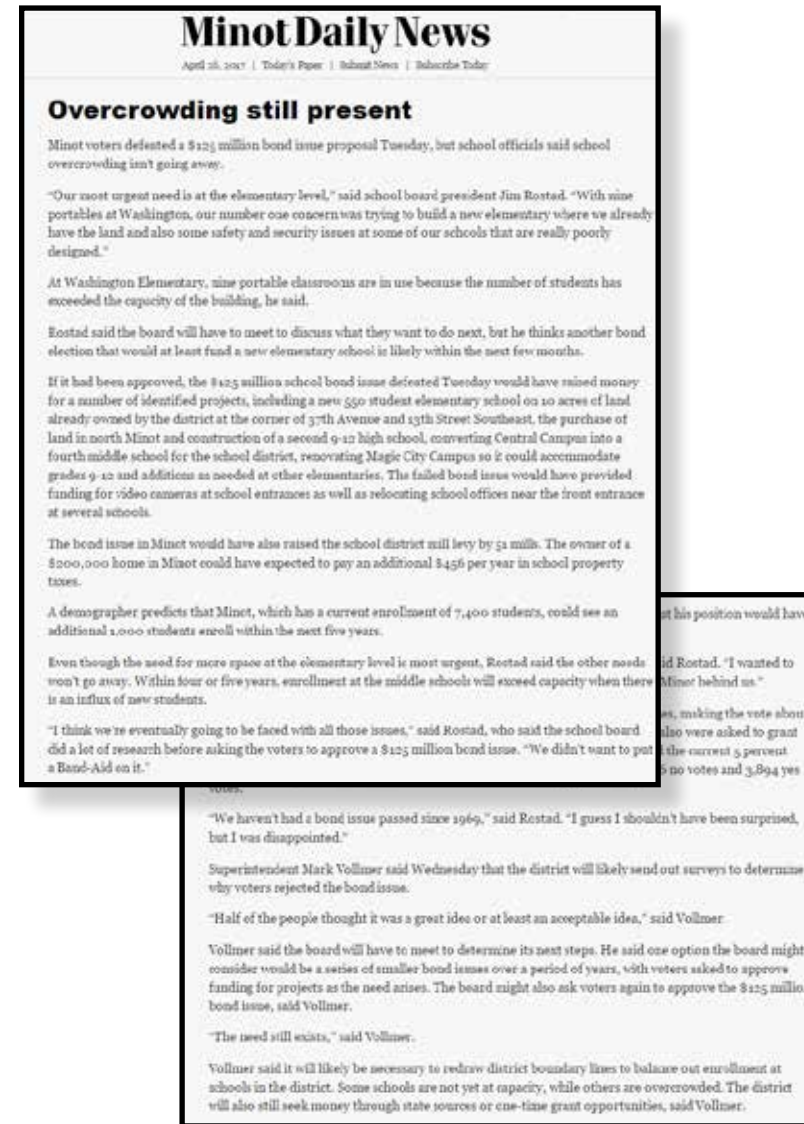
MINOT, NORTH DAKOTA

POPULATION: 49,450 (2015 EST.)

Minot is a city located in north central North Dakota. It is the fourth largest city in the state, and home to the state's largest air force base, which is home to over 6,000 residents. Minot began as a railroad hub for the Burlington Northern Santa Fe Railroad, which had to construct a nearly 1,000 foot rail bridge in what is now the southwest part of the city. This massive project brought many workers to the area for an extended period of time. So many workers, in fact, that the area grew from a few farmsteads to a community of hundreds overnight like magic, giving Minot the nickname "The Magic City."

WHY (NOT) MINOT?

Minot was chosen as the test site for this project due to some particular reasons. Minot is a city that has grown tremendously in the last decade. The city grew by over 15,000 people since the 1980's, however the city has built only one new elementary school in that time. This has caused massive overcrowding at many of the schools in Minot. Add this to the workers in the Bakken Oil Boom coming to settle in the city results in portable classrooms dotting the school yards of almost every school in town. The article on the right pulls specific quotes that tie directly to the problem at hand.



Minot Daily News

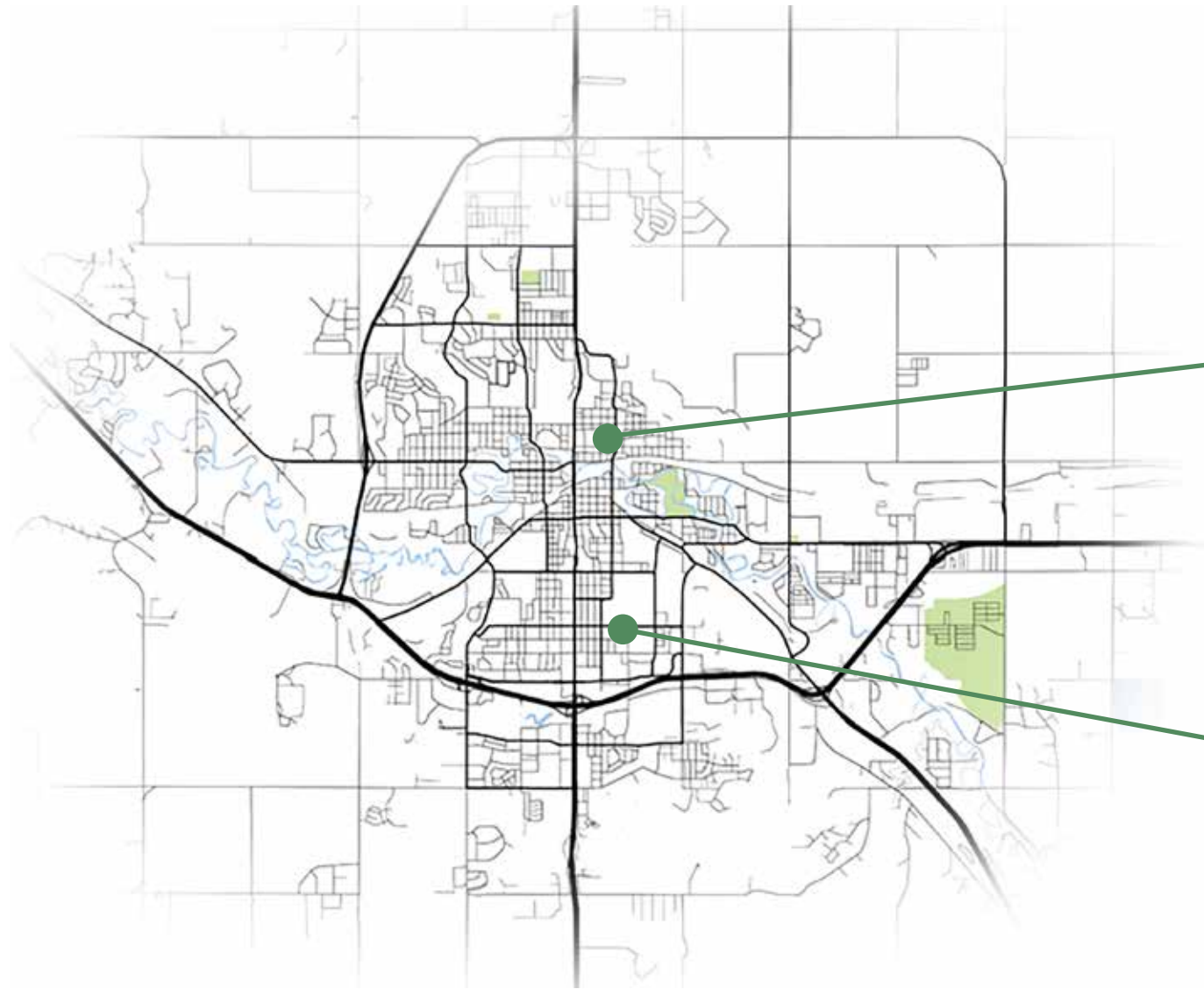
SELECT QUOTES

"Our most urgent need is at the **elementary level**," said school board president Jim Rostad. "With **nine portables at Washington**, our number one concern was trying to build a new elementary where we already have the land and also some safety and security issues at some of our schools that are really poorly designed."

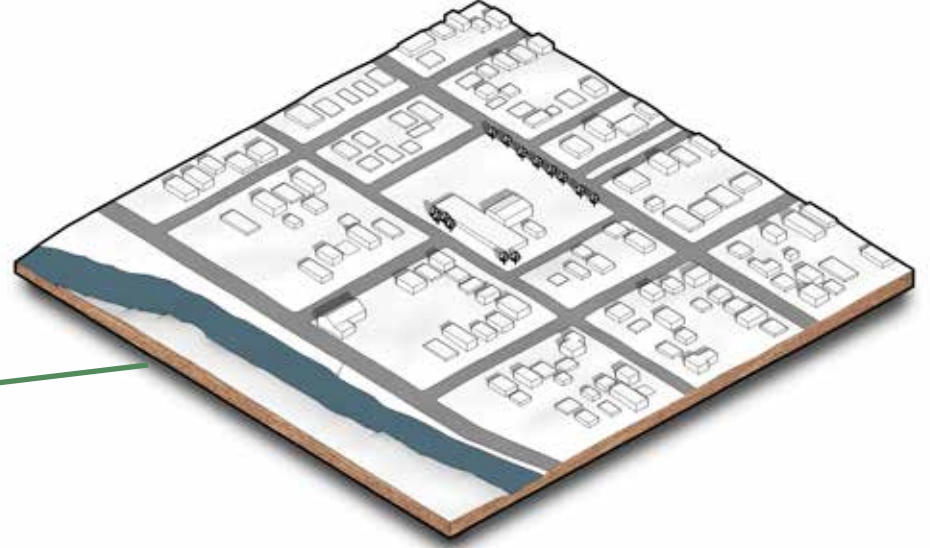
"Even though the need for more space at the elementary level is most urgent, Rostad said the other needs won't go away. **Within four or five years, enrollment at the middle schools will exceed capacity** when there is an influx of new students."

"**We haven't had a bond issue passed since 1969**," said Rostad. "I guess I shouldn't have been surprised, but I was disappointed."

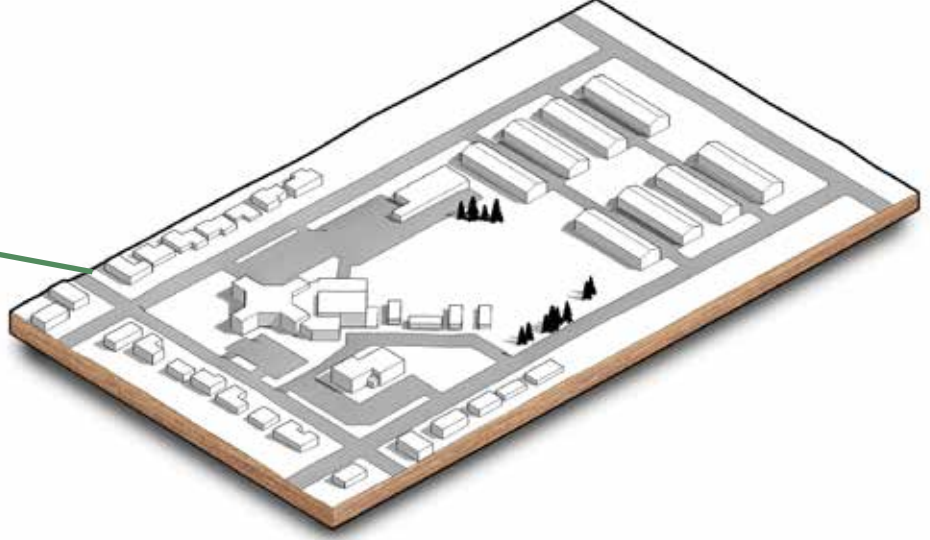
"Vollmer said the board will have to meet to determine its next steps. He said one option the board might consider would be a **series of smaller bond issues over a period of years**, with voters asked to **approve funding for projects as the need arises**."



MCKINLEY ELEMENTARY



WASHINGTON ELEMENTARY



PERFORMANCE CRITERIA

The following two pages will detail some of the preliminary goals for the thesis project. This will include quantitative and qualitative information regarding size of space, usage, hours of operation, environmental performance, energy consumption targets, materials necessary, support services, relationship to surrounding context, psychological impact, and a preliminary budget.

OPERATIONS

Hours of operation: 8AM-4PM

Support Services: teachers, janitorial, maintenance

Usage: during the school year (August through June), but may be adapted to year round use.

SIZING

Due to the modularity of the project, the size of the buildings will be relatively small. The largest modular unit will be roughly 1200 Gross SF, and the smallest unit being 150 Gross SF.

ENVIRONMENT

In order to fully accomplish the ecological sustainability goals of the project, the modular units must meet high indoor and outdoor environmental standards.

OUTDOOR

Due to its modular and portable nature, the project cannot be LEED certified as temporary buildings do not meet LEED required criteria. However, many sustainable factors will make their way into the project.

- High quality construction
- Locally sourced materials
- Minimal site excavation
- Energy efficient mechanical
- Rain harvesting equipment

INDOOR

A high quality indoor environment must also be incorporated into the design.

- Increased indoor air quality
- Non-VOC finishes
- Natural light with reduced glaring
- Stimulating learning environment

SPATIAL RELATIONSHIPS

The project must respond fully to the given site's conditions. The project must make use of its adaptability to allow for an efficient and high quality installation and use. It must relate to the existing school building to create an indoor and outdoor environment that is seamless and enhances the existing conditions.

BUDGET

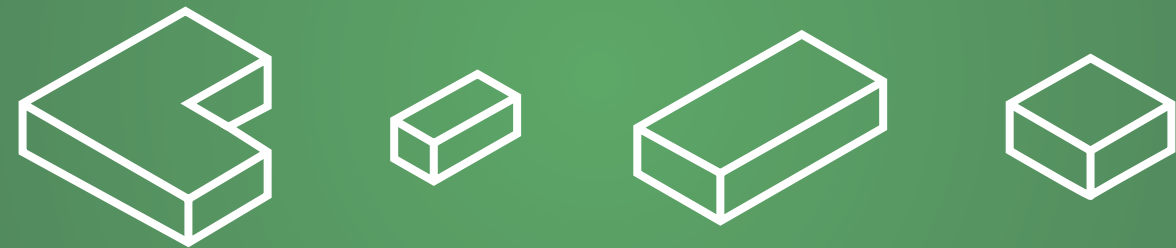
In order to be ecologically sustainable, the project must be cost effective. Each unit should outweigh the cost of a traditional school portable in a life cycle costing analysis. Each unit will cost between \$10,000 for a corridor to \$150,000 for a classroom.



DESIGN SOLUTION

The following section is a comprehensive look into the design solution. The design is based off of the idea called a 'Kit of Parts' which will be used to create an ecologically sustainable learning environment.

KIT OF PARTS

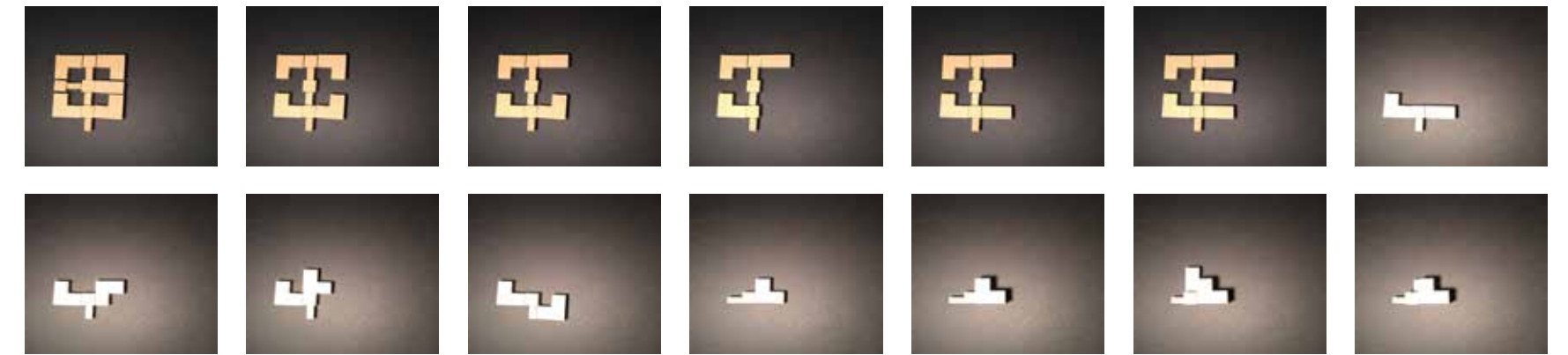
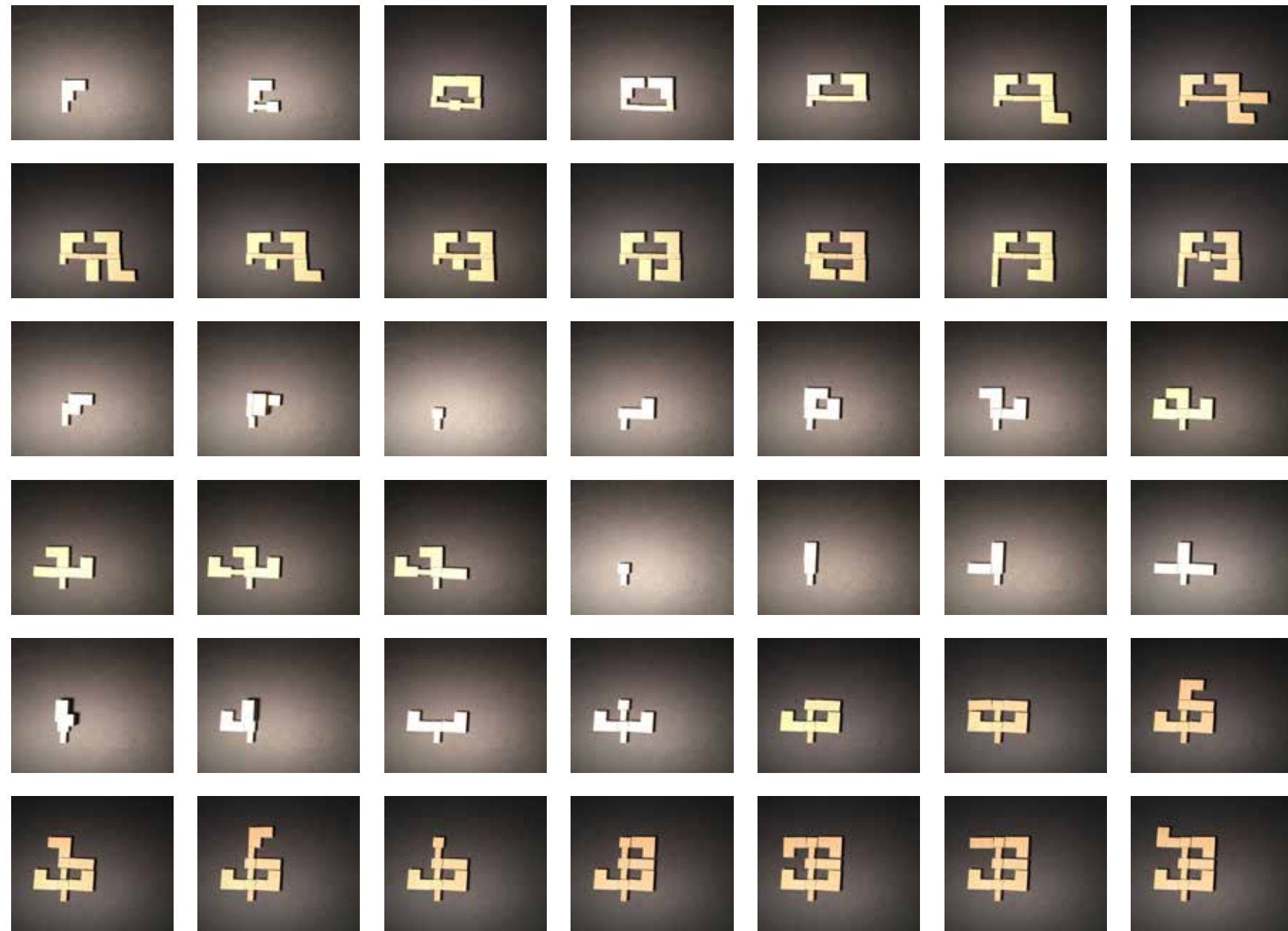


KIT OF PARTS

In many places around the country, children are not learning in the most ideal environment. Schools built decades ago were built for affordability and constructibility (Lippmann), not for a child to develop and thrive. Some of these schools are now dealing with over crowding a lack of quality space to house their classrooms. One of the cheapest and fastest solutions is acquiring portable classrooms. These spaces are considered temporary solutions, yet often become permanent fixtures on the school yard. The portables are built as temporary, and thus are not suited for the learner but rather the convenience of alleviating a problem.

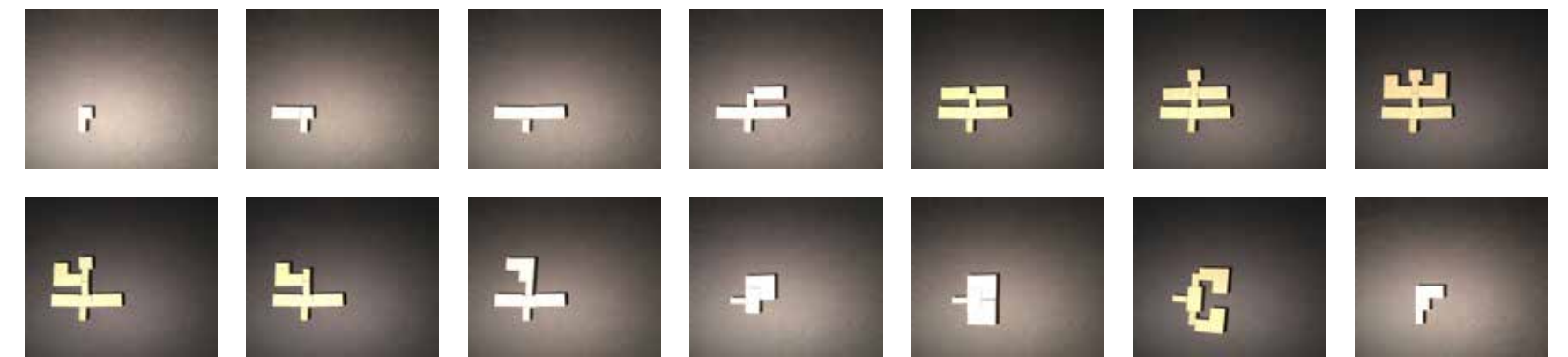
These modular and portable classrooms and units will create a learning environment that promotes socially conscious learning techniques, enhanced emphasis on a connection to nature, and be affordable and flexible for public schools around the country.

The Kit of Parts will consist of a classroom, flexible space, node, and corridors to connect them all together. Each piece has been carefully designed and programmed based off of achieving the goals of ecological sustainability and each has been influenced by the Montessori approach to learning and teaching.



Creating the 'Kit of Parts' was just step one in the process of creating an ecologically sustainable learning environment. How each piece acts together is just as important as how each piece functions inside. Finding opportunities in configuration was an important task at hand. Are there opportunities in the negative space created between the buildings? What can these spaces become, and how can they enhance the learning environment? This ended up resulting in an iterative study to how the shapes act

together. Over one hundred different configurations were tested and photographed in logical iterations that are shown throughout these two pages. This study allowed me to fully understand the outdoor spaces and labs that can be created by merely aligned certain pieces together.

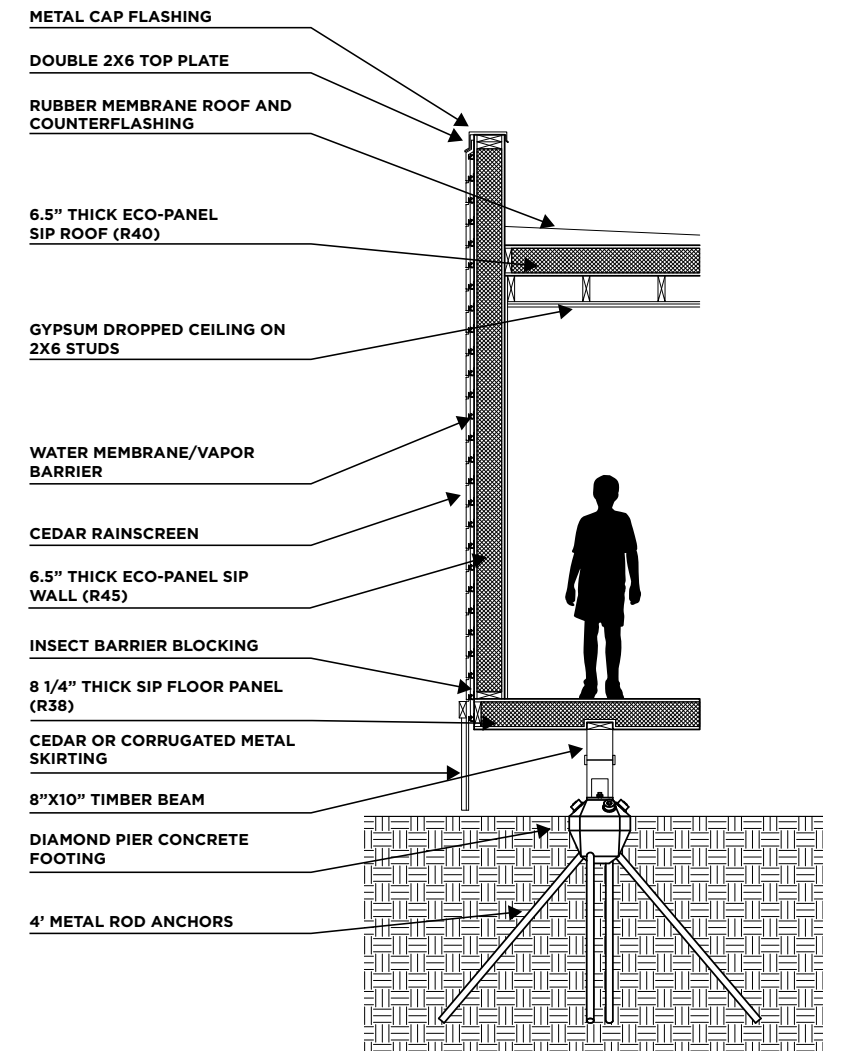




CLASSROOM

In many places around the country, children are not learning in the most ideal environment. Schools built decades ago were built for affordability and constructibility (Lippmann), not for a child to develop and thrive. Some of these schools are now dealing with over crowding a lack of quality space to house their classrooms. One of the cheapest and fastest solutions is acquiring portable classrooms. These spaces are considered temporary solutions, yet often become permanent fixtures on the school yard. The portables are built as temporary, and thus are not suited for the learner but rather the convenience of alleviating a problem.

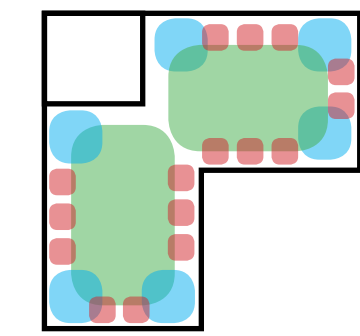
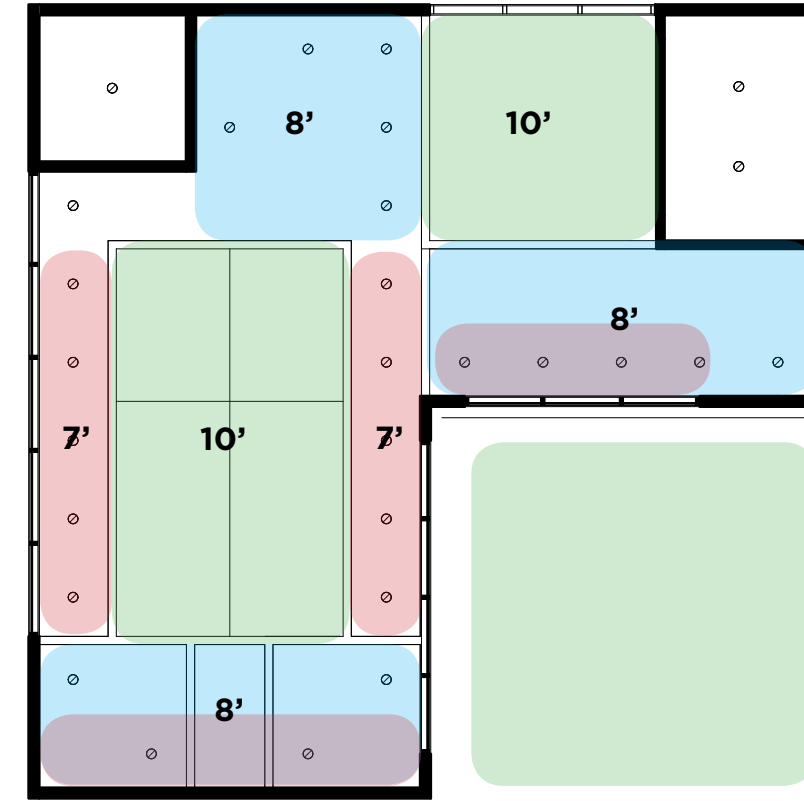
These modular and portable classrooms and units will create a learning environment that promotes socially conscious learning techniques, enhanced emphasis on a connection to nature, and be affordable and flexible for public schools around the country.



The construction of each part of the kit is carefully crafted to ensure a comfortable and stimulating environment both inside and outside the structures. Structurally Insulated Panels (SIPs) are utilized for modularity and sustainability, and special Diamond Piers act as the foundation, which is a cheap option and requires minimal excavation of the sites.

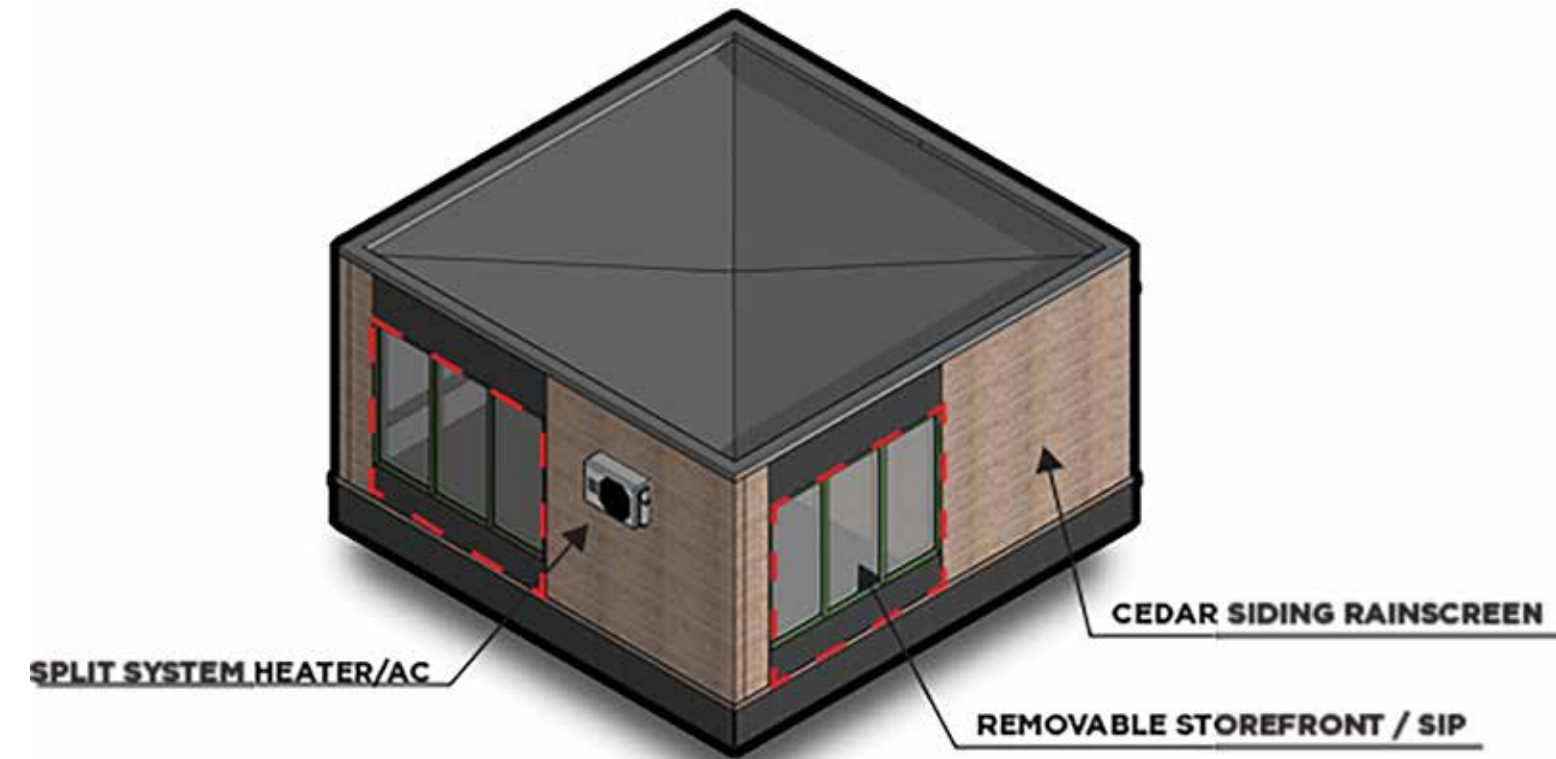
SUSTAINABLE BUILDING TECHNIQUES

- Polystyrene Structurally Insulated Panels
- Diamond Pier Footing & Foundation System
- Non VOC finishes
- Portable, modular construction
- High efficiency split system heater/AC
- Low-E windows
- Water harvesting, gray water recycling
- Future proofed for Solar Panels
- Recyclable Corrugated Metal Siding
- Cedar Siding
- LED lighting



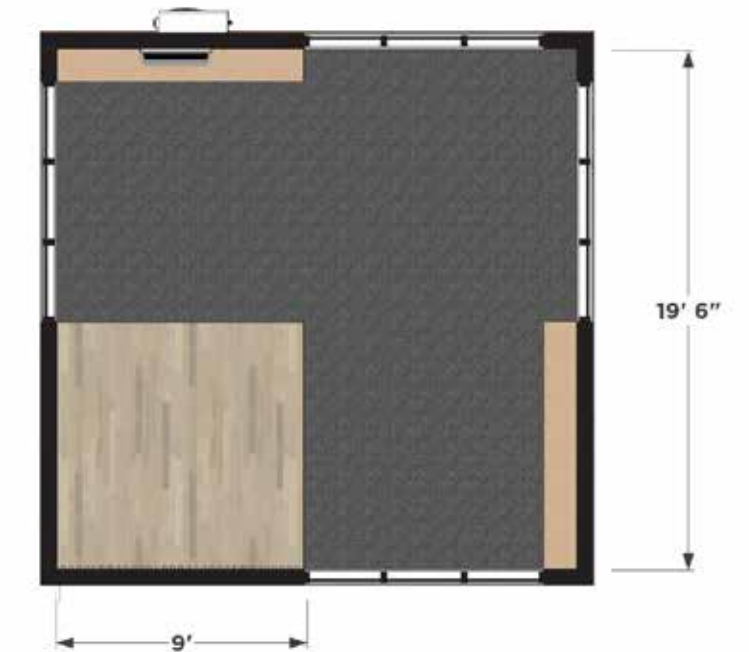
- PERIPHERAL ENGAGEMENT
- GUIDED ENGAGEMENT
- FULL ENGAGEMENT

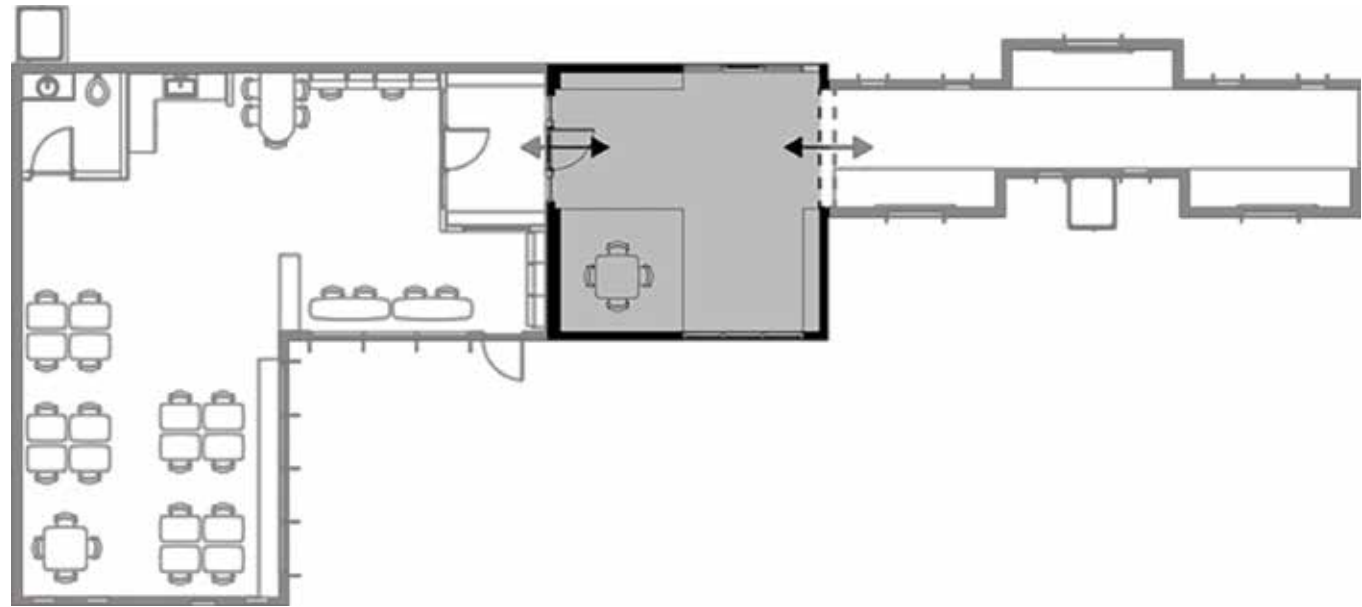




NODE

The Node piece acts both as a connecting piece and an additional learning space. Creating dynamic learning spaces that fit the needs of all students and their different learning styles is key to creating a more sustainable learning environment for everyone. The Node forms an implied “L” shape that creates a defined learning area for groups to gather. This space is defined by a change in flooring material and an engaging wall and ceiling feature that encourages gathering.





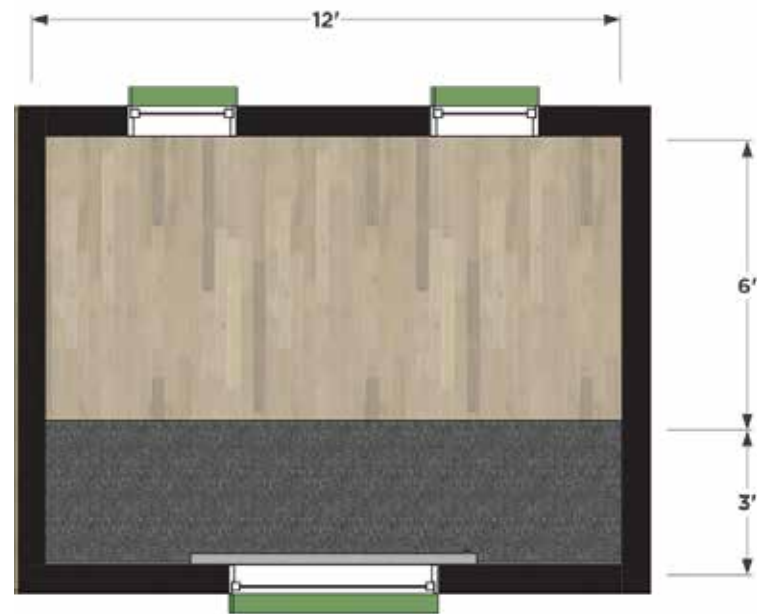
NODE

The above diagram shows the connection between the Node piece and the other Kit of Parts. When the storefront and SIP wall is removed, it can then be placed to connect with any of the other pieces to form an additional learning area.



CORRIDOR

Learning spaces do not have to be exclusive to the classroom. It can take place throughout the entire facility. With corridors and other breakout areas being fully integrated into a learner centric view, the chance for knowledge acquisition and learning strengthens. School corridors have, essentially, been an area of transition. However, what if it were considered a functional area of learning? If students are to acquire practical skills, the organization of both corridors and classroom spaces need to be reevaluated as layered environments that promote individual, one to one, and small group/large group transactions (Lippmann, 2007a, 2007b, 2007c).



CORRIDOR VARIATIONS

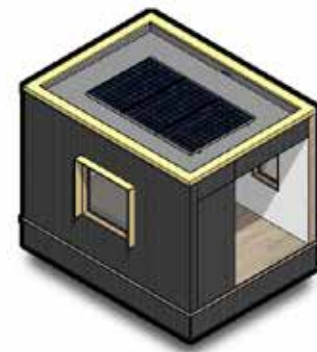
Each type of corridor piece offers a unique function. The 'Solar' corridor is equipped with solar panels on the roof, the 'Hydro' corridor features the water harvesting system used in the classrooms, and the 'Accessible' corridor features the required ramp slope for ADA in the case of elevation change within the sites.



GENERAL



HYDRO

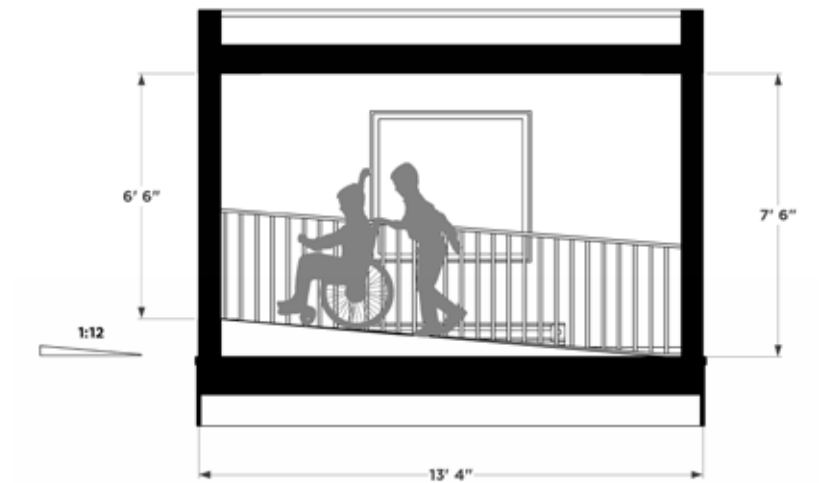
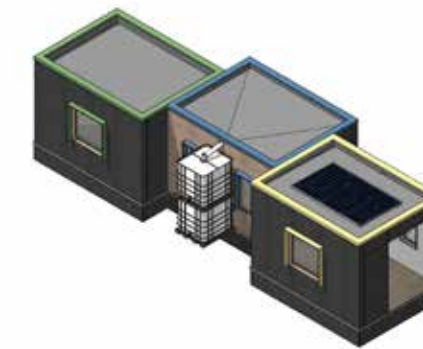
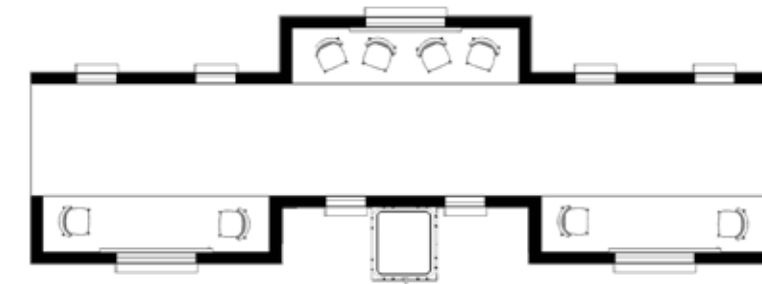


SOLAR



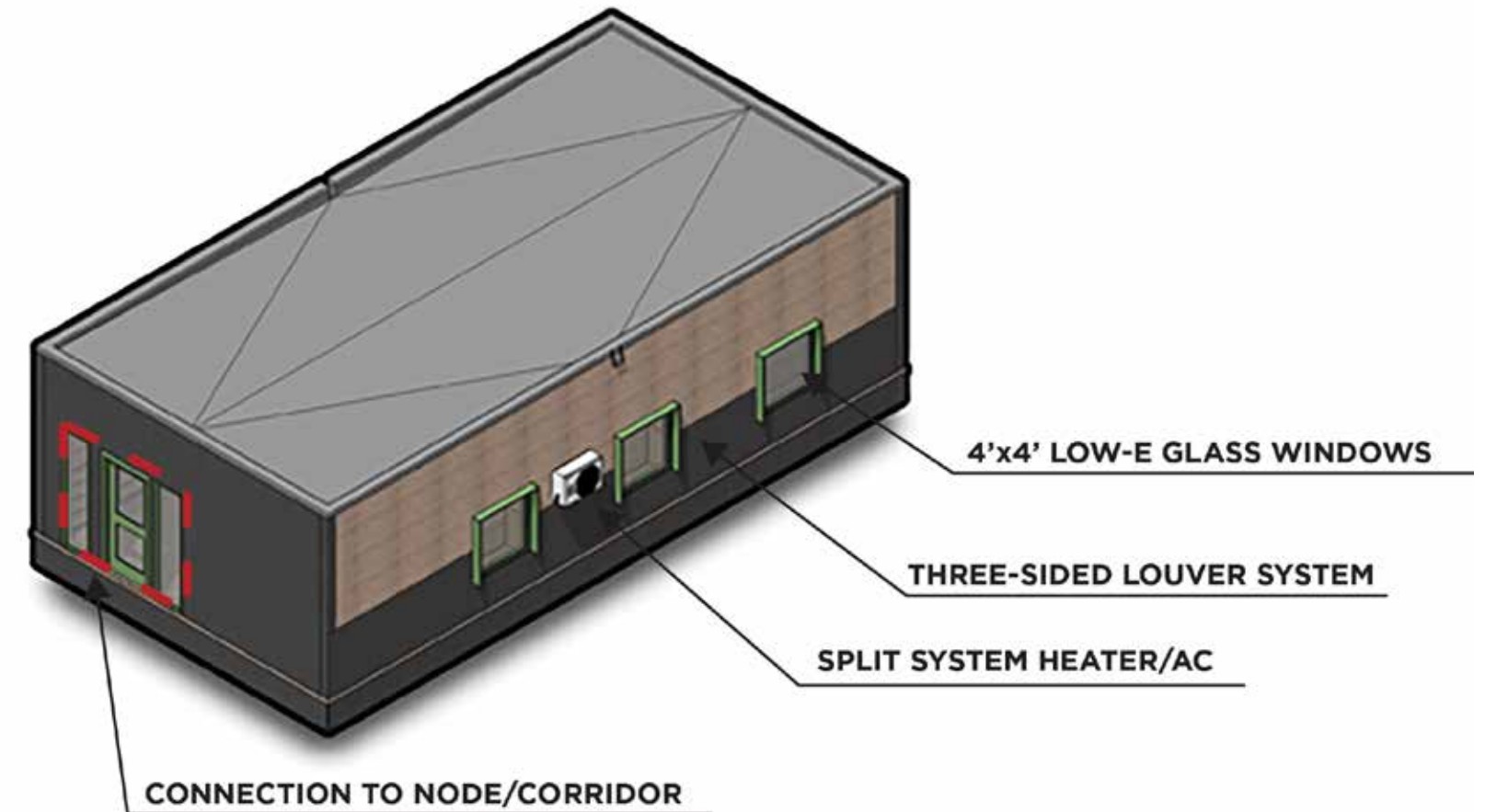
ACCESSIBLE

The corridors, when connected to each other, are offset 3' apart in a jagged array for the formation of new, dynamic meeting spaces. These spaces may encourage a small group to gather or an individual to work independently on a project.



FLEX

In many schools around the country, portable classrooms are used for more than just classroom spaces. Some schools experience a shortage of “flexible” space that can include uses like an art room, music room, or a laboratory. This Flex Room is arranged in a way to accommodate whichever function that the school may need to program. An open floor plan allows for flexibility in furniture arrangements and uses. A large sink is available for a more science or art focused program. Ample amounts of storage are provided along the perimeter of the room for storing craft/art supplies, science equipment, or musical instruments.



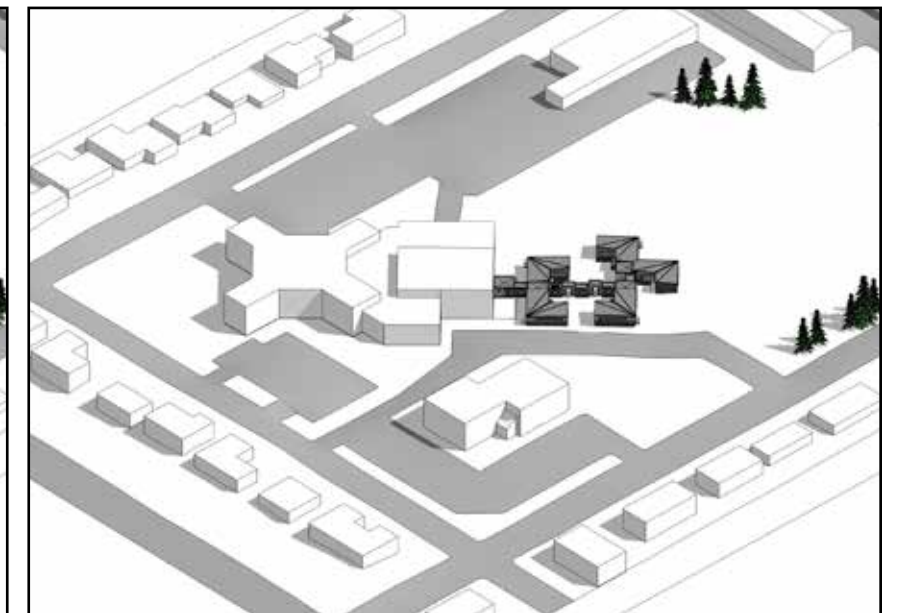
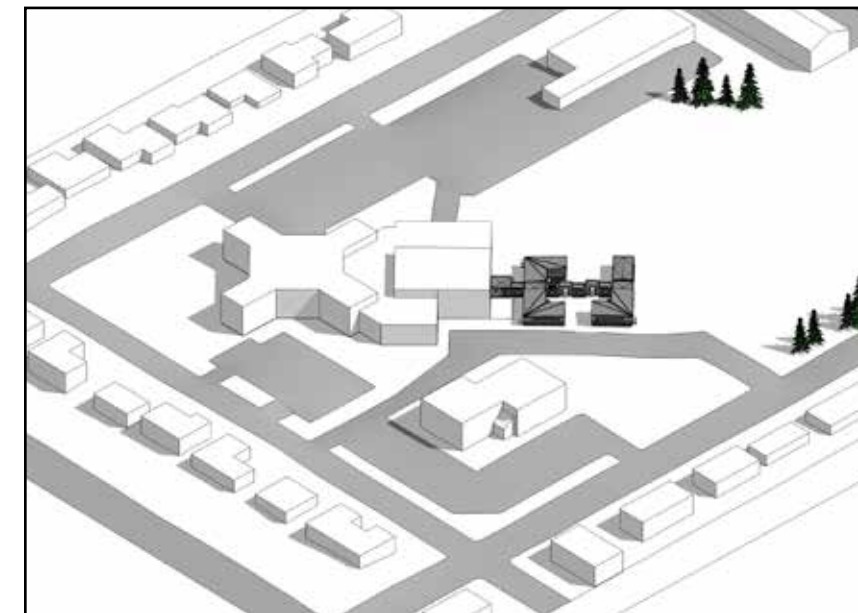
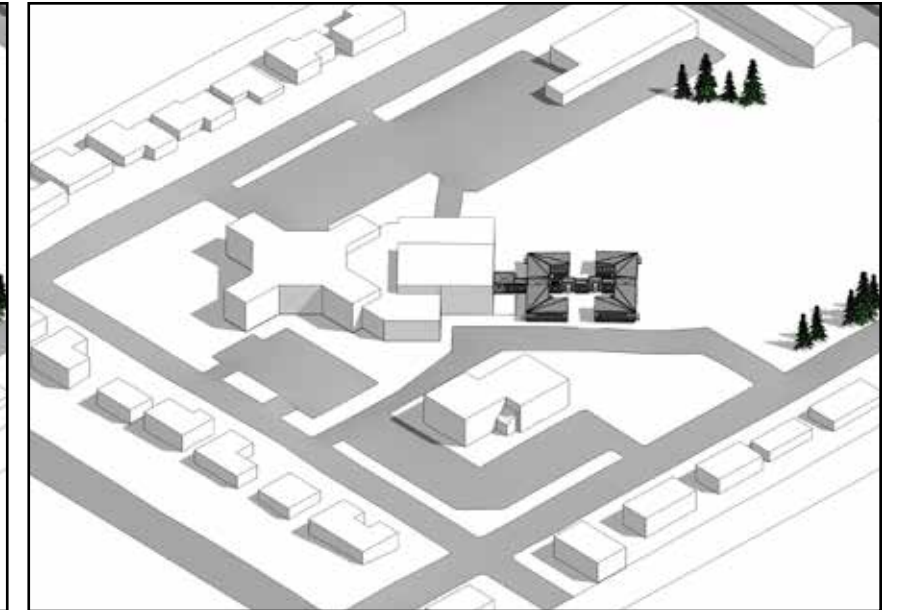
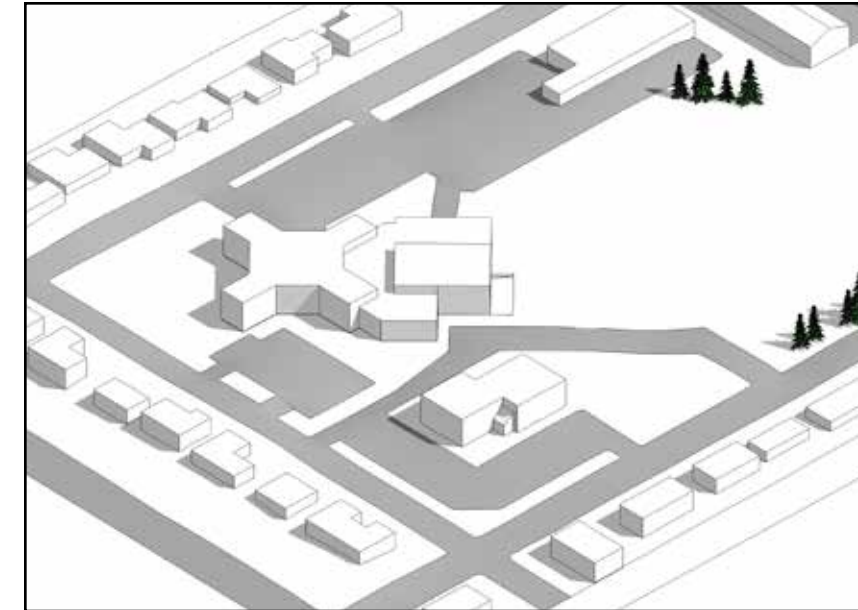


WASHINGTON ELEMENTARY

Washington Elementary was chosen as a test site for the modular classrooms for a few reasons.

1. The site was expansive, giving ample opportunity for a growing student population
2. There were, at one time, nine portable classrooms on site. As of 2016, there were four portables
3. Washington has been identified by the State of North Dakota as a Title 1 school, or in need of improvement

The images on the right show phasing for the project and how the portable classrooms can be used on the site. Phase one shows the removal of the existing portable, and phase four would be future expansion.



McKINLEY ELEMENTARY

McKinley Elementary was chosen as a test site for the modular classrooms for a few reasons.

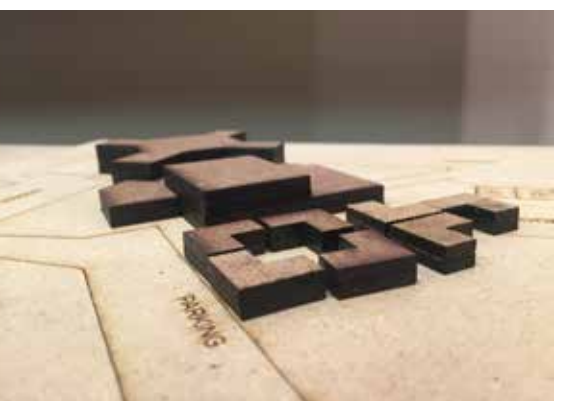
1. The site was compact, giving an opportunity to show small expansion
2. There is one existing portable on the site
3. McKinley has been identified by the State of North Dakota as a Title 1 school, or in need of improvement

The images on the right show phasing for the project and how the portable classrooms can be used on the site. Phase one shows the removal of the existing portable, and phase four would be future expansion.









ANNOTATED BIBLIOGRAPHY

Davis, J.M. (2014). What might education for sustainability look like in early childhood?. In *The contribution of early childhood education for a sustainable society*. (Ed.). Retrieved from unesdoc.unesco.org/images/0015/001593/159355E.pdf

In this article by Julie Davis, she explains how early childhood interactions and experiences are the main drivers behind neurological, biological, psychological, and social development. These traits then translate to adulthood, based off of case studies of sustainable learning techniques. There was little quantitative data provided in this document, however its findings are important in a qualitative sense when describing the alternative learning techniques. This fit into the context of the paper by explaining the importance of early childhood experiences in shaping adult behavior.

Flouri, E., Midouhas, E., & Joshi, H. (2014, June 27). The role of urban neighbourhood green space in children's emotional and behavioural resilience. *Journal of Environmental Psychology, 40*, 179-186.
doi:10.1016/j.jenvp.2014.06.007

The main focus of this article was to study the effects of quantitative nearby green space on emotional and behavioral problems in middle childhood. This was relevant to the paper, because of its context with different social settings. The study looked into different park settings in different class neighborhoods, ranging from well-off suburbs to inner cities to look at the disparity of child behavior and number of parks. A number of different methods were used to conduct the test, such as surveying participants, measuring land usage, life adversity, neighborhood disadvantages, child covariates, and key mediators. This study found, however, that the number of green spaces may not be a direct link to child behavioral issues. The researchers commented on how the quality of green space may be the true indicator, yet they provide no data or studies on that topic.

Herbert. T. (2007). Eco-intelligent education for a sustainable future life. In *The Role of Early Childhood Education for a Sustainable Society*. (Ed.). Retrieved from lararutbildning.gu.se/digitalAssets/837/837347_Workshop_May07_papers.pdf

Tricia Herbert's article introduces many ideas about the current state education taught to our children. She argues that the current education model is unsustainable, as most teaching is geared around learning to know rather than learning to live. Education should be focused around preparing our children to live in a society that is fully integrated with multiple cultures as well as the environment. Education for sustainable development (ESD) is learning to be environmental stewards, respectful to others, and curious to the outside world. She writes that eco-intelligence creates a sense of place and appreciate for the world around children, which will in turn create sustainable habits in them in their adult lives. This is relevant to set up my paper and create my initial arguments revolving around sustainable education to children creating a more sustainable environment in the future.

Kaga, Y. (2014). Early childhood education for a sustainable world. In *The contribution of early childhood education for a sustainable society*. (Ed.). Retrieved from unesdoc.unesco.org/images/0015/001593/159355E.pdf

Kaga argues the importance of teaching our children sustainable techniques and living now, because they are the ones that are going to be living in the results of the current generations actions. The education model that has been in use for over a century has produced important strides in culture and society, but has left us at a crossroads of where to go from here. The world has changed drastically in the last couple decades, and the way education is approached must keep up. This influenced the paper by giving more ideas into the current mode of education, and sets up the idea that connecting children with nature can create the foundation for a sustainable environment.

Long, H. (n.d.). What economic equality looks like in America. Retrieved October 5, 2016, from <http://money.cnn.com/2015/01/02/news/economy/inequality-america-versus-equality/>

This article made clear of the economic disparity that exists in America. It was used sparingly in this paper, however provided much insight on exact figures of disparity and wealth distribution.

Nature & Environment Learning Centre Amsterdam. (n.d.). Retrieved September 29, 2016, from <http://www.bureausla.nl/>

This article did not provide much in the form of data or observations on sustainable education, however it provided a case study to what would ultimately be a design solution to the given context of the paper. The Nature and Environment Learning Centre in Amsterdam is the result of a nationwide movement in sustainable education in The Netherlands, in which all primary school children are to care for and grow their own garden. This has, according to The Netherlands government, increased their sense of place to their home, and has shown an increase in social and environmental awareness. This has proved to be a valuable starting point for further development of my research and design theoretical project.

Norddahl, K. (2014). What might early childhood education for sustainability look like?. In *The contribution of early childhood education for a sustainable society*. (Ed.). Retrieved from unesdoc.unesco.org/images/0015/001593/159355E.pdf

Norddahl states examples of a few different approaches that have been made, mostly in the Scandinavian countries, of ways to connect children to nature, and create a more sustainable

curriculum for their children to follow. She introduces the idea of what sustainable development is, which is referring to the way humans should behave on Earth, specifically when dealing with economic welfare, social justice, and environmental stewardship. Her example of the forest schools of Norway shows that sustainable education can not only benefit the environment and people, but also be extremely popular. This influenced my idea that sustainable education in young children needs to be the most important component in their development from ages 2-6. The qualitative descriptions of similar programs around the world are important in developing my idea of sustainable education.

Pressoir, E. (2014). Preconditions for young children's learning and practice for sustainable development. In *The contribution of early childhood education for a sustainable society*. (Ed.). Retrieved from unesdoc.unesco.org/images/0015/001593/159355E.pdf

Much like other sources listed, Pressoir discusses strategies for sustainable development in education to children. She argues that young children's ability to absorb content and their sense of wonder makes them highly capable of developing habits that can improve and influence the future world.

Active participation in the environment and communicating with others is a key point in her statements. Pressoir also mentions the importance of teaching adults these behaviors to pass along to their kids as “the parents are the first caregivers and educators to children.” This article helped in my understanding of the importance of teaching children while they are still young and most capable of retaining much of what they learn around them.

Siddiqui, D. S., & Aqil, D. Z. (2014). Building up an ecologically sustainable society by inculcating environmental ethics and values in children. *IOSR Journal of Humanities and Social Science*, 19(3), 05-09. doi:10.9790/0837-19320509

This article opens by stating the problem with traditional education and its lack of preparing students for real world situations dealing with economics, society, and the environment. In the article, there are multiple charts and tables depicting the importance and effects of sustainable education on not just children, but also young adults and the elderly. There is also a chart comparing and contrasting the traditional educational system with that of a sustainable educational system. This article was

important in showing the disconnect the current educational system has with the ever changing world we live in. Many arguments and evidence can be found here that reflect back into the paper.

Sträng, M. (2014). Talking about science from the child’s perspective as an important feature of early childhood education for a sustainable society. In *The contribution of early childhood education for a sustainable society*. (Ed.). Retrieved from unesdoc.unesco.org/images/0015/001593/159355E.pdf

Sträng gives little statistical data in her article, but provides a qualitative insight on a component of children’s education that the other articles fail to raise. Children see the world from their perspective, and their human scale is much different than that of their parents and their teachers. This disconnect between the teacher and student in traditional education is evident. The article is helpful in strengthening the ideas that education in young children needs to be experiential and centered around them and their sense of wonder and place.

UNESCO. (2007). *Education for sustainable development*. Retrieved 4 October 2016 from:

<http://portal.unesco.org/education/en/ev.php->

[URL_ID=27542&URL_DO=DO_TOPIC&URL_SECTION=201.html](http://portal.unesco.org/education/en/ev.php-URL_ID=27542&URL_DO=DO_TOPIC&URL_SECTION=201.html)

This quick article from UNESCO states their goals for education for sustainable development.

Specifically, this article speaks on the importance of cultural education and integration with youth.

This influenced the paper in argument two, which talks about what sustainable development and eco-intelligence is in relation to young children.

Veitch, J., Salmon, J., Carver, A., Timperio, A., Crawford, D., Fletcher, E., & Giles-Corti, B. (2014). A natural experiment to examine the impact of park renewal on park-use and park-based physical activity in a disadvantaged neighbourhood: The REVAMP study methods. *BMC Public Health, 14*(1).

doi:10.1186/1471-2458-14-600

This article is a study on whether upgraded parks increase their usage in disadvantaged neighborhoods. The data collected in this investigation showed little in the form of usefulness for this

paper, since the findings showed that little increases in usage were a result of upgraded parks and green space. They did, however, conclude that a linkage of parks and a higher quantity of them resulted in an area of increased usage.

White, B. R. (2004). *Interaction with Nature During the Middle Years: Its Importance to Children's Development & Nature's Future*. Retrieved October 08, 2016, from <https://www.whitehutchinson.com/children/articles/nature.shtml>

Randy White's article on interacting with nature for children in middle years revealed much about the current state of education and its role in getting children interacted with their natural surroundings. The article stated many researched findings about the decline of children playing and learning in the outdoors and the increase in indoor time. He also states many methods of sustainable curriculum for schools to follow, as well as benefits of a connection to nature. This article proved to be relevant to the research I have been conducting, and much of what is discussed had an influence on what I speak on in this paper.



ABOUT ME

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Architecture has for as long as I remember fascinated me. Design is all around us, and architecture is something that influences us in almost every single aspect of life. We are always surrounded by architecture, and the idea that we can create what is around us has driven me to try to design as best as I can. I hope to use what I've learned in school to create spaces that make the human experience better. I would like to emphasize sustainable living into everything I do in my professional life and leave this world a little better than how it was before I started.

