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Green I Instruction

A Capstone Project Submitted in Partial Fulfillment of the Requirements of the Renée Crown University Honors Program at Syracuse University

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Honors Capstone Project in Architecture

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Abstract

If society shows the need for a re-engagement with its surrounding nature in order to develop conscious environmental decisions, then a pre-kindergarten through fifth grade school, with the careful design and testing of materials, courtyards, and circulation strategy, will be the vehicle through which everyday decisions are taught at the earliest age.

**Problem | Statistics** 20 percent of Americans go to school every day, equating to 55 million students and nearly 5 million teachers and staff. More than 25 percent of those students and teachers are going to school in inadequate facilities where their health is at risk.¹

**Problem | Program** in an increasing number of new school building program requests, space for play, creative thinking, and outdoor activity is left undefined and underutilized, especially in urban locations.

**Problem | New York City** in the lower two districts of Manhattan, population trends are steadily increasing, causing a need for new schools. In this area, many obstacles must be faced including noise, pollution, and view of automobiles, skyscrapers, and apartment-style housing, as well as, tight zoning laws with little space left for new construction in a dense area. Currently, there are only twelve elementary schools in the two districts and only one of them offers modern design with ample outdoor play space. Furthermore, four of the twelve schools lack gymnasiums and/or auditoriums, key community spaces for development. In addition, many of the schools are pushing overcrowding limits while some have already substantially exceeded suggested occupancy loads.² After review of the schools within the two zones, a site at the current Hernando de Soto, Public School 130 was chosen, a site located on the borders of Little Italy and Chinatown.

**Solution** there are two things that must be accomplished to solve the above three problems. First, students must have the ability to learn in an environment that is adequate to their health. More importantly, however, they should have the ability to learn from their environment. Second, schools must implement sustainable and green measures within their design.

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Please see the end of the reflective essay piece for acknowledgments. Thank you.
Advice to Future Honors Students

Writing an honors thesis is not, by any means, an easy task. I started this project as the very first architecture student to undergo the new Renee Crown University Honors Program curriculum requirements, all of which were not even illustrated to me until my second year on campus. For that matter, architecture, as many of you may know, includes a fifth year dedicated to the writing and designing of a thesis project. How could I possibly combine the already heavy course load of an architecture thesis with that of an honors thesis without any precedent? To repeat, it was not easy. I will, however, tell you this: just do it. It seems clichéd, but honestly, through careful planning of my semesters, combining the two final projects turned out to be a blessing in disguise. I learned how to better communicate my ideas by writing for honors and how to better demonstrate an architectural idea by explaining it to multiple parties outside the School of Architecture. I cannot say much as to topic choices and when to start besides the same things you have already, or should have already, heard. Start as soon as possible. Do not wait. Schedule your semester week by week, even if you have absolutely no idea where you are going to be by week ten. Whatever you do, choose something you are passionate about. By the last few weeks of thesis work, you will rely on this passion to finish. Trust me, because if it were not for this passion, I would be outside grilling and sitting in the sun, too. One more thing: have fun. Try something a little different this time. You finally have the ability to design your own project with your own thoughts, so let loose.
Reflective Essay

On a warm and sunny July day, I was sitting on the floor of a classroom with a young child on my lap. Like most days at summer school, we were playing a game of blocks. The child, a developmentally-delayed four-year-old girl, could only communicate with hand motions and facial expressions. Although she was often difficult to understand, her smile was always clear. She had the kind of grin that would be described as “ear to ear,” and when she was happy, her laughter was plentiful. Near the end of the game, I asked her a simple question: “Would you like to play again?” She looked at me, furrowed her brow, and with a push of sound, hammered out the word, “No!” I was shocked! Sierra, at age four, had finally spoken her first word. That day, I remember leaving the Atlantic County Special Services School Extended Summer Program (ACSSSESP) with a smile of my own and a feeling of satisfaction, knowing that I had connected with very special little girl in a way not possible for her before then.

For the three summers prior to entering the Syracuse University School of Architecture, I had been fortunate enough to be able volunteer with ACSSSESP for disabled and special needs children. Each summer, I had been assigned to a preschool-aged classroom
with eight to ten students, most too young to be sufficiently tested to have a specific diagnosis to explain their developmental delays and difficulties. Some children could not speak, others were confined to wheelchairs, and still others had behavioral disorders. Most people would say that working with these children would be too depressing or even too challenging, but I have never really understood that kind of thinking. In fact, I found this kind of work to be particularly rewarding. Each day, it forced me to find new ways to connect with and engage the children in both lessons and playtime. It was from these interactions that I began to realize how much I enjoy being able to connect with others, regardless of stage of development, background, or level of life experience.

When I began applying for college programs, I took a deep look into how I wanted to represent myself as a person while developing a strong professional career. While volunteering gave me increased awareness of others’ opinions and backgrounds and a passion for caring, I was, at first, unsure how to integrate these values within the field of architecture. Eventually, my understanding of the key intersection between my experience and profession emerged. I came to recognize that the built environment can be a response to the differences of society. This
became the forefront of my capstone project titled Green Instruction.

In preparation for choosing a thesis proposal in the School of Architecture, many different considerations are usually brought to the table. One reads completed projects from earlier years, sits in on graduating seniors’ reviews, reads architectural publications, and, ideally, chooses classes that help develop personal interests. Most “fifth years,” as they are referred to by fellow architecture students, choose to propose schemes with typical building forms or to examine current pedagogy within the field. This often leads to an atypical building form.

Regardless of where the student begins, it is more than just the last four years of schooling that contributes to the final thesis; this has been the case for me, as well. My thesis proposal has developed from the idea that I must somehow be able to give back to society, enhancing it in every way possible, and understanding the connections among different people while still developing my skills in basic architectural practice. This development has led to a more concrete form of giving in the architecture field: sustainability. Sustainability can be defined in many ways. It is a complex term, used today in many fields. In architecture, for example, sustainability is usually associated with
the term green. Green has to do with the ability for a product or service to perform in a matter that is better and healthier for the environment than a previous product or service once used. In this field, sustainability can be understand as the means by which a building or project has the ability to maintain or sustain its own process or state. One must also consider the state of the natural environment. It is without much question that the world has been slowly depleting its resources and has come to a point in time that it must re-examine how it uses these resources.

My personal passion for helping others in need through my profession and the relevant need for change in society to protect the environment led to a thesis proposal starting at an early stage of human development: with children. Children spend around seven hours a day in school buildings. Here, they learn basic principles, from the ABC’s, to how to share and color. School building designs include a few large spaces for gathering and one of three circulation strategies that lead a child to his or her classroom. These circulation strategies are single-loaded, double-loaded, or clustered, as seen in the diagram below.
While each of these conditions is a functional layout, my thesis design looks to enhance these strategies, using the building and not solely the classroom as a place of instruction.

To understand how each of the case studies below influenced my work, a brief description of my final design may be helpful. The subject is an elementary school in lower Manhattan on Baxter Street, a few blocks away from well known Canal and Brewery Streets. All classrooms are located along Baxter Street while open programmatic elements such as the cafeteria and media center are situated midblock between Baxter and Mulberry Streets. Destination locations are spread throughout, creating spaces that enhance connections between individuals at different points within the building. Sustainable approaches such as daylighting strategies and plant growth are included among the design features.

Several existing structures have influenced the thoughts and opinions presented in the design and development of Green 1
Instruction. First is the Casa del Fascio, located at the city edge in Como, Italy. This building’s design is derived from a cube form, with manipulations and alterations to its site lines and overall positioning. While the site strategy and layout are crucial to understanding the building, what fascinates me most is how the architect, Guiseppe Terragni, spent considerable time developing and designing a daylighting strategy in 1936, long before sustainability was on the forefront of intent. The careful articulation of window details and light penetration allows an individual inside, and even outdoors, to begin to question and investigate that this design is much more complex that the rudimentary forms usually associated with simple structures.

The second architectural work that has been a large influence on my thoughts is the church at Ronchamp, designed by famed architect, Le Corbusier. At Ronchamp, details are used in many ways from window and doorjamb construction to site strategy and wall thickness. Light enters the nave through windows that have varying degrees of opacity and perspectives to develop different degrees of view when one is outdoors or indoors. Sustainable themes are present throughout the work, again at a time when this was not the main concern in design practice.
While the two above-mentioned subjects are completed projects, there are many architects and firms that have made major contributions to current thought process and design consideration. First is Le Corbusier himself. From sustainable measures at Ronchamp to articulated circulation strategy at the Villa Savoye, Le Corbusier has designed for many types and sites. His work develops from many angles and while each detail is unique, they always come together to create a coherent whole. For example, the circulation path at Poissey can read as a single moment wherever one stands or as an entire movement that seemingly ends with a picturesque image at the rooftop. Through this type of model, every person that interacts with these design strategies gains an understanding of where they are and what they are doing, and thus, can begin to appreciate architectural design and created spaces.

Other architects and firms that have recently become influential to me are those that have developed school design strategies in the present day. In preparation for designing an elementary school as part of my thesis, I examined a series of case studies that focused on themes that would later become helpful in details and strategies. While I initially focused on single projects
completed by these firms, overall design themes and practice of each became relevant and influential for my consideration.

The first of these firms is KieranTimberlake Associates of Philadelphia, Pennsylvania. Most notably studied was the Sidwell Friends School in Washington, DC, although the firm’s attention to school design and sustainability has augmented a more general appreciation for their work and design practice. The Sidwell Friends Middle School offers an addition to a previous school structure creating a wetlands, green roof condition, and outdoor classrooms. These strategies are modern examples of how education can take place both in and out of a classroom. For example, students are taken out of their science room and into the wetlands for hands-on experiments.

The second major firm that was studied is FMSA Architects of Victoria, Australia. The specific school studied was Chum Creek, where students learn to create their own classroom through the use of louvers, openings, and moveable furniture. I find this project fascinating, due not only to the attention to detail but also its ability to allow transformation through student use, as one major obstacle that I had to overcome during the design phase has been handling varying degrees of use in both daily and yearly activities. For example, by introducing micro-wind turbines at the northern edge, I
had to consider how students would interact with them while also studying prevalent wind patterns during the various seasons. While some students may use the wind turbines to track patterns in New York City for a class assignment, others may look at the wind turbines as a constant reminder of how energy can be harvested for their building.

The third firm studied was Pfau Architects, who designed the Lick-Wilmerding High School in San Francisco, CA. While this school is for older students other than the population on which I have focused, it does offer the key concept of understanding. Students were built a brand new community center on their campus but learn that it only is able to operate because a series of windmills that were added at the edge of the design site. This community center was specifically designed to be “off the grid,” or, in other words, not part of the main energy source supplied by the city. If the windmills do not gather enough energy, the lights would dim, for example. One major part of my thesis is the ability for building to not only be a place of learning but a place that teaches. Because of this, as a student walks through my school, he or she is introduced to new technologies but is constantly reminded of past. For example, in each classroom there are “solatubes” that provide daylight from the rooftop. Only the largest tube extends to the
lowest grades, and while more tubes are visible on the floors above, they are increasingly smaller.

The final two firms studied in-depth both participated in a design competition held a few years ago for the City of Chicago Public Schools. Two organizers of the competition, President Thomas A. Forman and Associate Rose Grayson of the Chicago Associates Planners and Architects brought an interesting design problem to the competition, claiming that “many Americans are increasingly aware of and sensitive to the significance of sustainability in their everyday lives. Nonetheless, sustainability is still considered unconventional, alternative, expensive, or exceptional.”3 Thus, the key to this design competition was sustainability, although not necessarily through the accepted LEED accreditation program used to define a sustainable or green building in the last sixteen years. The firms of Marble Fairbanks and Smith-Miller + Hawkinson took steps to respond to this challenge. The Marble Fairbanks project introduced a community corridor at the first level of the school, providing connections between students, as well as among parents and faculty. This idea promotes active, involved, and informed relationships. The Smith-Miller +

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Hawkinson project, on the other hand, chose to focus on the classroom environment. Each room is attached to a shared greenhouse space that brings in daylight through slit skylights and provides teachers an opportunity to connect students with the natural environment. Both the community corridor and greenhouse spaces have become strong design features within my scheme. Due to the urban, dense location of my site, these design components were altered, but their main ideas remain present and are further explained later in this essay.

Influential works and case studies led me to one of the driving factors for the Green | Instruction project: a quote from the United States Green Building Council: “Twenty percent of Americans spend time in school every day, equating to fifty-five million students and nearly five million teachers and staff. More than twenty-five percent of those students and teachers are going to school in inadequate facilities where their health is at risk.”\(^4\) This observation startles and alarms me. Relevant information about Manhattan, New York, is equally grim. In areas such as the neighborhood of Hernando de Soto, Public School 130, where population growth is expected in the next two years, no new schools have been built and

occupancy levels of classrooms have risen steadily.\textsuperscript{5} Over a quarter of the schools in these areas lack what The Department of Education of New York City would consider standard features: gymnasiums and auditoriums.\textsuperscript{6} New schools are obviously needed, and they must be healthier, better, and more accessible.

Like any design, an elementary school in Manhattan requires unique site strategy and careful attention to its surroundings. It needs to provide for the same activities as other schools, but these must be inserted into a compact, dense location. Rather than being able to expand outwards, it must grow upwards. Rather than having picturesque views out the windows, it must take into consideration “sky-scrapers” and dense residential conditions, coupled with bustling, busy streets. With all of these obstacles, I have proposed a different strategy than the typical urban school plan: rather than sacrifice green space for more building program, the natural environment is given expression as the most substantial design attribute and an educational tool. This concept changes normative school pedagogy in which one learns primarily in a classroom – here, “green” attributes offer another context for instruction.


Design has thus led into an investigation of details that come together to create a coherent whole, paying attention to how students, parents, and faculty can learn from their building. The entire first floor of design has undergone various proposals starting with the introduction of large entry conditions on each major edge of the school along Baxter and Grand Streets. Using program such as a café, parent resource center, gymnasium, and art rooms there is a connection to a school but program allows for dual function depending on the time of day, allowing the community to access the spaces for nighttime activities, for example. A large ramping system will begin at the base and introduce students to a sort of green carpet that takes them along a path to various parts of the building. This system will be housed along the central core of the building with the large, double height and open programs of the café and media center to the west with classrooms and stacked programs to the east. The gymnasium is located at the north side of the site, a location chosen so that it can be shut off from the rest of the building if needed for a nighttime activity.
Following the ramp will be a series of bamboo planters that are cared for by the students. Bamboo has the ability to reach heights between forty and fifty feet without extensive light and is also a very sustainable material. This is one of the first interactions students, teachers, and parents will have, experiencing the bamboo every time they enter the building. Students and teachers will experience a bamboo garden located at the edge of each classroom. The youngest classes will be able to take care of the bamboo at ground level while the upper grades will experience the leafy aspects of the plant, keeping it untangled. These greenhouse gardens extend through each of the classrooms and continue partially up onto the roof, where they create light wells and act as ventilation chimneys. Attached to each of the greenhouses are full height glass gardens followed by shorter window ducts that provide
view between classrooms and connect back to the main corridor. Within each of the full height glass gardens are “solatubes” that extend from the roof where they capture sunlight and illuminate spans up to fifty feet. By allowing them to extend through the floors, much like the bamboo, the students are constantly reminded what they learned in years past about daylight. Sun louvers will align the western and eastern façade creating an environment for the classrooms that decreases glare while reducing the need for artificial lighting.

Destination pieces along the ramp include two outdoor classroom localities. The space atop the gymnasium along the north side is established for an outdoor play space that also captures wind through the use of micro-wind turbines. Micro-wind turbines do not require expansive space and need only small gusts of wind to operate. Thus, they are ideal for city locations where wind can only be harvested in small amounts. These turbines need only two meters per second of wind velocity to generate energy. This space will be connected to the rest of the building by a stair and ramp condition that starts at the cafeteria and is accessible from any floor. The space floating above half of the media center and main circulation path will have a planted roof garden for outdoor learning. This low profile and lightweight roof garden helps
cool the building, improve energy efficiency, and helps with storm water management and the urban heat island effect.

Overall, the design of the building has become a sectional study that alters the traditional approach to school design, which formerly is based on the plan and program only. Students at the new building will be able to learn about their building at any point, drawing connections and gaining intuitive understanding of how the building works and operates within a larger community of sustainable thought and practice. In this way, I hope that my building’s design creates a new standard, teaching future designers that green design is possible and more importantly achievable in all types of buildings.

To conclude, I would like to thank a number of friends, family, and advisors that have been my continued backbone throughout this thesis. A special thank you extends to my family for providing the opportunity to attend this school and their continued support in pursuing my academic goals. I would also like to thank my sister in particular for helping me with trips to the site in New York. As for my day to day, I cannot thank my roommate and boyfriend enough for their continued support, design charette help, and presentation critiques. Within the academic setting, a personal thank you extends to my honors reader, Elliotta Callahan. With her
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Written Summary of Capstone Project

Green Instruction is a project deeply rooted in the themes of education, sustainability, instruction, and trends. In practical terms, the thesis conclusion is a project that created a sustainable elementary school design in the heart of lower Manhattan at the juxtaposition of the Chinatown and Little Italy communities.

To begin, an explanation of how the thesis was developed is only appropriate. Sustainability can be defined in many ways. It is a complex term, used today in many fields. In architecture, for example, sustainability is usually associated with the term green. Green has to do with the ability for a product or service to perform in a matter that is better and healthier for the environment than a previous product or service once used. In this field, sustainability can be understood as the means by which a building or project has the ability to maintain or sustain its own process or state. One must also consider the state of the natural environment. It is without much question that the world has been slowly depleting its resources and has come to a point in time that it must re-examine how it uses these resources. My personal passion for helping others in need through my profession and the relevant need for change in
society to protect the environment led to a thesis proposal starting at an early stage of human development: with children.

It is said, “Those who will learns its lessons, take them to heart, and carry them home are our children.” (cite needed) With this idea in mind, I began investigating school pedagogy, as well as current trends in education and building forms. I researched population trends and occupancy levels in the classrooms to determine where students were located and where to expect their attendance in the near future. In an attempt to bring sustainable thought into the schools, I also studied what kinds of spaces already existed in school program layouts, looking at auditoriums, gymnasiums, atriums, and courtyards. I lastly looked at health considerations, and was startled by the facts. Too many current schools have poor ventilation, insufficient daylighting, meager heating systems, and inferior acoustics. Rather than improve these facilities, however, superintendents and school board members are often overwhelmed with the need to improve student test scores, prepare for future education, or enhance curriculum standards.

The solution soon became apparent to me: a green school in which students will be able to study in a healthy environment and also to learn from their surroundings, hopefully using what they learn about sustainability to make better decisions in the near future.
Design soon followed at the chosen site of the current Hernando de Soto School, PS 130. With a very tight site, the current school built upwards, totaling five stories, but did not take active use of the alleyway between buildings at its southern edge. The northern alley, however, has a loading dock and delivery access to the cafeteria space. Classrooms were located on both the east and west facades, each with individual air conditioner window units. This limits not only efficient ventilation but also daylighting strategy. With over 1,000 students at the school, there also was no time for recess and overcrowding became an issue.

Taking many ideas from current green school design including daylighting strategies, wind source power, and community spaces, I approached the site with key program adjacencies. Layout pushed classrooms to the west side for daylight with larger open spaces to the inner core of the block on the east side. The first floor doubled in height to invite community into new, enhanced spaces with dual uses such as the gymnasium, cafeteria, and parent resource center. Destination points became scattered throughout the building, including two key spaces atop the gymnasium and attached to the media center, each offering a unique journey for a student to go from ground level to their classrooms. These two key spaces will have a roof garden and
micro-wind turbines in conjunction with seating for outdoor learning spaces.

Located throughout the building will be many opportunities to learn about sustainability, beginning with the introduction of bamboo. Bamboo is a highly regenerative plant that is able to grow to heights of fifty feet, a perfect choice for greenhouses implemented into each classroom. Beginning at the lower grades, bamboo shoots will run through each of the classroom levels allowing students to take care of them while learning about their growth patterns. Bamboo will also be located throughout the building along a ramp that connects the key spaces. Connecting between the ramps will be ducts running from hallway to greenhouses, providing a reminder of the larger systems going on in the building. Each greenhouse will rise to the roof, creating a ventilation chimney, helping to maintain healthier air throughout the building.

Overall, this new, sustainable school is about a building that serves its purpose by providing shelter as an educational facility but also introduces a new way of learning from the building itself. Its purpose is twofold: one, to demonstrate what can be done across the board in school design and two, to highlight in the future, how
sustainable school design can begin to change the mindsets of individuals learning and teaching within them.