



School at the Zoo:

Enhancing education through
site and design

A Terminal Project
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at the
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Major: Architecture
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Professor Nathan Krug
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SCHOOL AT THE ZOO:



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SCHOOL AT THE ZOO:



Project Abstract

Statement of Intent: As the concern for quality public education in America continues to grow, parents, educators, and citizens seek alternative methods for meeting students' needs. My intent for this design thesis project is to explore one such method: the placement of an educational facility in a non-traditional setting. Whether or not this method actually improves public education is not the focus of my project; instead, the development and design of a facility that promotes learning, encourages conservation, enhances creative problem-solving and forward thinking, and integrates real world situations in an educational context is the focus of my thesis. The fulfillment of these conditions seems to be well-suited to a non-traditional setting, in this instance, a zoo. The facility will incorporate environmentally friendly materials and methods, energy efficient systems, and an innovative design that endorses the goals and objectives of the Association of Zoo and Aquariums and the mission statement of this zoo in particular.

The outcome of this project will be to create an educational facility and animal outreach program that will be used as a full-time alternative school for public school children. It will also be a resource center for educators, leaders of organized groups (such as boy/girl scouts,) families, church groups, and other parties interested in opportunities to connect to nature. Overnight visits, Saturday and summer camps, field trips, pre-school and after school programs, animal encounter shows, nature workshops, birthday parties, and other such events will be projected uses for this facility. The design of the building will fit the context of the existing zoo structures but will also be one that excites visitors and emphasizes the message of care and concern for nature and wildlife. In addition to providing a place for people to learn and grow, this facility will house a small number of animals.

Of particular focus will be how architecture can be used to enhance the educational experience for students and zoo visitors and how architecture can be used to incorporate a school environment into a zoo setting. I plan to explore these two conditions through research, a literature review, interviews with educators, administrators, and zoologists, and site visits to the Henry Doorly Zoo and other zoos in the United States.

I am especially excited about this thesis project because of my past experience and education. A former teacher with over 15 years of classroom experience, I have some awareness of appropriate school design. Having worked as a zoo school teacher at the Fort Worth Zoo in Fort Worth, Texas for several years, I have learned much about animal conservation and wildlife preservation. I understand ways in which zoo classrooms need to differ from traditional classroom settings. My educational background, including a Master's Degree in Education, has provided me with a deep knowledge base from which to draw for the development of the environmental, educational, and spatial needs for this project. It is my belief, therefore, that I can utilize my current expertise, past experience, and prior knowledge to design a facility that incorporates my three greatest passions: children, animals, and architecture. Through this project I hope to improve my design skills, increase my understanding of the design process, and advance my proficiency as an architect.



SCHOOL AT THE ZOO:



Project Abstract

Project Description: This “zoo” school will be an educational option for elementary-aged students. All subjects and programs, including music, P.E., art, and special education, will be available at this facility. In all respects, this school will meet the state mandates and include all of the necessary components of a traditional elementary school. The uniqueness of the school will be in its location – on a zoo campus, and in its focus – science, math, the environment, and conservation. Another special quality of this school will be the incorporation of architecture as a means of enhancing the educational experience and to serve as an example of environmental responsibility. Environmentally friendly products and methods will be proposed for the construction of this design.

This school will serve approximately 200 students from grades kindergarten to six during the school week and shall include classrooms for an average of 20 students each, a cafeteria, a small gymnasium, a science lab, a library, a computer lab, in addition to other program identified spaces. Select areas of the school building will be open to the public for birthday parties, family and organization tour groups, corporate gatherings, and overnight stays. Shower facilities will also be available for overnight guests. A small-animal zoo will be housed in the school for educational purposes available to both the weekday students and the visitors to the building during evenings and weekends events. Storage and maintenance needs will be included in the design program for this animal housing unit. Even though daily tours of the zoo may be part of the educational experience of the zoo school students, a small playground will also be designed for “recess.” This playground may or may not be open to zoo guests.

The overall design of the facility shall be one that positively influences the educational conditions of the school and exemplifies the ecological and conservation goals of the zoo. My desire is to create a building that not only addresses academics needs and objectives but becomes a landmark among the many unique buildings already on the Henry Doorly Zoo grounds.

Site Description: The site for this educational facility is the Henry Doorly Zoo in Omaha, NE. It will be necessary for the site to have access to peripheral roads for easy drop off and pick up of students. In addition, this building will act as a beginning point for visiting groups from area schools, troops, and other organizations. Therefore, it must be located at a logical starting place for a tour. A location outside the zoo gates but within walking distance of the zoo entrance may also be an option.

Criteria used to determine the location of the site will include the space available, the proximity to peripheral roads or ease of access to peripheral roads, desires and suggestions of zoo administration, the master plan, restrictions due to animals needs/impact on the animals, and coordination requirements between zoo school and other zoo departments. I will use aerial views and my personal knowledge of school activity and experience as a zoo educator to analyze what site will be most convenient for student interaction and group tours.



SCHOOL AT THE ZOO:



Project Abstract

NAAB Criteria (means of meeting criteria in italics)

Arch 613

Speaking and Writing Skills: Ability to read, write, listen, and speak effectively *through the development of questionnaires, proposals, and presentation materials, the conduction of surveys and interviews, and the presentation and defense of design ideas*

Critical Thinking Skills: Ability to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test them against relevant criteria and standards *through extensive research, in-depth interviews, literature review, and collaboration with fellow students and educational faculty*

Graphic Skills: Ability to use appropriate representational media, including freehand drawing and computer technology, to convey essential formal elements at each stage of the programming and design process *through preliminary drawings, revisions and development, and final presentation materials*

Research Skills: Ability to gather, assess, record, and apply relevant information in architectural coursework *through literature reviews, case studies and comparative data, site visits, field studies, and precedents, and surveys*

Formal Ordering Systems: Understanding of the fundamentals of visual perception and the principles and systems of order that inform two-and three-dimensional design, architectural composition, and urban design *through physical model making and computer-aided drawing, examination of maps and aerial images, and precedents*

Fundamental Design Skills: Ability to use basic architectural principles in the design of buildings, interior spaces, and sites *through examination of precedents, direction from college faculty, and prior knowledge/learning*

Use of Precedents: Ability to incorporate relevant precedents into architectural and urban design projects *through case studies and research data, examination of historical, contemporary, local and contextual architecture, and extensive journal/website review*

Human Behavior: Understanding of the theories and methods of inquiry that seek the relationships between behavior and the physical environment *through surveys, case studies, educational research, and literature review*

Program Preparation: Ability to prepare a comprehensive program for an architecture project, including assessment of client and user needs, a critical review of appropriate precedents, an inventory of space and equipment requirements, an analysis of site conditions, a review of the relevant laws and standards and assessment of their implication for the project, and a definition of site selection and design assessment criteria *through collaboration with zoo administrators, education experts, college faculty, and examination of precedents and case studies/research*

Site Conditions: Ability to respond to natural and built site characteristics in the development of a program and design of a project *through observation of current zoo architecture, examination of zoo master plan, assessment of topographical maps and conditions, and consideration of needs, goals and desires of zoo administrators*

Arch 614

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SCHOOL AT THE ZOO:



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Fundamental Design Skills: Ability to use basic architectural principles in the design of buildings, interior spaces, and sites

Use of Precedents: Ability to incorporate relevant precedents into architectural and urban design projects

Human Behavior: Understanding of the theories and methods of inquiry that seek the relationships between behavior and the physical environment.

Accessibility: Ability to design both site and building to accommodate individuals with varying physical abilities *through the incorporation of ADA recommended and required design elements*

Program Preparation: Ability to prepare a comprehensive program for an architecture project, including assessment of client and user needs, a critical review of appropriate precedents, an inventory of space and equipment requirements, an analysis of site conditions, a review of the relevant laws and standards and assessment of their implication for the project, and a definition of site selection and design assessment criteria.

Site Conditions: Ability to respond to natural and built site characteristics in the development of a program and design of a project.

Building System Integration: Ability to assess, select, and integrate structural systems, building envelope systems, environmental systems, life-safety system, and building service systems into building design *through the examination of available technology and recommendations of college faculty*

Comprehensive Design: Ability to produce a comprehensive architectural project based on a building program and site that includes development of programmed spaces demonstrating an understanding of structural and environmental systems, building envelope systems, life-safety provisions, wall sections and building assemblies, and the principles of sustainability evidenced *through an extensive and thorough design presentation*.

Methodology/Approach: This thesis project will result in the completed design of a zoological educational facility as a response to the growing need to improve America's public school system. Personal interviews will be conducted with zoo administrators and educators to determine needs, goals, requirements, regulations, mission statements, and objectives of alternative education opportunities in non-traditional settings. A review of the zoo's master plan will assist in determining the direction this facility will take. In addition, a thorough examination of existing zoo schools, zoological architecture precedents, case studies, and educational and zoological philosophies will be conducted to set a framework of investigation. Aerial images, contour maps and models, context photographs, and other site related evidence will be acquired to further understand the opportunities and limitations of the site. Ideally, visits to zoos with onsite schools will be made or information gathered via the internet and e-mail will be attained for comparison and insight. A comprehensive program will be developed to ensure that both the zoo's and the tax payers' needs are addressed. The design will be influenced by the context analysis, examination of precedents, review of research literature, and program requirements.



SCHOOL AT THE ZOO:

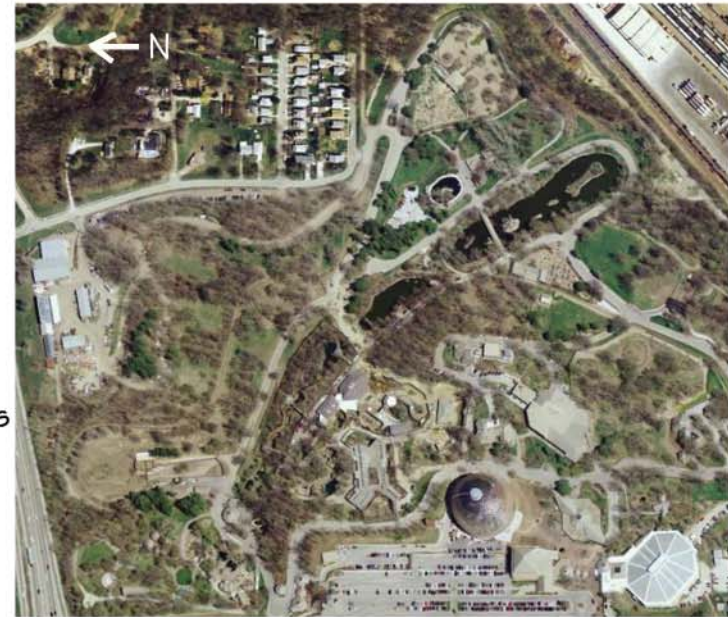


Project Abstract

Summary: Current educational research indicates that specialized schools focused on math, science and engineering “can help to improve the United States' ability to remain competitive in the global economy, and it calls for additional federal funding for new specialty schools”.¹ Alternative school settings have long been valued as means to enhance educational experiences and prevent school failure and student drop-out.² Most of these schools are geared toward secondary school-aged students. Reaching students at an age younger than 6th grade so as to cultivate an interest and passion in these subject areas and the world around them may be a means of improving the US educational standing in the world while increasing global awareness and responsibility. A specialty school for elementary aged students situated in a zoo context where science, math, ecology and conservation are emphasized may address these research findings.

The question remains, then, as to how architecture can impact this educational experience. My research will include an investigation into the impact of architecture on school design. Changes in pedagogy have had an influence on the development of new technologies and the design of school buildings.³ A thorough examination of this influence will be the crux of my research and how to incorporate my findings into the design will be my ultimate goal.

Public education is a concern to all American citizens whether or not they have children in school. Educators and public officials are continually looking for ways that education can be improved. In this design thesis project, I propose that architectural design and the placement of the facility in a non-traditional location can positively impact the educational experience. The intention of this project is to design a building and place it in a setting that promotes learning, encourages conservation, utilizes ecologically-sound materials, and supports global responsibility.



Google Earth image of Omaha's Henry Doorly Zoo



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Research-Analysis

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SCHOOL AT THE ZOO:

My Background

When I started my first job as an elementary school teacher in 1990, my classroom was a square, windowless room in a long rectangular building. The walls were wood paneling that did not accept tape. The floor was dingy linoleum that reverberated the squeal of chairs as the students pushed back from their desks. And the ceiling was plaster that rained particles every time a door was slammed. Although the surroundings were less than desirable, I faced the eager students in my classroom with a sense of responsibility and purpose not unlike most beginning teachers. My goal: to individualize my instruction for each student to best optimize his or her learning potential. This meant having different spelling lists for different children, reading groups geared toward varied needs and levels, small group math instruction to build upon prior knowledge, and flexible presentation methods to meet a variety of learning styles. When I left the teaching profession fifteen years later, I had a beautiful classroom with staple-able walls, carpeted floors, and hanger-friendly ceilings. Much to my dismay, and one of the reasons I left the profession, my instruction had changed too, but it was less beautiful. No more individualized education. Teachers now had to teach all children in the same way at the same pace from the same textbook at the same time because we wanted to make sure there was “no child left behind.”

One of the highlights of my career as a teacher was working during the summers and on the weekends as a “zoo school” teacher at the Fort Worth Zoo in Fort Worth, Texas. At the zoo, I taught students from ages four to twelve about plants and animals, gave tours of the zoo, and presented animals. It was a wonderful experience that, years later, greatly influenced my design thesis project.



Top left: first classroom
Middle: teacher and students
Bottom: zoo school

Literature Review

Outside of the home, a child is most impacted by what happens at school.⁴ Attending school is a student's indoctrination into the society and culture into which he resides, and it is his introduction to the rules and regulations that will govern him the rest of his life. Therefore, what a child is taught, how a child is taught, when a child is taught, and where a child is taught are all important factors to consider in the design of an educational facility. Among these four equally important factors, the focus of this thesis is *where* a child is taught, specifically the physical school building and the site location.

How architecture impacts education and if the site location of a school building matters are the two main issues of this design thesis. Currently, the public evaluates its local school's performance on test scores only. The features and location of the physical surroundings in which education takes place are usually not considered. In fact, until the middle of the 20th century, architects were not actively involved in the design of school buildings beyond structural engineering and exterior décor.⁵ Health concerns, protection from the elements, and safety aspects were the main issues architects responded to in school design.⁶ "The effects of this neglect by architects [to consider the affect of design on learning] were out-sized schools that contained non-functional, poorly-arranged spaces that were uncreative in their designs and unsuccessful in contributing to the educational experience."⁷

Not until 1940 did this unimpassioned relationship between architecture and education change. Crow Island Elementary School in Winnetka, Illinois, is deemed the first American public school building designed by architects specifically responding to an educational philosophy: progressive education. A collaboration of architect, client, and user, this project followed a design development process of "extended...listening, analysis, and discussion among educators, teachers, and designers."⁸ According to Roger Shepherd, this design process led to "the architects [being] eminently successful in expressing their sensitivity to the needs and desires of small children. Everything at Crow Island affords young people a more intimate, homelike atmosphere



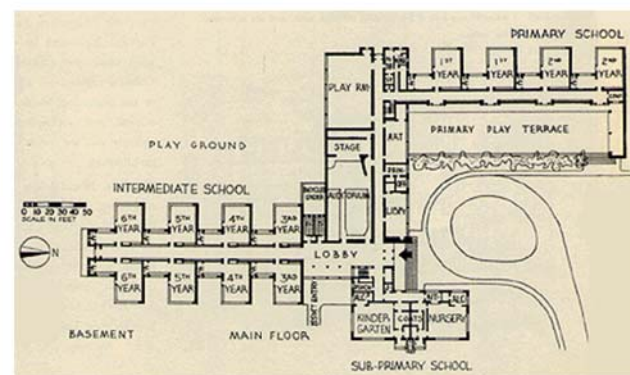
Omaha's Henry Doorly Zoo Wild Kingdom Pavilion Learning Zone.

while, at the same time, they experience an expansive sense of freedom. Each of the L-shaped 'one-room school' modules contains large sections of glass to admit light into all the rooms and the hallways. Each also has its own small courtyard of flagstone, walks, and shrubs, contributing to a pleasant sense of spaciousness."⁹ The architects credited with changing the role of architecture in school design were Larry Perkins and Eero Saarinen. They followed the philosophy that everything in the school should fit the student and everything within the school should be scaled to child-size so as to meet child needs. Door handles and blackboards were lowered to aid in student use. Benches were proportioned to child dimensions. Ceilings were lowered from twelve feet to nine feet. No "overly elaborate or forbidding refinements" were used that might intimidate children. Bright, primary colors on doors and walls acted as way-finding elements to help students find their classrooms and other important locations in the building.¹⁰ Finally, nearly 200 years after the American schoolhouse building type originated, a school design addressed the conditions of the activities within.

From this point forward, attention to changing philosophies in education and society became a driving force in school design. This was evident in the "social engineering experiment" of the open-plan school in the 1960s.¹¹ School design consisted of large open spaces with moveable interior walls aimed at encouraging "self-directed, student-motivated learning."¹² As new trends emerged, architects responded, although not always in a manner that best suited the educational process. Windowless school buildings became commonplace as school districts dealt with energy conservation due to the oil embargo of the 1970s. Economic worries and budget concerns led to design focused less on student needs and more on saving money by reducing heating and cooling costs.¹³ This continually fluctuating opinion of what role architecture should play in education – from a partnership in the educational process to an agency of economics and efficiency – has led to increased examination of how or if school building design impacts the educational process.

School Building Design for the 21st Century

According to U.S. Department of Education's National Center for Education Statistics, nearly 75% of the public



Above: Crow Island School Floor Plan designed to bring an abundance of light and air into every classroom.

Right: Crow Island classroom - each classroom has a glass-paneled transom door opening onto a courtyard, linking outdoors and indoors.

Images from website
<http://rogersshepherd.com/WIW/solution5/crow2.html>





schools in America were built before 1969.¹⁴ These 20th school buildings

represent an approach to education that emphasizes teachers as lecturers and students as listeners. Standard-sized classrooms were designed to hold groups of 30 or so children, who sit at desks facing a teacher standing at a blackboard. [The classrooms] were intended to contain young people, rather than expose them to the outside world. They emphasize uniformity and utilitarianism over diversity and discovery. Even as our understand of how people learn has become more sophisticated and we've developed innovative technologies and techniques to help children achieve, most schools still reflect an outmoded model of education. Eighty percent of current schools, for example, were built before the advent of personal computers. Most weren't designed with such innovative instructional practices as cooperative learning or project-based education in mind. Such out-of-date facilities present both physical and psychological barriers to change.¹⁵

This type of school building is no longer conducive to a new type of education. It is best to "provide a 21st century education in a well-designed, well-equipped, 21st century building. If our goal is to create facilities that support 21st century learning needs, rather than to recreate 20th century schools, then the process we use to select designers and architects will need to extend beyond looking at what they have already accomplished."¹⁶ In the 21st century school building, there should be an "underlying premise that all learning environments should be learner-centered, developmentally- and age-appropriate, safe, comfortable, accessible, flexible, and equitable in addition to being cost effective."¹⁷ Learning spaces need to reflect the way children learn. They should be diverse in size and type to provide for large-group instruction to small-group work, from hands-on investigation to individualized projects. And they should be designed to be flexible and have the capacity to change as educational needs change.¹⁸ Bruce Jilk, an award-winning educational architect, believes all newly built schools should be flexible enough to be used as something other than an educational facility in twenty-five years.¹⁹



Left - Students sitting in rows completing worksheets independently is a teaching method of the 20th century.

Right - Learning in cooperative groups and through computer use is the desired educational practice in the 21st century classroom.



Images from

left - http://sitemaker.umich.edu/schueller.356/teaching_methods

upper right - <http://web.whittier.edu/broad Oaks/index.htm>

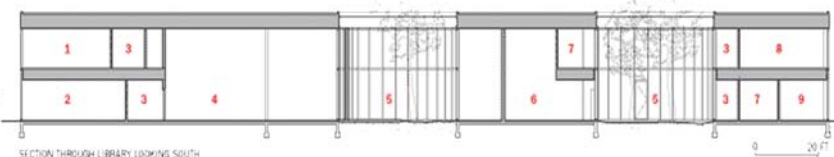
right - <http://www.sbac.edu/~wpops/spotlights/07-SmartBoardRelease.jpg>

Furthermore, the 21st century schoolhouse must be more than merely a container in which learning takes place. It must, in a sense, become “a ‘third teacher’ a tripartite alliance between teachers, parents and the environment within which [education] takes place.”²⁰ As a “third teacher,” a school building can teach about math, science, social studies and art through both the manmade structures and the surrounding natural environments. If carefully designed, the school building can “stimulate curiosity and serve as an instructional tool.”

[If the] mechanical equipment for the heating and cooling systems of the school is visible, [the] students can study how it works. Exposed structural elements such as beams, trusses, and columns [can] demonstrate principles of geometry, physics, and design. Walls, floors, and furnishings feature[ing] large-scale maps, murals, and timelines prompt wonder among younger children and reinforce learning for older students.²¹

The addition of Lexan-covered cutaways of plumbing, electrical, and HVAC systems allow children to see what happens to the pipes and cables that disappear into the wall.²² Planned nature areas and garden plots provide a multitude of learning opportunities that extend learning beyond the classroom walls. “Not only the built environment of school but also the school’s natural setting reveal the ideas, laws, and principles that we are trying to teach children from textbooks. ... The buildings, the trees, the dirt, the grass can become convenient teaching tools for innovative educators,” said architect Anne Taylor. These often neglected sites for learning have the potential to offer students “endless possibilities for exploration.”²³

- | | |
|-----------------|----------------------|
| 1. Second grade | 6. Music room |
| 2. Kindergarten | 7. Special education |
| 3. Corridor | 8. Fourth grade |
| 4. Media center | 9. Speech lab |
| 5. Courtyard | |



A building that teaches, Burr Elementary in Connecticut designed by SOM has generous glazing and interior courtyards and cut-outs in the building mass to create a strong relationship to the 15-acre site. Enhanced by the use of local stone and wood, the design takes advantage of daylight within a fluid plan. Sustainable components include the use of recycled materials, a waste-management plan, and irrigation systems. In the center of the floorplan is the library/media center, which opens onto an outdoor courtyard furnished with benches. A science courtyard contains a weather station for student experiments.

Data and images from <http://www.modernsteel.com/>
http://archrecord.construction.com/projects/bts/archives/k12/05_burr/photos
 and <http://www.archidose.org/Feb05/020705.html>

Designing a sustainable or “green” building also makes it a “third teacher.” Mark Biedron, co-founder of New Jersey’s The Willow School believes teaching sustainability is the responsibility of all educators so as to “help children understand what it means to take care of this planet so we can continue to live on it and do all the things we’re doing without using up all our resources. Green building does that for schools and educates anyone inside the building about it. I think any architectural firm and school that’s not talking about this is going to be left behind.”²⁴

Roof-top gardens, greenhouses, and the surrounding landscape can be used to help students become stewards of the land and learn to care for and nourish their environment. This sense of responsibility and ownership virtually eliminates vandalism and graffiti.²⁵ Employing additional environmentally-sound techniques allow students to integrate their studies of science and math with their learning of alternative methods of energy production. The use of wind generators, solar panels, natural daylighting, and trombe walls can help students understand the cost of maintaining a school and the toll on the earth of traditional methods of energy production. “A school that embodies stewardship through careful and conscious management of land, air, water, energy, and building materials teaches children that taking care of their community is important and that their actions have an impact on the world in which they live.”²⁶



Denver School of Science and Technology is an innovative public charter school housed in a colorful and award-winning building in which both the building structure and the mechanical systems are exposed in order to facilitate learning. Image from American Architectural Foundation, KnowledgeWorks Foundation and Target “Schools Designed for Learning”

Twenty-first century school buildings are designed with the students, faculty and staff at the forefront. In addition to responding to the new educational models of student participation rather than passive listening and watching and new teaching strategies of cooperative, project-based, and interdisciplinary learning, school architects recognize additional factors that affect learning including indoor air quality, occupant comfort, lighting, and classroom acoustics.²⁷ Twenty-first century schools support teaching and learning, are safe and healthy, incorporate sustainability and environmentally-sound technologies, integrate the community and engage the public, and accommodate the potential for future needs and changes.²⁸ All-in all, a well designed school that positively impacts the educational process is one that is a delightful and relaxing place to learn; feels fresh, safe and new; does not consist merely of squares or oblongs and straight lines; has lots of natural light and fresh air; has lots of space and flexibility with different zones for different work; includes lots of colors but is not too bright; uses new technology, new furniture, and new

ideas; provides lots of storage and provisions for teachers; relishes lots of green things; incorporates a garden, a pool, pets, and/or flowers; and uses solar and wind power.²⁹

Research confirms that architecture can and does impact the educational process. Susan Wolff, in her doctoral dissertation under the guidance of Dr. George Copa, identified thirty-two design features that, if implemented, optimize the educational process. These thirty-two design features were then categorized into six design groups. Figure 1 identifies the features and categories that can help provide an optimal learning experience. The six groups are (a) learning group size, (b) functional spaces for learning activities, (c) adjacencies, (d) furnishings, (e) psychological and physiological support of the learners, and (f) structural aspects.³⁰ It is important for architects and educators to consider these design features as they build educational facilities of the future because now, as Bruce Jilk remarked, “Form is failing function” and if designers are unable to create school buildings that can adapt to rapidly changing educational processes, American schools will continue to decline and fall behind other nations.³¹

The Elementary Classroom

One specific area in need of being a well-designed space is the classroom itself. Most discussion of how architecture can impact education refers to the building as a whole. But the classroom itself most greatly impacts the students’ learning processes. In a well-designed school that exemplifies modern learning principles, it is inappropriate to have a classroom with straight rows of desks and a teacher lecturing in the front. Instead, today’s classroom must be designed to “encourage learning and support the developmental needs of the whole person.” It must be a place for students to “engage in applied hands-on inquiry, problem-solving, group work, discussions, presentations, and reflection.”³²

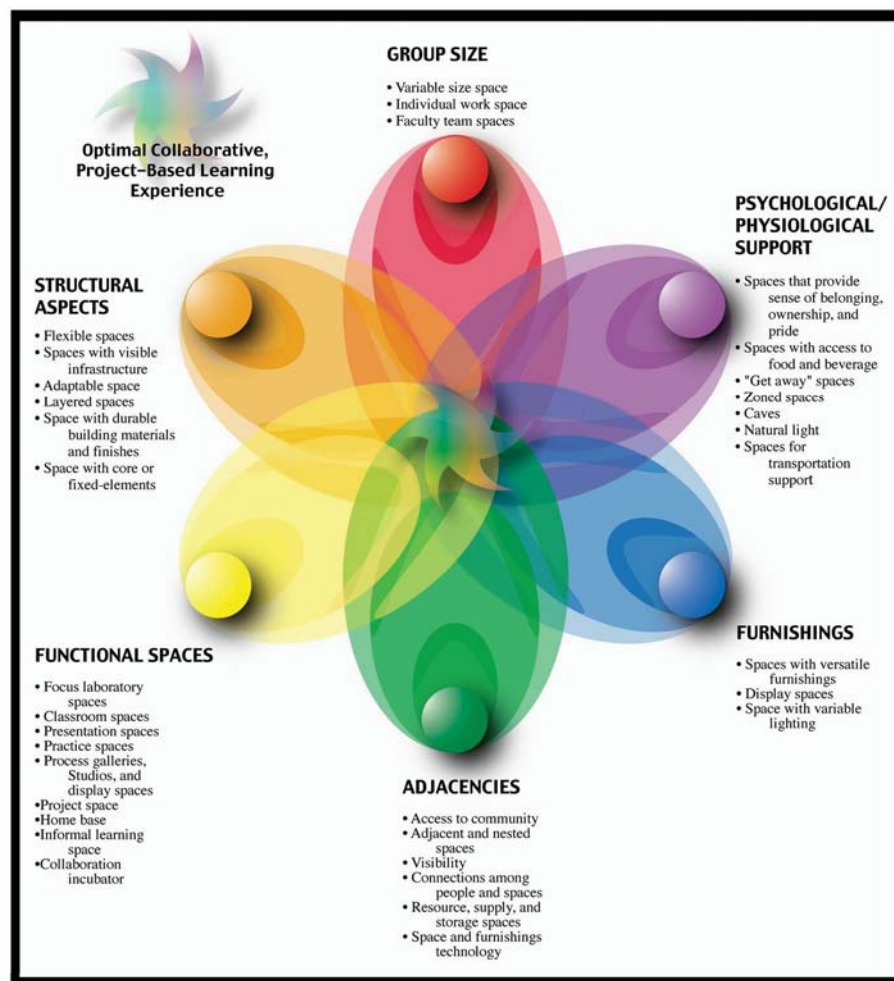


Fig. 1. The features within each group are best applied when in coordination with features in each of the other groups. No design feature on its own can optimally impact the educational process.

James Dyck, a Nebraska architect and Montessori School Administrator, describes the modern classroom as

- accommodate[ing] 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

- [being] flexible enough to allow the continual reorganization of the whole class into various sizes and number of small learning groups

- [being] manageable by a single teacher who has command of the entire space.³³

To meet these criteria, many factors must be considered. The number of students, the size and configuration of the classroom, indoor air quality, thermal comfort, lighting, color, acoustics, and furniture selection all need to be addressed when designing the modern classroom.

Classroom Size and Configuration

School districts throughout the United States are beginning to realize that small class sizes with a low student to teacher ratio is a Best Practice in education. Students in smaller classes

- did better on math and reading tests
- behaved better than students from larger classes
- had more parental involvement
- had teachers who had more time for instruction and needed less time for discipline³⁴

The negative ramifications of smaller class sizes are many but are ultimately financial. See Table 1.³⁵ Fewer students per classroom implies more classrooms per school. Limiting classroom square footage seems to be the logical, money-saving solution. Yet, research confirms that both poor student achievement and negative behavior are linked to the physical conditions and overcrowding of schools.³⁶ One

	Smaller Schools	Larger Schools
Advantages	<ul style="list-style-type: none"> • School safety/violence prevention • Personal touch with students • Potential improved learning • Less bus distance/time • Potential "walkable" school • Higher percent of student involvement in activities 	<ul style="list-style-type: none"> • Enhanced course offerings • Less expensive per student <ul style="list-style-type: none"> Construction Operation Administrative staff • More/higher-league athletics and student activities • Can achieve diversity with normal busing
Disadvantages	<ul style="list-style-type: none"> • Basics-only course offerings • More expensive per student <ul style="list-style-type: none"> Construction Operation Administrative staff • Fewer/lower-league athletics and student activities • Difficult to achieve diversity without busing • Susceptible to family aging of neighborhood 	<ul style="list-style-type: none"> • School safety/violence problems • Impersonal student/staff relationships • Institutional" rather than community" feel • Contributes to sprawl • Potential reduced learning • More bus distance/time • Less percent of student involvement in activities

Table 1. Comparison of advantages and disadvantages of small and large schools



Image from Report from the National Summit on School Design

In Hartford, grouping of 4 schools on a 16-acre campus has allowed the sharing of resources and facilities while keeping school size small by concentrating school populations. On the site are a Montessori magnet school, a magnet middle school, and two Greater Hartford Academies that teach high-level math, science, and arts. The campus is also home to a performing arts center, a Boys and Girls Club, the Aetna Center for Families, and the Connecticut Valley Girl Scouts Council.

Types of Classroom Designs

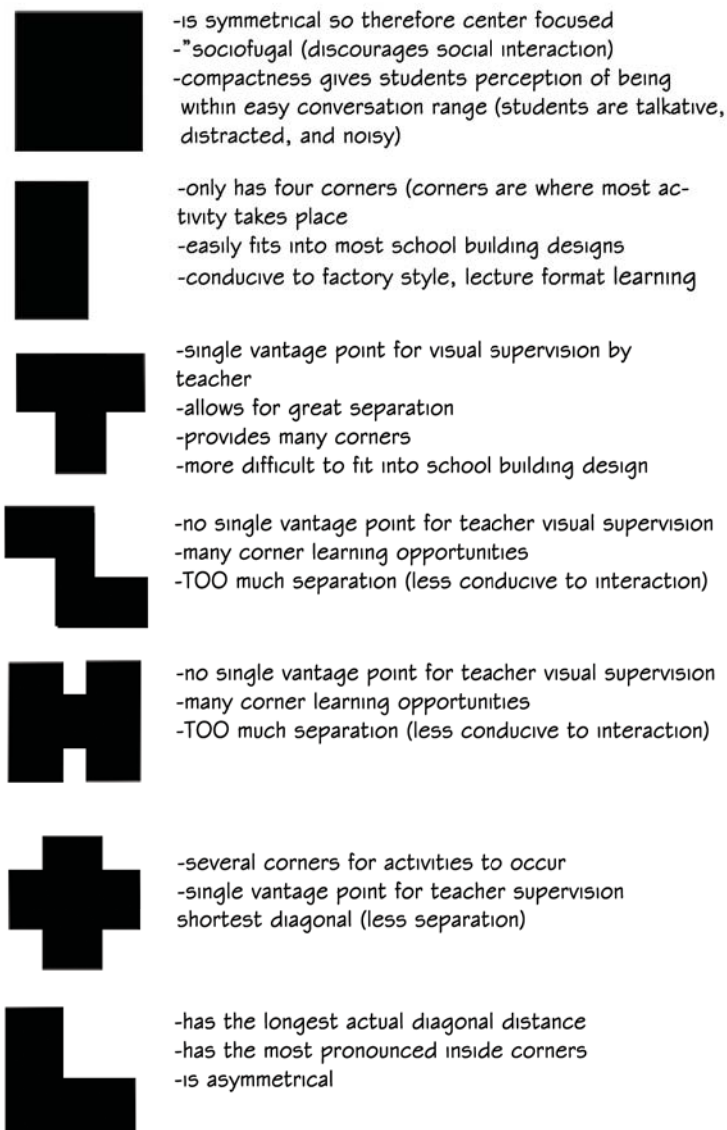


Fig. 2. The various types of classroom designs impact the students' experiences differently.

means to address the issue of smaller classrooms is the configuration or layout of the room. Potential classroom "shapes" include the traditional square and rectangle, the cross, T-, H-, L-, and Z-shaped. Each configuration has advantages and disadvantages. It is the L-shaped classroom, though, that seems to best suit the needs of the teacher, the students, and the school board. It is a layout that can be used to keep the square footage of the room lower than other configurations while providing for a sense of separation and easing the perception of being crowded.³⁷ The L-shaped classroom, because of five corner zones, can provide opportunities in which small groups of students may be engaged in diverse activities at the same time.³⁸ In addition, there is space for teachers to meet with their students as an entire group, there is good visibility and ease of movement for the teacher, and there is a visible barrier (an interior corner) that inhibits distractions from other groups. Other types of classroom layouts, as seen in Figure 2, may not share all of the benefits of the L-shaped classroom. In traditional classrooms (square and rectangular,) furniture and furnishings can be rearranged, but what can occur within the layout is limited. Desks in the conventional classroom shapes can be arranged in clusters which encourage collaborative learning activities and small group learning, but the square and rectangular layouts do not provide defined areas in which activities are separate from, yet part of, the class. This lack of perceived separation might disrupt the flow of learning between groups. The L-shaped, especially the "fat-L" which indicates both legs of the L are of equal length and width, allows for private and semi-private zones to occur along the perimeter of the space, and for activity space to be organized around the corner features. The various zones provide a sense of place so that students may be engaged in their tasks. In addition, these conditions "allow students to be engaged peripherally with other projects without having to leave their defined workspace."³⁹

IAQ, Thermal Comfort, Lighting, Color, and Acoustics

Within the classroom, several factors previously unexamined are now being shown to greatly impact the academic achievement of students. Not all of these factors have conclusively been shown to affect educational outcomes. Yet with some, such as indoor air quality, mere logic creates a link. It stands to reason that poor indoor air quality makes teachers and students sick, and “sick students and teachers can't perform as well as healthy ones.” Other factors are a matter of perception by users. Studies in the 1990s concluded similarly that teachers believe being able to control light levels, sun penetration, acoustic conditions, temperature, and ventilation in their classrooms directly affected their performance and that of their students.⁴⁰ Additional studies indicated that physical comfort based on temperature, lighting, noise control, and ventilation, correlates positively to the ability to concentrate, student attendance rates, and teacher retention.⁴¹

Lighting has also been shown to impact teacher and student performance. There is a general preference for natural lighting over artificial, and an “active dislike of fluorescent lighting” because of the glare and flicker. Classrooms with limited natural lighting appear gloomy and depressing. Natural lighting supports physical and mental well-being and directly affects academic achievement. A study by the Heschong Mahone Group (1999) indicated that students with the most amount of classroom daylight progressed twenty percent faster in math and twenty-six percent faster in reading than those students who learned in environments that received the least amount of natural light. How the daylight enters the classroom is important, too. Daylight coming through large windows of which students can see out create the illusion of openness and conditions conducive to thinking and learning. It is necessary for teachers and students to be able to direct sunlight so as to prevent glare on boards, computer screens, and in students' eyes. Teachers also need to have the opportunity to darken the room to near black-out level for multi-media presentations. When artificial light is a necessity, full-spectrum lighting rather than standard cool white fluorescent lighting has been found to minimize mental fatigue as well as reduce hyperactivity in children. Full-spectrum lighting also is the more responsible economic and energy conscious choice.⁴²

Windows not only provide daylight but also a sense of time, weather, and distant focal points – all of which prevent fatigue and contribute to greater alertness in class.



- Use fixtures that provide comfort by distributing some light on ceilings and walls, such as direct/indirect or semi-indirect fixtures.
- Use light-colored finishes on room surfaces to maximize reflected light.
- Include windows or skylights in every classroom.
- Design electric lighting to maximize benefits from natural lighting.
- Use interior blinds to control window glare.
- Use lighting controls to increase flexibility and decrease energy use for each room.
- Provide additional light for front wall or board, and other important room features.

Image and data from http://www.designlights.org/downloads/classroom_guide.pdf

Directly related to lighting is color in the classroom. Lighting can accent or diminish colors, and the colors used in a school can help or hinder students in the classroom. Having glaring white classroom walls was once thought to be not only cost effective but the least intrusive on academic activities. Yet, Kathleen Yarbrough stated in her doctoral dissertation that studies have shown the use of color in the classroom has improved student achievement.

Color experts agree that reds, oranges and pinks are warm and stimulating colors, while most blues and greens are considered cool and relaxing. Most grays are thought of as neutral. Tints are "receding" and make the room look larger, while deep tones are "approaching" and make the room look smaller. Different age children prefer different colors. Young children prefer red, blue, green, violet, orange, and yellow. Although young children prefer bright colors, too many high contrasts should be avoided because they can produce fatigue. Upper elementary classrooms should be painted with the cooler hues blue and green.

People and animals are stimulated by brightness and by warm color. An increase in muscular tension, respiration rate, heart action, blood pressure, and brain activity occur under these conditions. Dim light and cool colors have the opposite effect. They encourage withdrawal from external stimuli and decreases in muscular tension, respiration rate, heart action, and blood pressure.⁴³

It is important that, no matter which colors are chosen, overuse and extensive brightness of color is avoided. Also to be avoided is excessive ambient noise from ventilation systems, classroom equipment, movement of furniture on hard surfaces, and passing vehicles. Proper acoustics in classrooms is vital because studies have revealed that noise competes with the speech of teachers, classmates, and audio-media lessening a student's ability to listen and learn.⁴⁴ "Chronic noise exposure...has been shown to trigger the stress response by stimulating the amygdala (the area in the brain responsible for the fight-or-flight response), thereby increasing the heart rate and blood pressure. This reaction inhibits prefrontal cortex activity (the area responsible for learning) and thus impedes the student's higher cognitive functioning." Design considerations for managing noise include sound-dampening insulation in walls and ceilings, specifying double- or triple-paned windows, extending walls from the floor to the next level without an air gap. Outdoor landscaping can mitigate external noises, and the use of sound-absorbent cladding on low ceilings can help minimize internal disruptive noises. Angling the ceiling so that it is lower in the back of the room and higher where the instructor teaches and angling walls out five degrees from parallel are additional design features that aids in acoustics of a classroom.⁴⁵

Furniture Selection

"The reason many children fidget in their chairs is because they are forced to sit for long periods of time in furniture with poor ergonomics. The resulting stress placed upon their muscles, ligaments and vertebrae causes them to move around to seek relief."⁴⁶ Appropriate furniture is not only necessary for students' comfort, it also affects their safety and achievement. Research findings show that classroom furniture is linked to the students' overall "health,

behavior and quality of education.” It is recommended that students sit at high tables in chairs that can slope forward and back. The same standards found in workplace environments that offer a variety of seating options and furniture that is adjustable (particularly in seat height) should be offered in schools as well.⁴⁷ Ergonomics and options in furniture are necessary to ensure the best designed classroom for students.

When asked if they liked their classrooms, sixty-three percent of students said they did not. Reasons included uncomfortable furniture and old equipment, boring environments, overly cold or hot classroom temperatures; messy, smelly environments; and not enough windows. To improve the classroom situation, designers need to create opportunities for a variety of classrooms arrangements, more color and light, better acoustics, more space and personal storage in classrooms, and better internal temperature control. In addition to positively impacting the educational process, a well-designed classroom can meet the criteria listed by the thirty-seven percent of students who liked their classrooms by creating spaces “where they can relax, do homework, and study or chat with their friends.”⁴⁸



Image and data from website:
<http://www.back2.co.uk/products/children/index.html>

The growing body requires many movement stimuli to be able to develop healthily. Most children and young people already sit for up to 9 hours a day: At school, doing homework, in front of the computer. The result is that about 70% of them have back problems. Ergonomists call for young people to choose chairs that can be adjusted, and encourage appropriate sitting positions.

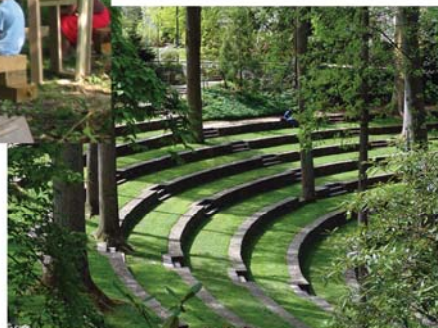
The Outdoor Classroom

School landscaping and designing of outdoor environments is often limited to the paving of parking lots and black-top hard surfaces for recess basketball. Designers often neglect the opportunities outdoor learning environments can offer. The variety of activities and experiences not possible inside school buildings can contribute much to the students overall education. Nature trails, gardens, exploratoriums, fields, forested areas, ponds and other natural outdoor learning settings offer opportunities for students to engage the natural environment “visually, aurally and kinesthetically.” Outdoor areas include a variety of surfaces, such as soil, sand, grass, hills, flat sections, and hard areas. Digging, riding, climbing, balancing, and individual play are all important activities for outdoor play. Yet, outdoor space can be used for more than simply “burning off energy” before the real learning begins inside the school building.⁴⁹ The outdoor spaces of schools are often neglected as potential sites for learning. Social activities and large group programs in outdoor amphitheaters, learning about the sun and earth’s rotation through a large working sundial, planting a garden to study botany and farming are among the many activities that can be both educational and fun. Teachers can incorporate outdoor learning into units about chemistry, physics, literature, botany, and other subjects. Students who learn outdoors describe their experience as meaningful and informative.⁵⁰

The design of a school should extend beyond the building’s walls to connect to the outdoor thus providing ample



Images from
<http://www.scottarboretum.org/gardentour/amphitheater/>
 and <http://www.aquitecture.co.uk/schoolsv3noan.htm>



Images of
 Kansas City
 Schools
 Zoo
 Magnet
 Program,
 Kansas Cty,
 MO



opportunities for learning about the natural world's flora and fauna and help students link their education to the world itself. Learning outside the classroom also teaches students to appreciate the natural world and learn ecological and environmental responsibility. Science experiments, nature walks, and interaction with animal and plant life aid students' in understanding their impact on the land and in developing a resolve to preserve the natural habitat and protect scenic resources. A further step of incorporating "environmentally intelligent" features such as radiant heating in concrete floor slabs and natural ventilation and solar gain to decrease heating and cooling loads, the utilization of solar panels and wind turbines for alternate methods of energy production, and the collection of rainwater for irrigation of landscaping and garden plants become life-long lessons for students on reducing the carbon footprint left on the planet.⁵¹ Designing an outdoor classroom is just as important to a well-rounded 21st century education as the indoor classroom.

A Different Kind of Education

In 1981, the United States Government, through the Department of Education, created the National Commission on Excellence in Education and directed it to present a report on the quality of education in America. In 1983, this commission published its findings in a report entitled "A Nation at Risk: The Imperative for Educational Reform. The findings of the report were grim noting wide-spread underachievement and an urgent need for immediate reform.⁵² Since the publication of that report, school districts, parents, teachers, and government officials have been seeking methods for improvement of American schools. One such method is the option for an alternative education through charter schools, magnet schools, day-treatment and educational centers, residential schools, schools-without walls, alternative learning centers, second-chance schools, detention centers, and correctional facilities, among others.



According to Kenneth Stevenson, alternative education became viable when

growing numbers of educators and policymakers have begun to realize that 'identical' school facilities do not translate into 'equal opportunity' for students. While some students function measurably better in one kind of environment, others perform more effectively in another; the differences depend on student talents, abilities, and needs. As a result of school choice and equity trends, planners and educators may increasingly find themselves challenged to develop individualized renovation and construction plans that support a particular school's distinctive mission. Increasingly, school systems have embraced the concept that parents and their children should have some choice about which school a child attends.⁵³

Parents and teachers are the two major driving forces behind the school choice movement. A 1994 study found that sixty-one percent of parents said that academic standards of the public schools were too low, and their children were not developing strong skills. Unfortunately, teachers who tried to be innovative and raise the standards of their classrooms met with "bureaucratic systems unwilling to listen to new, promising ideas."⁵⁴ Many parents and teachers believe that there are better ways to educate students, and they are using school choice to do so.

Omaha Public Schools Magnet Programs

Visual & Performing Arts at Catlin

International & Global Studies at Crestridge

Mathematics & Economics at Conestoga

Science, Spanish & Technology at Lothrop

Mathematics, Visual & Performing Arts at Skinner

Mathematics, Spanish & Technology at Spring Lake

Communication Skills & Electronic Media at Fullerton

University Partnership at Western Hills

Offering creative, themed, skills-based alternative educational programs are becoming commonplace in most large American school districts. Omaha Public Schools in Omaha, Nebraska, the 99th largest school district in the U.S., currently has seventeen magnet schools available for their K-12 students to attend. According to the OPS website, "magnet schools offer extra-value curriculum and experiences not available at other schools in the district. Students and their families select magnet schools because of their interest in the theme or focus of the school. Generally, this interest is so strong that families are willing to sacrifice the conveniences of sending their children to schools close to home." OPS offers these alternative educational opportunities to promote a learning environment that embraces diversity and cultural understanding, teaches students valuable lessons about themselves and others, and encourages future citizens to be more willing to interact well with people of different cultures.⁵⁴

Magnet schools were originally created to "attract" students to attend them through interesting curricular themes. When

from <http://www.ops.org/ops/SCHOOLS/MagnetSchools/tabid/1077/Default.aspx>

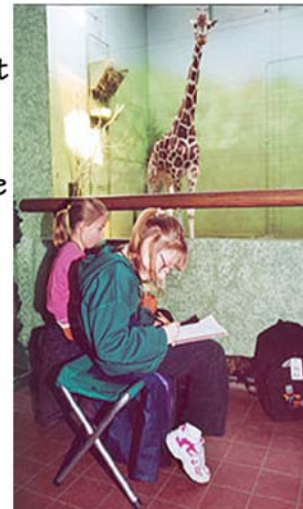
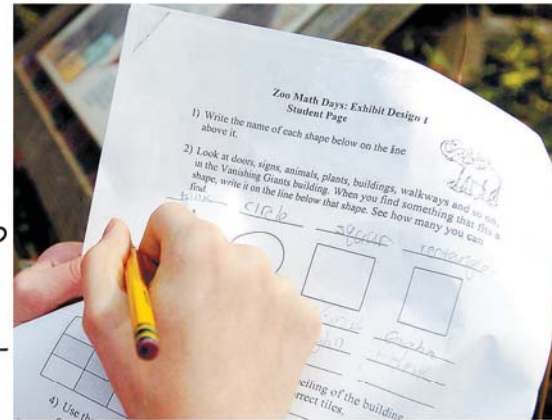
students choose to attend magnet schools, forced busing is no longer necessary in promoting academic desegregation. The goal of magnet schools was to reduce racial segregation voluntarily.⁵⁵ Yet, the special curricula, such as math-science or performing arts programs, or special instructional approaches, made alternative educational opportunities beneficial beyond racial integration. In general, magnet schools have been found to increase student achievement, student motivation and satisfaction with school, teacher motivation and morale, and parent satisfaction with the school. Many studies of magnet school attendees showed that average test scores of students in magnet schools are higher than scores for non-magnet schools.⁵⁶

In an effort to continue to entice students, especially minorities and those from low socio-economic areas, to attend magnet schools (which often have smaller class sizes and attract the most innovative teachers), school districts are making the specialized curricula especially compelling. Programs focusing on the performing and visual arts, computers, the environment, science and math may be located in opera houses, in office buildings, at the zoo or museum, or on college campuses rather than within the walls of traditional school buildings. These alternative sites add further educational benefits and create strong community bonds that linger beyond the school day and school year.

American prosperity, innovation and quality of life are the benefits of the economic freedom we enjoy in nearly every market except education. Yet research has shown the free market system through these school choice programs yield significant gains for participating students. "With choice, everybody wins. The power of choice is not magic and it's not too good to be true—it's simple economics. It's the same economic principle that gives us world-class universities and a world-class standard of living. Why not give equal economic freedom to every American student to get a world-class K-12 education?"⁵⁷

Images from Cincinnati Zoo website, The Willow School website, Lincoln Children's Zoo website, and San Diego zoo

What Might You Do if You Went to School at the Zoo?





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SCHOOL AT THE ZOO:

Mission Statement

To incorporate site and building design to create a multi-use, educational facility that positively impacts the educational process, functions as a teaching tool, symbolizes the importance of conserving energy and preserving the environment, and celebrates human, animal and plant life.

Goals/Objectives

Incorporate building with site

- take advantage of hill
- take advantage of south and west exposures
- create outdoor learning environments

Use building to exemplify and teach about sustainability

- use environmentally friendly materials and technologies
- utilize alternate sources of power (wind, solar, water etc.)
- specify geo-thermal heat pump

Include architectural design features that impact teaching and learning

- based on research findings





Henry Doorly Zoo

The Henry Doorly Zoo covers 130 acres and includes fifteen types of habitats. There are more than 24,300 plant and animal specimens in the zoo with 972 species represented. Of these species, 192 are mammals (3233 specimens), 263 are birds (1966 specimens), 223 are reptiles and amphibians (642 specimens of reptiles and 553 specimens of amphibians), 199 are fish (3285 specimens), and 95 are invertebrates (14651 specimens).* Forty-four of the 972 species housed at the zoo are listed as endangered. Seven species are considered threatened.

The zoo attracts about 1.25 million visitors each year. Admission costs range from \$7.00 (children ages 3 – 11) to \$10.75 (ages 12 and over). A senior rate of \$9.25 is available to adults over 62 years of age. Children under three are admitted for free. The average number of family memberships (\$75) is 70,000.

Approximately 300 people are employed at the Henry Doorly Zoo. The Director of the Zoo is Dr. Lee G. Simmons. Danny Morris is the Assistant Director, and Elizabeth Mulkerrin is the Education Curator.

The zoo is adjacent to a small enclosed neighborhood of single family homes and rental properties.

April 2007 Data



Up close and personal with the great apes.



The overhead aquarium provides a fascinating view.

Images from the Henry Doorly Zoo Webpage <http://www.omahazoo.com/gallery/gallery.asp>

The City of Omaha

Omaha is the largest city in the state of Nebraska. Situated along the Missouri River and the junctions of Interstates 80 and 29, this metropolitan area's "heartland" location makes it an attractive locale for many industrial, business, research, and financial markets. The greater metropolitan statistical area of Omaha (MSA) includes five counties in Nebraska and three counties in Iowa.

Based on 2006 data, Omaha MSA has a population of 819,246 people. Of these citizens, 50.6% are female and 49.4% are male. The majority of the citizens (53%) are married with a both spouses present in the home. The MSA has a per capita income of \$25,060 with a median household income of \$51,752. Sixty-three percent of the MSA own the homes in which they live. The median home value is \$99,830. Nearly 94% of the people living within the MSA are employed, although 11.3% of the population lives below the poverty level. The median age of the MSA is 35 years.

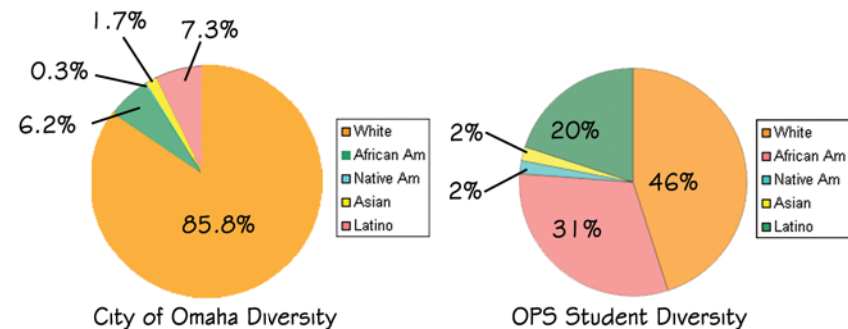
Enrollment in colleges and universities in the metro area is over 50,000; within a 50-mile radius, it is over 87,000. Approximately 31.3% of Omaha college graduates have bachelor degrees or higher.

Omaha Public Schools is the city's school district. It is the largest elementary and secondary public education system in Nebraska enrolling over 46,000 students of various ethnic, cultural and religious backgrounds. The district has eighty-eight schools (63 elementary schools, 11 middle schools, 8 high schools) with 3,131 teachers. The student/teacher ratio is 16:1. The average teacher salary is \$46,666. Funding per pupil is \$7,293.

An extensive parochial school system and a number of private schools also offer instruction for students in kindergarten through twelfth grade. The most notable private institution is Boys Town, a residential facility founded by Father Edward J. Flanagan in 1917.

Omaha Top 10 Employers

Company	Employment
1. Offutt Air Force Base	11,500
2. Alegent Health	8,400
3. Nebraska Medical Center	8,000
4. First National Bank	7,500
5. Omaha Public Schools	7,100
6. Methodist Health System	6,200
7. First Data Corp	5,800
8. Union Pacific Corporation	4,500
9. Mutual of Omaha Ins.	4,300
10. West Corporation	4,000





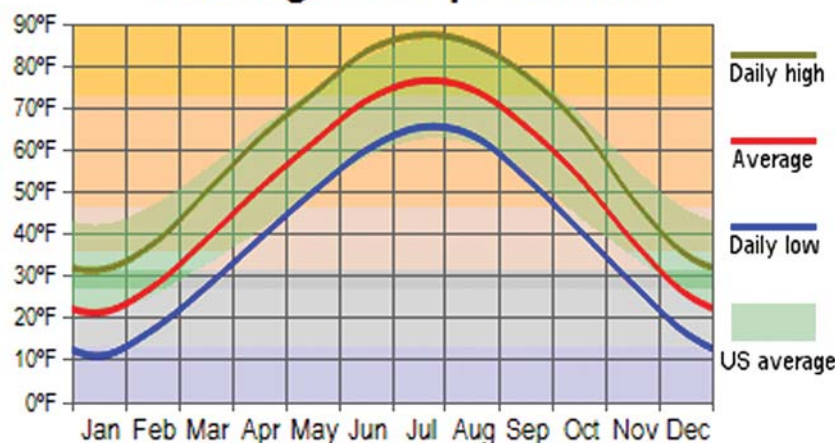
SCHOOL AT THE ZOO:

Site Analysis - Climate

Examining the climatic conditions of the site before the design is even begun is important so as to identify special design issues that may need to be considered. Design issues associated with climatic concerns usually include safety and welfare of the user, maintenance of the immediate surroundings, interior and exterior window treatments, HVAC systems, and landscaping needs. Among the climatic conditions examined for this site analysis are snowfall, sunshine, cloudy days, wind speed, humidity, temperature, precipitation, and pollution levels,

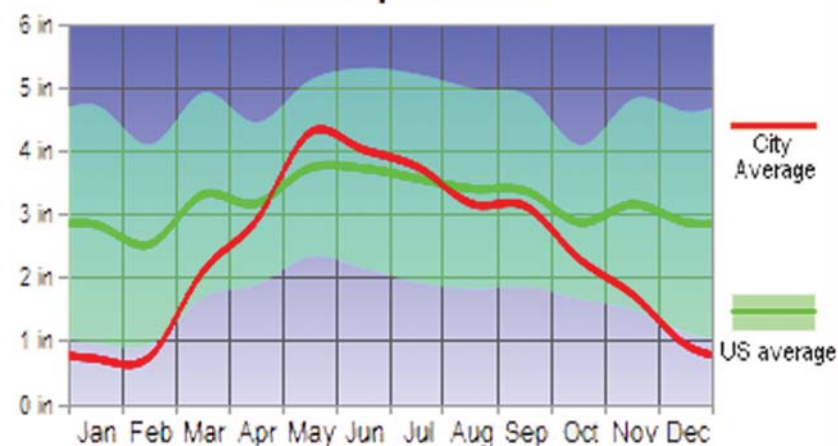
data and graphics from
<http://www.city-data.com/city/Omaha-Nebraska.html>

Average Temperatures

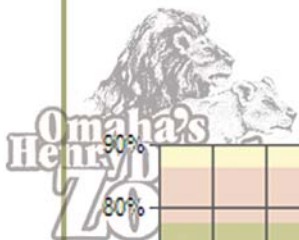


Omaha enjoys a wide range of temperatures making it a city of four seasons. Although the temperature varies throughout the year from below freezing to close to three digits, neither end of the spectrum is to the extreme. Overall, the climate in Omaha is on the borderline between the temperate zones found in the southern parts of the U.S. and the more arctic zones found in northern U.S. and Canada. In general, the temperature may limit but usually does not prevent or obstruct outdoor activity in Omaha. Design issues include health concerns for students, appropriate mechanical system CFUs, care of animals, landscaping needs, and roof garden upkeep.

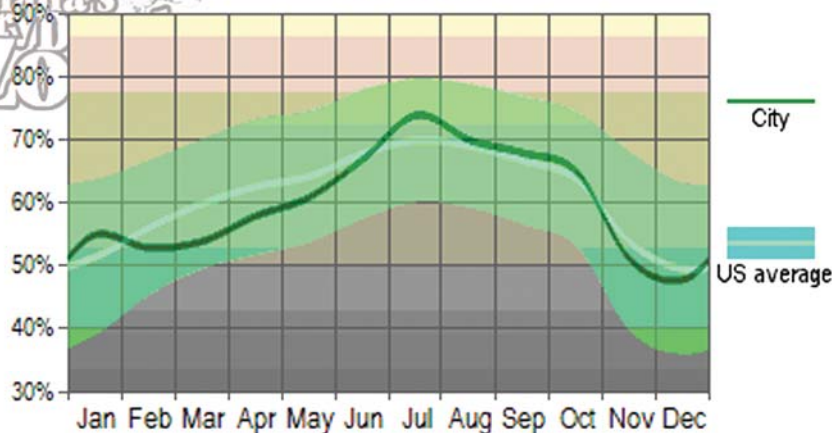
Precipitation



Omaha does not see many rainy days (on average, fewer than 100 days of .01 inches of rain or more). Capturing rainwater when it does fall can be used for outdoor landscaping. Landscaping with native prairie grasses and wildflowers will be most conducive to a dry climate. Because of the low occurrence of rain, outdoor activities are usually unaffected. When rain does fall, travel between buildings would require special protective clothing and umbrellas, and freezing rain turned to ice on pathways would require greater awareness and caution. Design issues include rain harvesting, roof garden plant choices, extended roof lines and overhangs for traveling along buildings, and safety measures on pathways to prevent slipping.



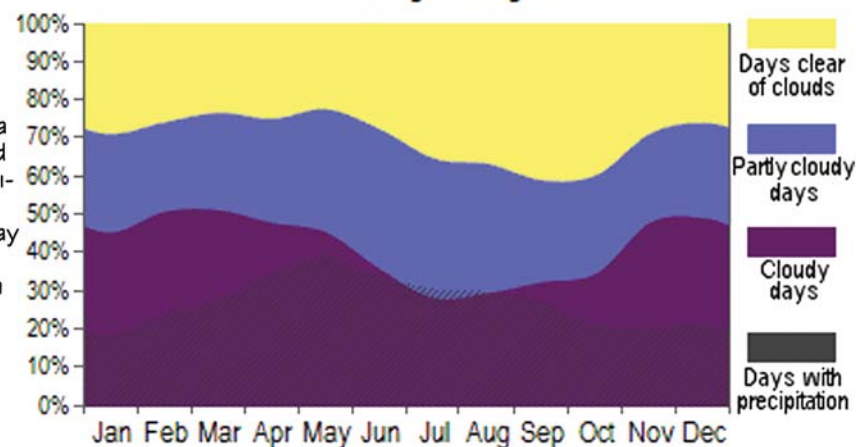
Sunshine



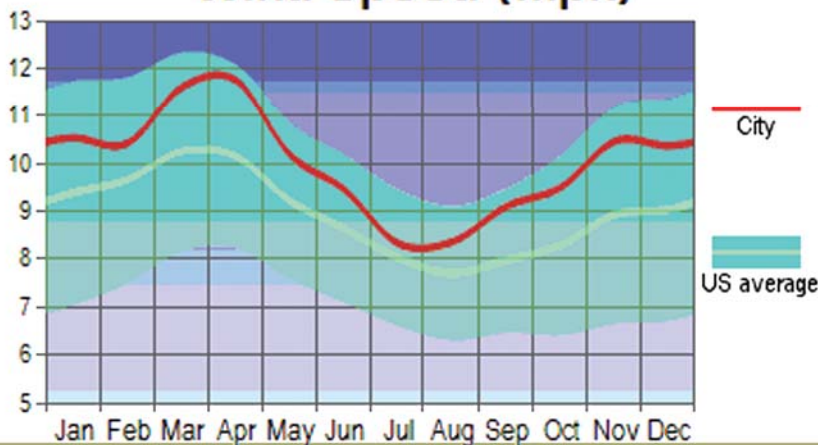
The least amount of sunshine in Omaha occurs during the winter and spring. Because of this, solar energy output may be reduced. Little sunlight also impacts the amount of daylighting illuminating the interior of the school building. Outdoor activities should not be greatly affected by lessened sunlight during the winter and spring months. Design issues include the need for sun shading to alleviate solar heat gain.

Although Omaha does not receive abundant rainfall, cloudiness is a common occurrence. The cloudiest days are during the fall, winter and spring, the same time of year when students are in school. This cloudiness will have little impact on outdoor activities, but it will affect the daylighting of the school interior. On cloudy days, artificial lighting may be required to a greater degree. Design issues include providing interior adjustable window treatments, adjustable lighting fixtures with multiple zones, and alternate energy production due to lower solar output.

Cloudy Days



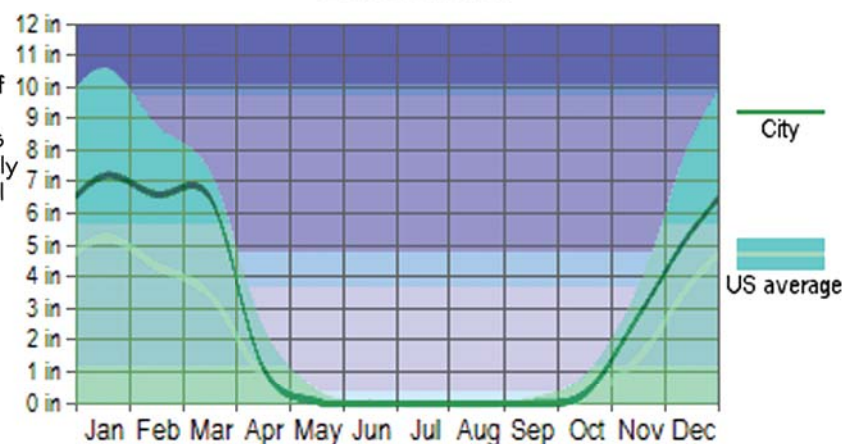
Wind Speed (mph)



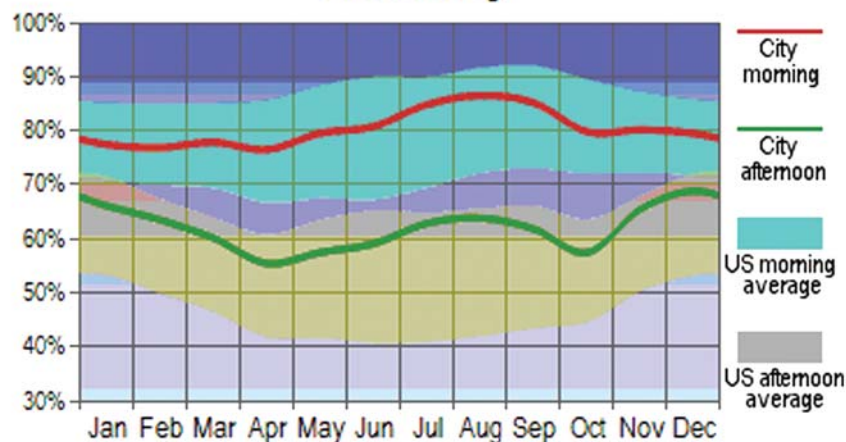
Located on the Great Plains, Omaha is one of the more windy cities in the United States. This makes the Omaha area an ideal location for use of wind turbines to generate power. The strongest winds are in the winter months which in turn create a wind chill factor. On average, the windiest time of year is when the seasons are changing from winter to spring. This is the time of year when most people enjoy resuming outdoor activities. The wind can affect activities throughout the year by blowing snow, dirt, and debris, making air temperatures unbearable, and interfering with equipment and materials being used. Design issues include roof garden protection, erosion, integrating building into hill (site).

Between October and April, Omaha usually gets about 30 inches of snow. This snow affects driving conditions, pedestrian travel, animal activity, and business/school continuity. In general, snowfall in Omaha is gradual and slow accumulating; therefore activities should not be greatly impacted by the snow. Weather appropriate clothing and equipment will be required for students going out onto zoo grounds. Building and grounds maintenance will be most affected by the snowfall. Design issues include snow removal on roof garden, potential drifting on roof, and service entrance road clearing.

Snowfall



Humidity



Humidity, like wind chill, affects a person's perception of the climate often making one feel uncomfortable. The mornings in Omaha are more humid than the afternoons whereas the afternoons usually have a higher temperature level. This information may be used to determine time of day and distance from the school building where outdoor activities will occur. The humidity levels throughout the year are fairly consistent with the least humid times being in spring and fall. The average humidity levels for Omaha range between 80% and 60%. Overall, humidity levels should not greatly impact outdoor activities at the zoo as all buildings are air conditioned with controlled humidity levels. Design issues include ventilation and air movement considerations, dehumidifying controls, health concerns for students overheating, prevention of fogging over of windows.

Omaha Environmental Report Pollution Ratings

Generally speaking, Omaha has low pollution ratings. This rating will affect safety of outdoor activities and should be monitored closely. Design issues include proper ventilation, pathway design and distances, and landscaping considerations.

EDN CITY RANK, Overall **22**

Environmental Data Card

Note: All rank information is out of 72 cities, though not all cities may have scores/data in every category. 1 is the 'best' (least polluting, most education, etc) and 72 is the 'worst'.

EDN Subject Areas	EDN SCORE ² (1 is best, 5 is worst)	EDN VPI Rank (1 is best, 72 is worst)
1 • TOXICS & WASTE	2.7	27
2 • AIR QUALITY	1.8	11
3 • DRINKING & SURFACE WATER	2.5	38
4 • QUALITY OF LIFE (SITES ⁴)	2.8	18
5 • PARKS & RECREATION OPPORTUNITIES	3.6	39
6 • HUMAN & PUBLIC HEALTH	2.8	18
7 • GLOBAL WARMING CLIMATE CHANGE	3.3	34

³ All cities have vulnerable populations. However, in some U.S. cities the concentration of citizens at risk is of particular concern. Our vulnerable population index is a measure suggesting what portion of a city's population may have greater sensitivity to change. The **EDN VULNERABLE POPULATION INDEX (EDN VPI)** for Omaha is 1.21, which yields a rank of 16 out of 72 (1 is best, 72 is worst). Approximately 14.5% of Omaha's population is more susceptible to environmental degradation.



SCHOOL AT THE ZOO:

Prospective Sites

Six sites were chosen as prospective locations for the new elementary school. Site choices were determined by examining aerial photographs of the zoo grounds and studying maps of current and proposed land use of the zoo. One site, site #4, was recommended by zoo officials and the zoo architect. The remaining sites were chosen because of their sizes and the fact that few to no buildings or habitats were currently located on them. Criteria for narrowing the selection to a final choice included proximity to existing access roads and zoo entrances, security and safety concerns for students, accessibility to zoo exhibits, current conditions of the terrain (including size, slope, need for modification, number of trees, noise levels, views, and existing built environment,) and potential for integrated use.

Site #1 – Located in the northwest corner of the zoo, this site is currently a garden with a fountain.

Site #2 – Located in the northeast corner of the zoo, this site is a prairie dog habitat but otherwise undeveloped.

Site #3 – Three potential locations exist on the south side of the zoo, all of which are undeveloped.

Site #4 – Located near the west entrance of the zoo, this site is behind the Lied Jungle where part of it is used as a parking lot for zoo employees.



Site 1



Site 2



Site 3a



Site 3b



Site 3c



Site 4





Prospective Site #1

Site Analysis





Pros

- site already graded
- near current kindergarten
- private and protected
- on perimeter
- few trees to remove

Cons

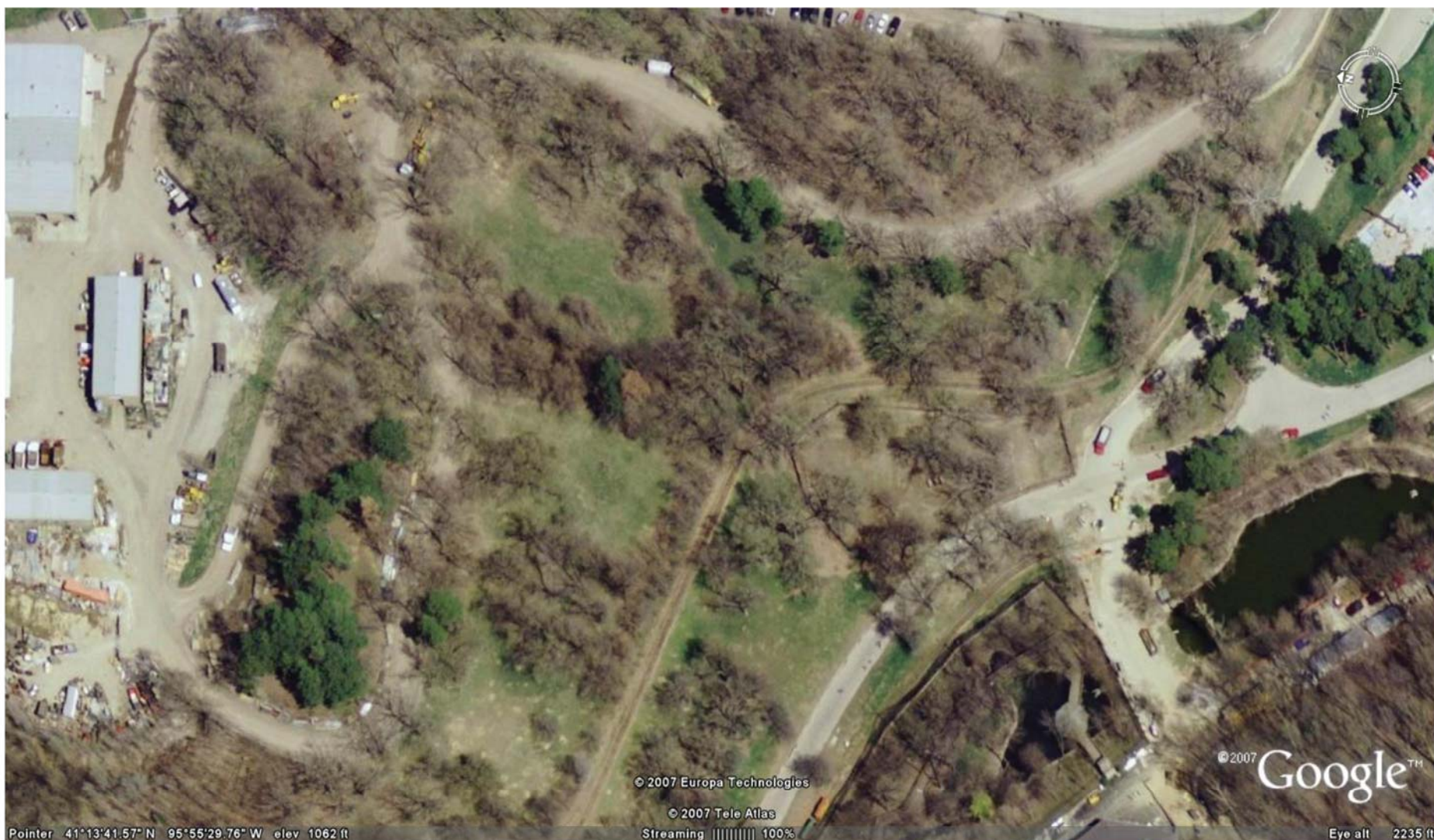
- currently a beautiful garden
- no access road nearby
- extreme highway noise
- must climb steep hill
- quite a distance from entrance
- longer walk to main exhibits



Prospective Site #2

Site Analysis





Pros

- near an access road
- near an entrance
- entrance separate from main zoo entrance
- entrance in neighborhood
- on perimeter
- private and protected
- close to zoo exhibits

Cons

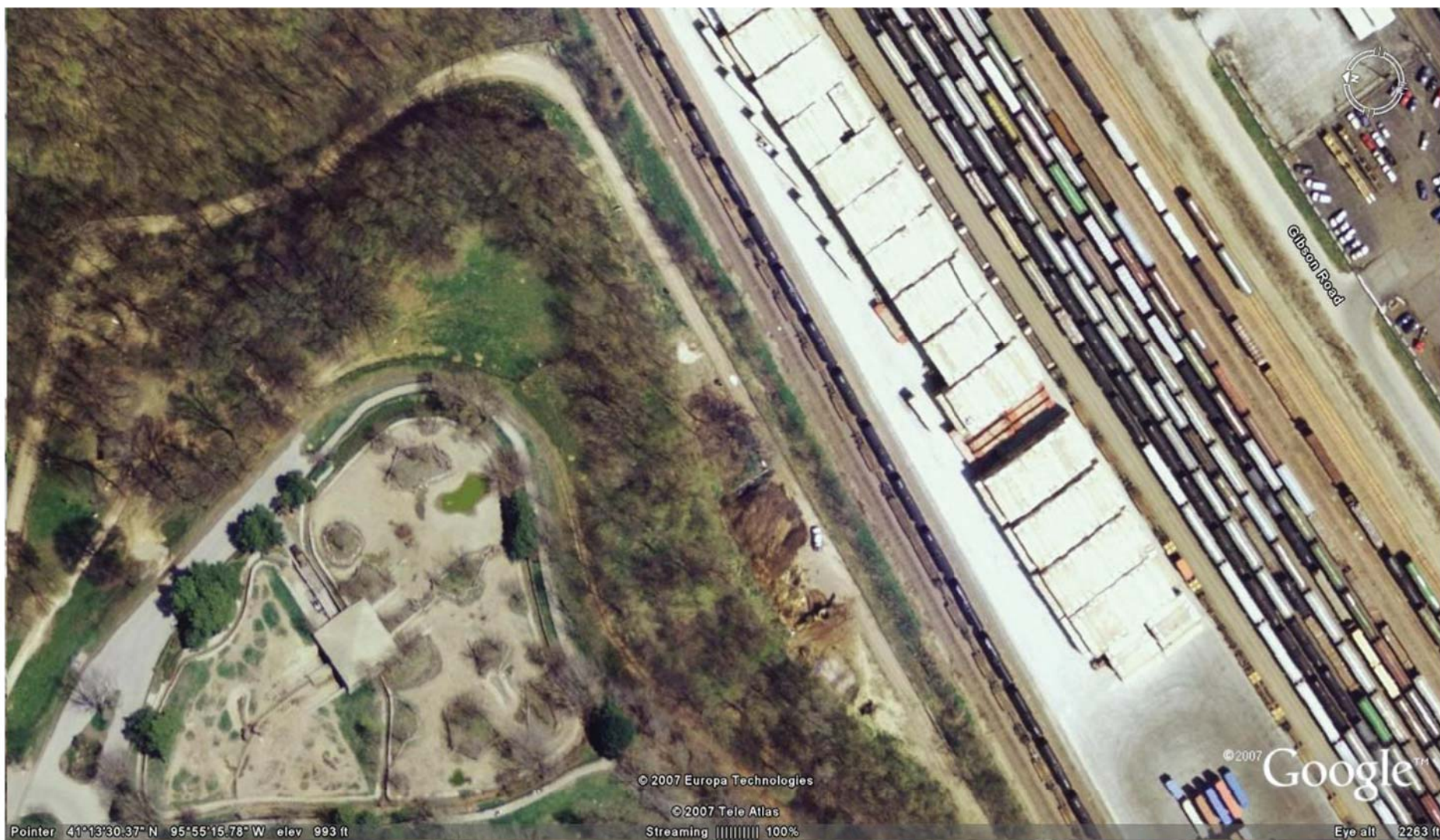
- currently a prairie dog habitat
- long drive for bus/car drop-off/pick-up
- near drive for large vehicles
- cannot get to entrance from Interstate
- must remove some trees



Prospective Site #3a

Site Analysis





Pros

- near an access road
- near an entrance
- entrance separate from main zoo entrance
- private and protected
- on perimeter
- cleared area

Cons

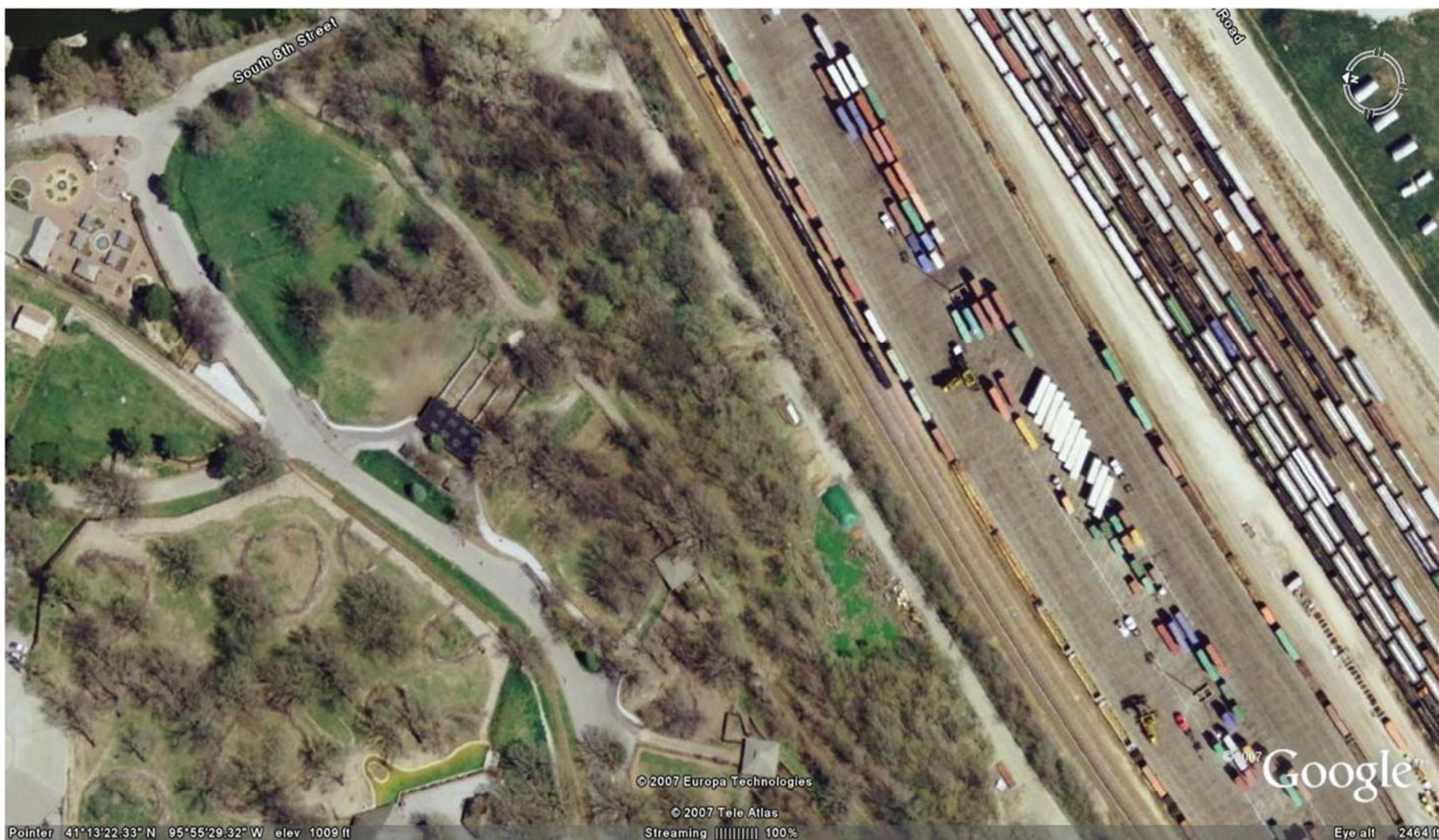
- long, narrow, oddly shaped site
- heavily wooded (would have to cut down quite a few trees)
- cleared area is small
- steep hill
- quite a distance from main zoo exhibits
- very close to rail yard
- noisy from rail yard



Prospective Site #3b

Site Analysis





Pros

- on an to access road
- on perimeter
- private and protected
- good south sunlight

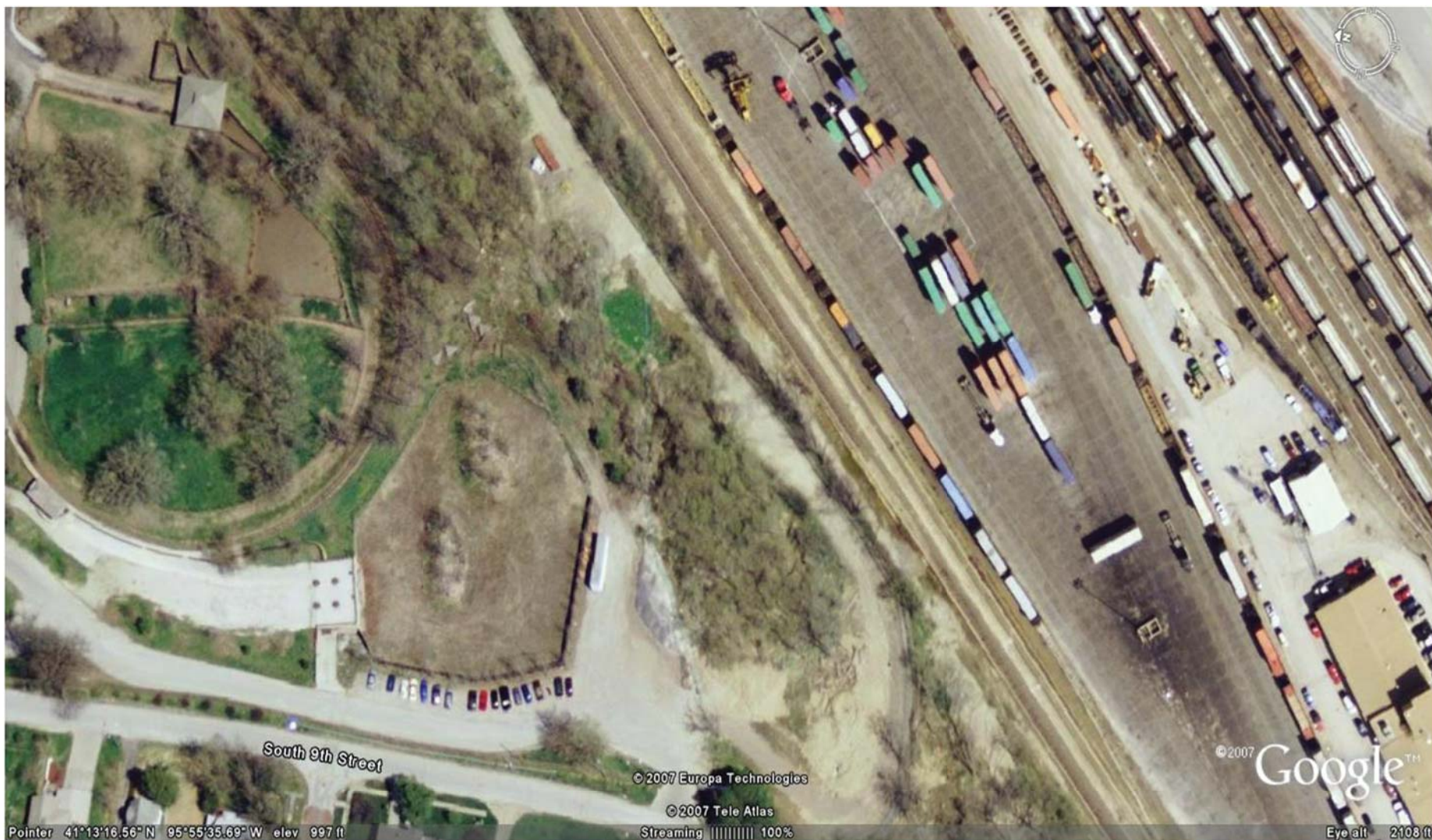
Cons

- heavily covered with trees
- steep hill
- long, narrow site
- quite a distance from zoo exhibits
- very close to rail yard
- extreme rail yard noise
- quite a distance from an entrance



Prospective Site #3c





Pros

- close to access road
- close to an entrance
- on perimeter
- private and protected
- a lot of area available for parking lot

Cons

- heavily covered with trees
- very close to rail yard
- extreme rail yard noise
- steep hill
- quite a distance from zoo exhibits
- long, narrow site



Prospective Site #4





Pros

- close to access road
- close to an entrance
- close to existing parking lot
- close to zoo exhibits
- on perimeter
- highly visible (showcase building)
- recommended by zoo administrators

Cons

- very public
- very close to existing building (less distinction as its own building)
- steep hill (in valley)
- heavily tree covered
- oddly shaped site
- less protected (security)
- not a very interesting view





Site Selection

Based on the criteria used for analysis, two of the six prospective sites were determined as potentially ideal locations for a new elementary school on the Henry Doorly Zoo grounds. Site #2 in the northeast corner of the zoo and site #4 near the main entrance of the zoo both possess characteristics well-suited to a learning environment and education center. Greater analysis of these two sites included a return visit to each location, visual exploration of the terrain through 3-D computer modeling, and indepth examination of the positive and negative characteristics of each site.

Site #2



Site #4

Criteria for Site Selection

- on perimeter
- near access road and/or entrance
- close proximity to zoo exhibits
- secure and safe
- low impact on site
- conducive to educational activities
- exposure to sunlight and views

Sites #2 and #4



enhancing education through site and design



Site #2 Analysis

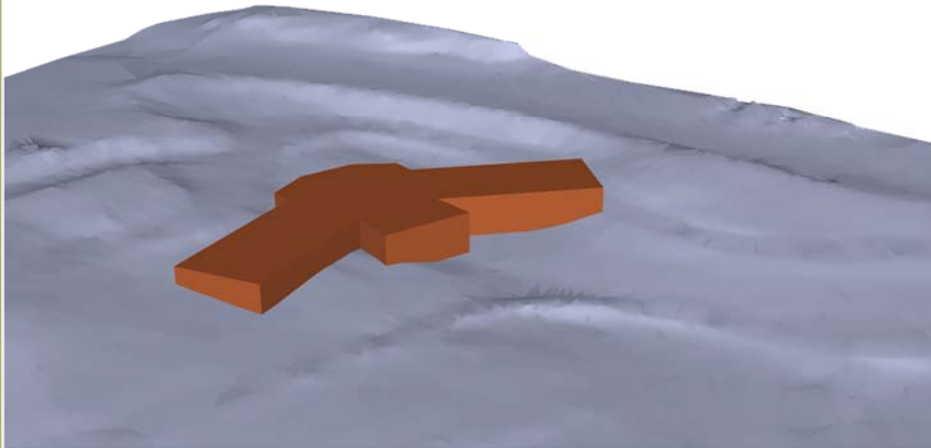
Pros

- large site allows for multiple building placement choices and forms
- large site allows for potential growth, expansion, and integration of future habitats surrounding building
- large site allows for outdoor school activities such as soccer and baseball
- site is within zoo grounds and close to existing exhibits
- close to perimeter, two entrances, and access roads
- close to zoo personnel buildings where potential learning activities may take place
- neighborhood access ties school and zoo with community
- northeast entrance more secure and private
- great view of picnic area and desert dome
- little site modification and minimum tree removal required
- separation from other buildings allows for greater distinction of school building design and purpose
- site location is not along main zoo path providing greater privacy and security without preventing zoo visitors from easily locating building
- train runs during the week from May to September only
- zoo train riders will see building along train route (justifies showcase building)
- no built environments (other than prairie dog - built) exist on site



Cons

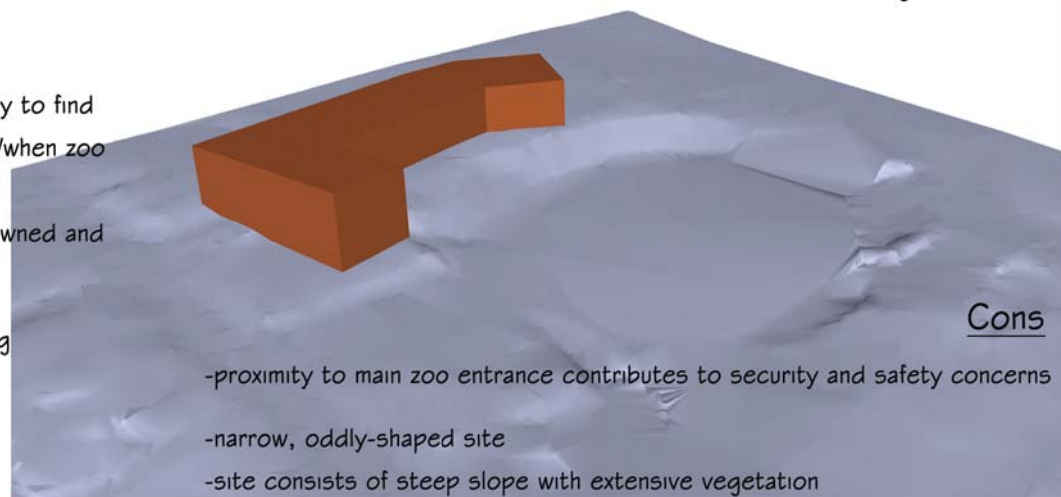
- requires students to cross railroad tracks to access zoo exhibits
- noise from passing train may be disruptive
- location is quite a distance from main entrance where building users might enter
- no direct exit off Interstate 80 may cause confusion for visitors trying to access building from neighborhood entrance
- greater traffic will cause noise and congestion in small neighborhood area
- some site modification and tree removal would be required
- current parking lot not large enough for increased need (must include additional space for cars being parked there now)
- improvement and modification to access roads required
- drop-off/pick-up area for buses and cars quite a distance from zoo entrance or from school building
- prairie dog habitat disrupted
- neighborhood-side entrance currently being used by service vehicles and large trucks (dangerous and may cause inconvenience)



Site #4 Analysis

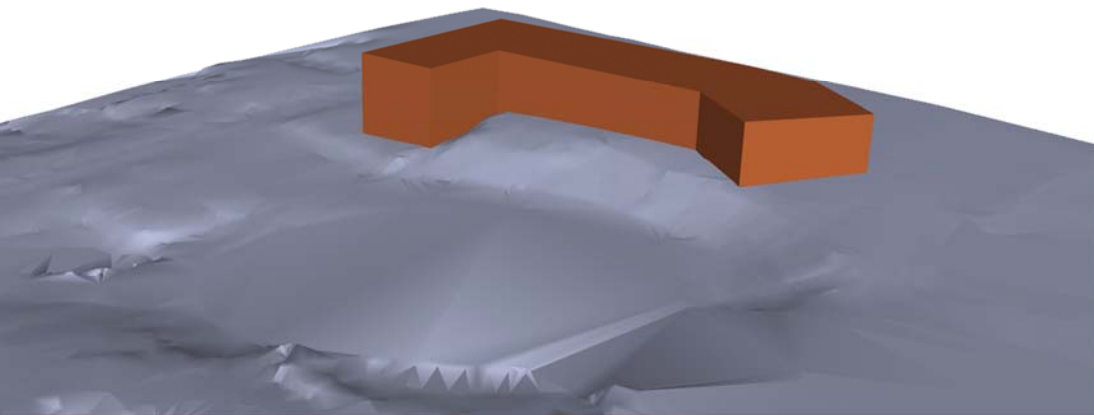
Pros

- prominent site justifies showcase building design
- proximity to main entrance is convenient, accessible, and easy to find
- potential to expand site by extending area into parking lot (if/when zoo renovates parking lot and redirects entrance traffic)
- potential to expand site into neighborhood (several houses owned and used by zoo)
- potential to physically link school to Lied Jungle
- site location increases potential for zoo visitor use of building
- existing parking lot can be used for school parking
- no need to build or modify any roads or driveways
- utilities readily available
- easy access to most zoo exhibits
- close to zoo personnel offices and buildings where learning opportunities may take place
- site recommended by zoo personnel
- oddly shaped site lends itself to creative and challenging design solution
- construction access convenient
- close to neighborhood to south of zoo



Cons

- proximity to main zoo entrance contributes to security and safety concerns
- narrow, oddly-shaped site
- site consists of steep slope with extensive vegetation
- very close to an existing building (Lied Jungle)
- access to area behind Lied Jungle would be restricted or inconvenient
- small site limits outdoor use for school activities
- small site limits building placement options and future growth or inclusion of surrounding habitats
- closeness to Lied Jungle building lends to feeling of being cramped and restricted
- closeness to Lied Jungle building could interfere with school's identity and distinction
- close to heavy traffic area (dangerous and congested)
- drop-off/pick up traffic may cause congestion
- prominent entrance of school building could confuse zoo visitors as to location of zoo entry
- site not fully integrated with zoo
- view restricted by back of Lied Jungle
- view of concrete parking lot to west
- no direct access to building for residents in neighborhoods south and east of zoo preventing students to walk to school (requires car or bus transportation)
- extension of site into parking lot would require rerouting of zoo visitor traffic
- expansion into neighborhood to south would require demolition of several houses (currently used by graduate students studying at zoo)



Site Choice

Both sites offer unique and exciting possibilities for design, but based on the preceding criteria analysis, Site #2 is best-suited for the needs and goals of this project.

Site #2 is larger and offers the opportunity for greater site use. Elementary school children, even those who spend a portion of the day hiking around zoo grounds, need outdoor areas for exercise and play. Site #4 does not currently allow for such spaces. The zoo's plans to redesign the parking lot and eventually assume the land now utilized for Rosenblatt Stadium will add new site potential and consideration but not in the time frame of this design thesis project.

Both sites are near zoo entrances and access roads. Although Site #4 is closer to well-developed roads, parking lots, and the main zoo entrance, this proximity creates security issues, traffic safety concerns, and potential drop-off/pick-up congestion. The entrances, roads, and parking lot near Site #2 will require upgrades, but upgrading will allow for the purposeful design of security controls and the manipulation of traffic flow. Modification of the parking lot and development of drop-off/pick-up locations will ensure these site features meet the needs and goals of the overall design. Having a "back" zoo entrance to the site will increase the likelihood that visitors to the school are intentional thus reducing student safety concerns.

Site #2 is a wide, sloping hillside while Site #4 is steep and narrow. Vegetation thickly covers Site #4 whereas open grassy meadows make up the majority of Site #2. The conditions of Site #2 require fewer trees be removed and less alteration to the terrain. The views and vistas from site #2 in comparison to those of Site #4 also lead to the preference of Site #2 as the selected site for this project.

Convenient and direct accessibility to zoo exhibits is important to consider in site selection because of the physical limitations of elementary school-aged students. Both Site #2 and Site #4 are close to zoo exhibits, although traveling from Site #2 would involve less initial mingling between zoo visitors and students. Keeping students together is easier when distanced from the main gate of the zoo where most tour groups originate.

Finally, the choice of Site #2 as the selected site rested on the proximity of the new elementary school to existing buildings. Although close proximity allows for convenient interactions between zoo personnel and students, it also impacts the design, use, identity, and flexibility of the school facility. The limitations (albeit challenges) this closeness imposes was the determining factor in choosing Site #2 as the designated site for this design thesis project.






Topographic Map

The proposed site is a grassy hillside interspersed with groves of trees and low-lying vegetation. Sandwiched between the rail-road tracks to the south and west and the access road to the north and east, the highest point of the hill is at an elevation of 1096.1 feet. The site slopes from northeast to southwest ending the with an elevation of 1058 feet. The lowest point on the site consists of a small valley dipping down to an elevation of 1051.3 feet.



The slope of the site is approximately 40 feet from the road to the railroad tracks.

-  Proposed Site
-  Existing Access Road
-  Zoo Entrances





Case Studies and Precedents

The following pages are case studies of schools across the nation that have put into practice the principles and design features described in the literature review of this thesis. These case studies, including K-12 traditional and alternative (magnet) schools, exemplify the type of schools required to meet the needs of the “digital natives” who attend and will attend America's schools in the 21st century. Descriptive narratives taken *directly* from the websites listed highlight the special considerations that make these schools exceptional. The designs, and more importantly, the philosophies, of the educators and architects of these schools heavily influenced the culminating design of the project resulting in this thesis.

Image from <http://www.willowschool.org/campus/viewer/>





The Willow School Farewell Mills Gatsch Gladstone, New Jersey

The Biedrons use the ideas of sustainability and place as lenses through which to see curriculum, campus ecology, construction of the current Lower School Classroom building and future classrooms, and the community. The current classroom basically is four connected barns that total 15,000 square feet. Biedron served as the general contractor on the project, which explains the amount of salvaged material used throughout the building's interior and exterior. A Maine toothpick factory and South Carolina cotton mill provided the timber-frame structure. The South Carolina wood was painted and full of nails when it arrived at the school site, but local craftsmen used band saws to expose beautiful southern yellow pine. "We put the whole thing together on-site without a single nail or piece of metal," Biedron remembers. "It's all mortised in just like an old barn using pegs."

A ketchup factory in Pittsburgh dismantled its vertical-grain Douglas fir tomato and vinegar vats, which had been used for 50 to 75 years, and sold the wood to The Willow School. Half was shipped to a manufacturer that made it into the school's windows and doors. The other half provides the school's interior trim. Biedron says on a wet day you faintly can smell the vinegar in some pieces.

Highly important in a school filled with rambunctious children is acoustics. The ceiling features 100 percent recycled cotton sound insulation covered with wooden slats. The slats are heart cypress from marine pilings removed from the coast of North Carolina. The



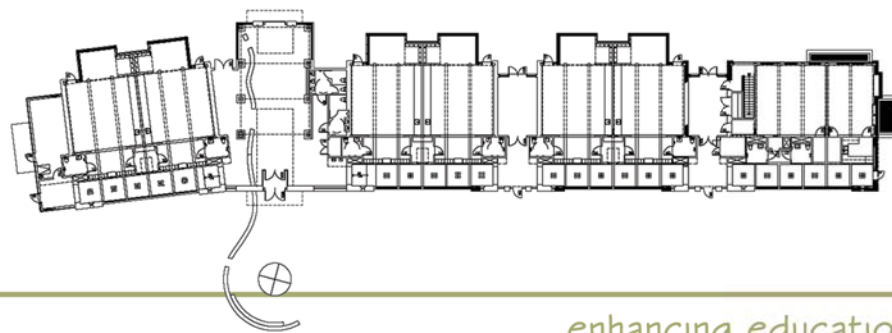
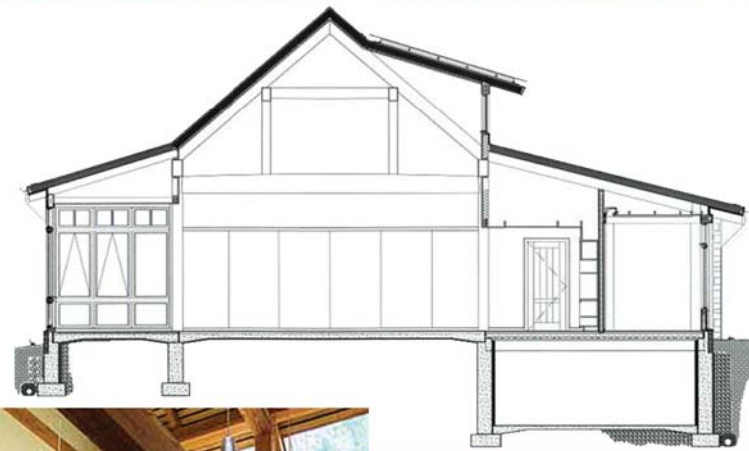
Info and images from http://www.eco-structure.com/docs/archives%202005/eco_sept05/eco_sept05_feature.pdf

A number of reused materials also can be found outside the school. Half of the school's sidewalks came from the notorious Boston Dig; the Charles Street demolition provided huge pieces of bluestone. The small amount of curbing used next to the sidewalk is granite from an interstate clover leaf in Hartford, Conn. In addition, road millings were used instead of newly quarried stone as a base for the school's roads. Other materials within the school boast recycled content, including fly-ash concrete, 100 percent recycled glass tiles and 60 percent recycled ceramic tiles in the bathroom, ceiling tiles made of old newspapers and computer runs, and bathroom partitions made of detergent bottles. The structural steel over the basement is 99 percent recycled. Linoleum floors also contain a high percentage of postindustrial recycled content.

Biedron explains how he and the design team chose materials for The Willow School: "Every material that was going to be part of this building we determined whether we could buy salvaged. If we couldn't do that, could we buy it new but with a huge recycled content? Can we recycle it once this building is demolished? And we considered what it is made of. What's the environmental impact when it's manufactured and thrown away?"

For example, the team specified cork flooring because cork is a rapidly renewable material. Biedron and the team also didn't want to use polyvinyl chloride (PVC) piping because of the controversy surrounding PVC. Instead, they used high-density polyethylene (HDPE) piping. In fact, piping used for underground storm water is 100 percent recycled HDPE.

As can be expected from Biedron who knows his paints, The Willow School features improved IAQ because of non-VOC paints and glues and the avoidance of formaldehyde and solvents. All air ducts arrived covered in plastic and were sealed for dust when installed. Carbon dioxide monitoring takes place in each classroom.





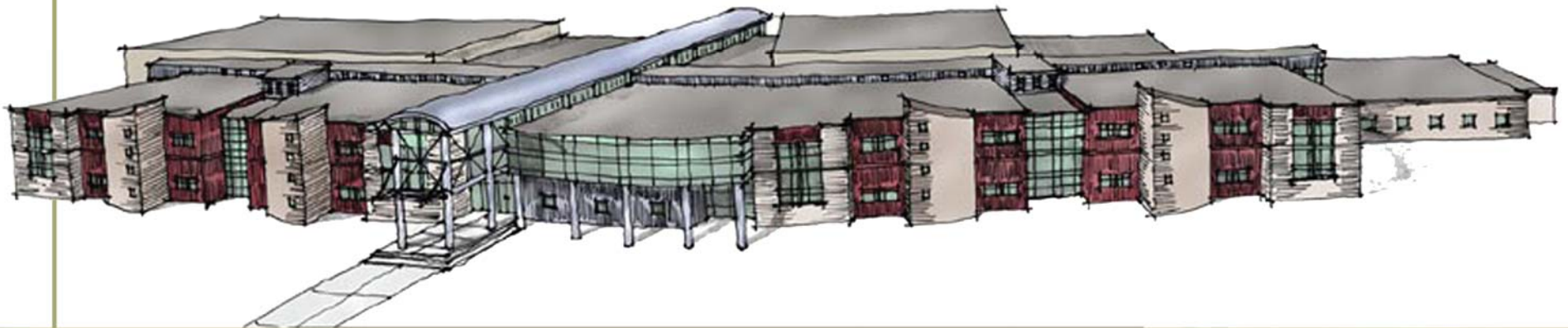
Alpine Prototype Middle School

VCBO
Alpine, Utah

This prototype is a state-of-the-art design solution resulting from a lively collaboration of players including teachers, students, District staff, community members, students, and architects. In this fast-growing region, the District determined the need for more than one new middle school building, and set up a group to begin defining the program for a completely new and different facility. A key component of this group was the architect, who played a key role in assisting the District in defining the Educational Facilities Program.

This marriage of client and architect led to a series of programming and philosophy workshops, tours of outstanding similar facilities, and the formation of a diverse group of project stakeholders to plan the new school. One of the unusual challenges of the project was the idea that this school must be a prototype design-the urgent need for multiple new schools, paired with the need for economy in the state with the lowest per pupil spending in the country, mandated the idea that this design be applicable to more than one venue.

Three committees were established by the District-the Curriculum Committee, the Community Building Committee, and the Maintenance Committee. At the architect's request, a fourth committee-Students-was also incorporated into the design process. All four groups were heavily involved in the facility program and design discussions. The groups visited the site during construction (monthly tours), and were intimately involved in the dedication ceremonies.



The Educational Facilities Program focus was to create a meaningful educational environment, and the design committee created specific challenges that the new building must accommodate. It would have to:

- Support an integrated curriculum (The building should assist students to learn and enable teachers to instruct utilizing a variety of styles and techniques.)
- Encourage collaboration (An inter-disciplinary approach to curriculum to accommodate teaming and collaboration across disciplines.)
- Facilitate curriculum flexibility - theme-based, project-based, technology-based, hands-on based, or experimentally-based
- Create community for learning where relationships are developed between peers and adults



Richly colored ribbed metal cladding highlights the building exterior, providing a striking contrast to the neutral masonry used for the basic structure. Visitors enter the school under a smooth metal “scoop” into the heart of the complex, a high ceilinged central Commons/Gathering space, supported by custom steel columns. This space provides a striking setting for students and visitors to gather, eat, socialize, and watch performances and presentations. The combination of concrete materials, textures, and building masses facilitate a “campus feel” to what would otherwise be one large building. The dynamic color schemes, and detailing more commonly found in a retail setting were chosen to captivate and enchant the young people participating in the educational experience.

<http://www.designshare.com/index.php/projects/alpine-prototype-middle/narratives>



The goal:

- Pique student interest(By providing learning opportunities within the architecture itself, utilizing colors, textures, and ideas integral to the building architecture, students take interest in and become curious about their surroundings.)
- Enhance educational space (A building that provides natural daylighting, great acoustics, and year round environmental comfort creates a successful learning environment for its occupants.)
- Incorporate durability & maintainability (The facility should be designed to minimize long term lifecycle costs, and to facilitate ease of maintenance.)
- The design of this prototype provides a highly flexible, open, and extremely visible environment for group collaboration, fostering critical student/ student and student/teacher relationships.





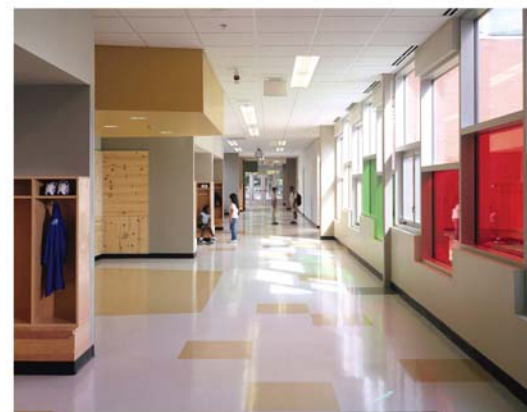
Greenman Elementary Architecture For Education Aurora, Illinois

Personalized Learning

The school is divided into 7 classroom clusters: one for pre-K and K, and six others that can be for grade-level groupings and/or schools-within-a-school. The cluster is a small learning community of 4 classrooms, 2 technology/resource areas, and a flexible learning corridor. The cluster can be individual rooms or various larger spaces for team teaching. This resource room and corridor serve as a project area for hands-on, project based, group learning.

3-D Textbook

Looking into the mechanical room, porthole windows provide students to observe the equipment, lights, pipes, etc. Each classroom cluster is color-coded green, red, or yellow (a variation on the primary colors), giving the small learning unit their own identity. Rather than tackable wall covering, which requires replacement after only a few years, the walls are covered in soft pine wood. The pine works well for tacking posters, announcements and student art. The pine will develop a rich amber color, never needing replacement or refinishing. Exploring the performing arts themes of the curriculum, playful window arrangements of colored glass create an expression of music, rhythm and harmony.





Social Interaction

The extra wide stairway serves as a gathering area and amphitheater seating for the stage. The corridors are lined with niches and custom cubbies for informal interaction. Within the classroom, window bays with seating provide intimate, quiet areas. The library has a built-in amphitheater area for reading groups.

Accommodate Change

Within each classroom, there are "Learning Walls": custom, flexible and adaptable millwork that can conform to each teacher and students' needs. The pairing of classrooms around a resource room and group activity corridor allows for many variations of learning environment shapes, sizes and functions. The stage is also a flexible performing arts classroom and is double-sided, serving the multipurpose room and the lobby with staircase/amphitheater seating.



Resources

Each classroom has a private restroom. Though at first sounding inefficient, the concept has provided savings for resources and maintenance. These restrooms are self-maintaining by each classroom's students. Custodial duties and resources are minimized as compared to a typical group restroom down the hallway. In addition, the time of gathering students to use a traditional restroom, and the bullying and intimidation that might occur in large restrooms are eliminated with our design.

<http://www.designshare.com/index.php/projects/greenman-elementary/narratives> and
<http://www.architecture4e.com/>

Los Angeles High School No. 3

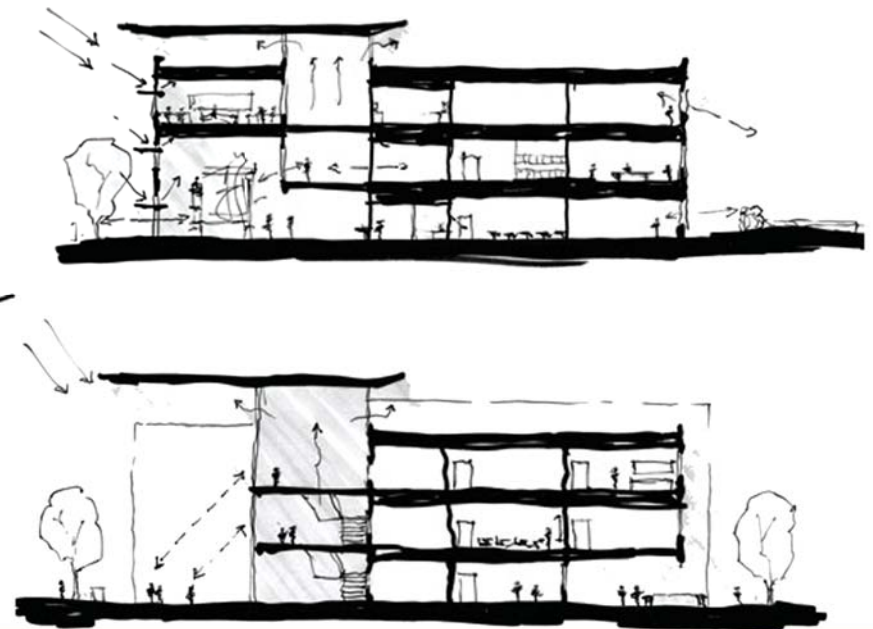
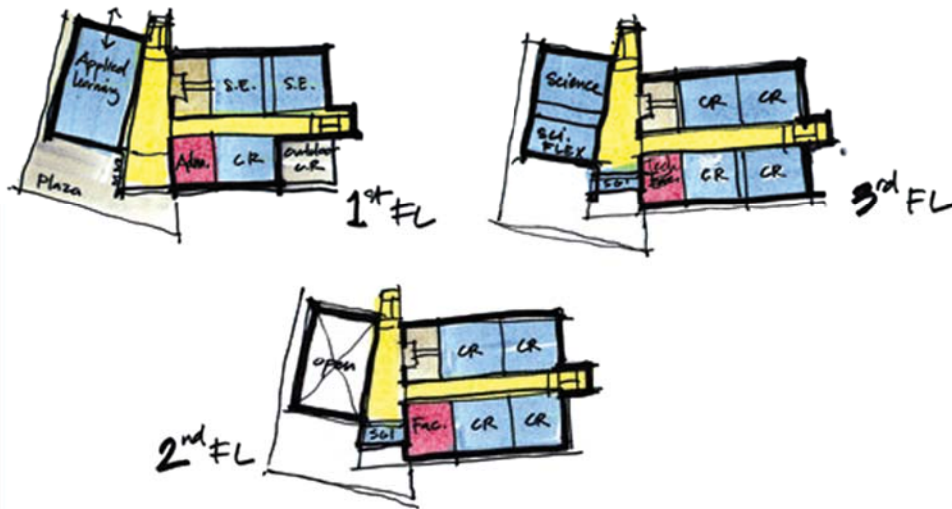
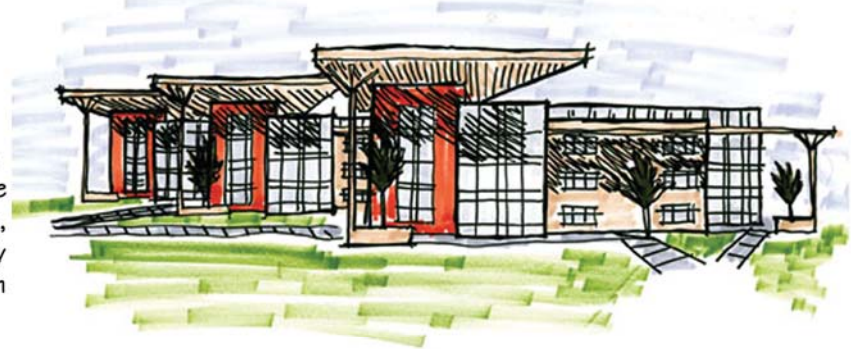
VCBO

Los Angeles, CA

With 13,000 buildings and a student population of 712,000 the Los Angeles Unified School District is very large and its challenges are complex. Its New Construction Program is valued at over \$19 billion and it will deliver 150 new schools by 2012. This major multi-year capital-improvement program is intended to achieve several goals, including the relief of overcrowding, elimination of involuntary busing, and the return of all students to a traditional two-semester calendar. Ideally, every student should attend a neighborhood school with small learning communities within it. This year alone, Los Angeles Unified School District (LAUSD) will open 13 new schools to provide over 67,000 new classroom seats.

The LAUSD representatives brought the design of South Los Angeles High School No. 3 (HS No. 3) to the National School Design Institute charrette. It is a 1,215 seat, two-semester high school that was planned to relieve severe crowding at Manual Arts High School, which was built in 1910 and has an enrollment of 4,100 students. HS No. 3's design featured three small learning communities with contiguous clusters of classrooms and satellite administrative offices. The project, as planned, would have been constructed on an 8-acre site with approximately 146,000 square feet of building area, excluding the parking garage. The total project budget was nearly \$90 million. The school's opening was planned for the fall of 2009, and its construction documents were complete. The challenge for the charrette was to determine whether the completed construction documents for HS No. 3 could be amended to add an additional 800 seats of capacity to the 1,215 seat design, or if LAUSD should start a new design for the project.

http://archrecord.construction.com/schools/0701_CHI_southLA.asp



The site is rectangular in shape, with its long axis oriented to the north and south, and is bordered on its east, south, and west sides by through-streets. In its earliest iterations, the buildings were located on the south end of the site. Under the redesign, it made more sense to locate the athletic fields in a park-like setting within the residential area at the south site, so they function as a neighborhood amenity. The school buildings are located in the northern end of the site amongst commercial buildings, but face the courtyard at the interior of the site, instead of the surrounding streets.

The original design demonstrated LAUSD's commitment to small learning communities (SLCs). At the charrette, a variety of diagrams were developed to show how the small learning community buildings originally designed for High School No. 3 could in fact be utilized with the newly developed site-scheme, although the new program for 2,025 seats requires four SLCs instead of the three originally utilized. The multiuse areas needed include: a field house, two gyms, a performing arts space, and dining and food service. The central plaza includes spaces for group study as well as niches and alcoves for socializing. Outdoor dining is located adjacent to the servery; performance spaces are adjacent to the theater, and presentation/collaboration spaces are next to the SLCs.

The SLCs are the central component of the facilities program. The first completed design had resolved design issues and was based on many hours of committee input. The design team utilized this previous effort and found that its design and resolution of spatial adjacencies worked very well with the selected site scheme, although they did experiment with its circulation patterns. The four SLCs can be arranged as separate individual buildings, or arranged with connecting nodes for common spaces and vertical circulation. Staggering the SLCs provides shaded work areas and direct access to labs. The programmatic needs of different SLCs could be met by adding floors as needed. The final staggered scheme provides ideal solar orientation for daylighting (see sections, opposite page), an improvement over the original design.



LESSONS LEARNED:

- + Support from neighbors in residential areas surrounding the proposed new site is important. Delays may compromise this support.
- + Any new design for schools should consider community pride and joint-use opportunities.
- + The site strategy places exterior amenities such as the track, courts, and fields so they are easily accessible to the adjacent residential neighborhood.
- + The design takes advantage of small learning communities' strengths. There is good separation between small schools, more areas for projects and collaborative opportunities, and more opportunities for interaction between students and school staff.
- + Getting the most recent enrollment projections is crucial for accurate planning and design.
- + Environmental assessments and due diligence should take place early in the design process.



Harold C. Schott Education Center

glaserworks
Cincinnati, Ohio

The Cincinnati Zoo and Botanical Garden constructed a new thirty-three thousand square foot, three-story facility on their sixty-seven acre grounds. The center will house the Zoo's Education and Nocturnal Adventures overnight program, Frisch's Animal Outreach program, a greenhouse containing both a new rain-forest exhibit and hands-on classroom; and a theater / multi-use room for lectures, large workshops and fundraising events. In addition, The Zoo Academy, a twenty-nine year collaboration between the Zoo and Cincinnati Public Schools, will move into the new building. The fifty-student Zoo Academy is a four-year college preparatory high school program where, in their junior and senior year, students with strong interest in biological sciences earn vocational degrees by working with zoo keepers for two hours a day. During the remaining time, students attend class in one of two standard classrooms, the "Hub" classroom or their new biology lab. Due to the success and growth of the Cincinnati Zoo's education program, the new facility replaces a much smaller building constructed in the 1970's.

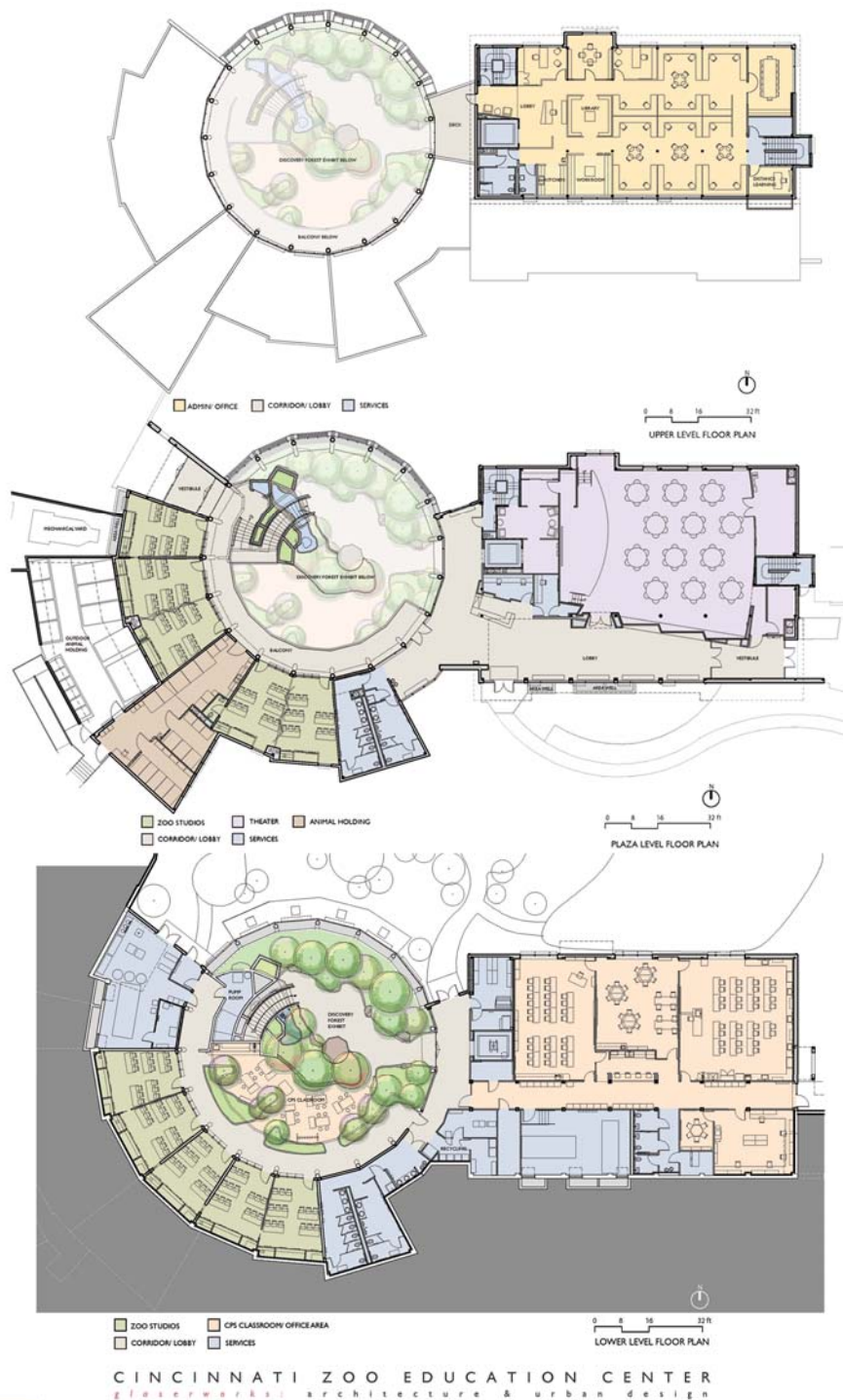
glaserworks, architect for the \$8.4 million project, designed the center as a high-performance, sustainable, twenty-four / seven, education facility that supports the Zoo's mission of "Creating Adventure, Conveying Knowledge, Conserving Nature, Serving Community". Modeling and daylight studies helped determine the optimum slope of the roof for the photovoltaic array, the single-pitch greenhouse roof to maximize sunlight into the greenhouse, and the extent and length of roof overhangs to control daylighting. In support of sustainable architecture and to help the project meet LEED Certification, the greenhouse structure has window, heating, fan and fog systems tied to the building's automated controls to reduce cooling and heating costs. A 20kW photovoltaic array helps reduce the facility's reliance on grid-power, waterless urinals and low-flow plumbing fixtures will reduce water consumption.

Interior finishes and materials are recyclable, rapidly renewable and low-VOC emitting, and includes wood trim and benches from a prominent burr oak tree that was felled to accommodate the new building. Roofing materials are high-emissivity / Energy Star rated. Exterior lighting is dark-sky compliant and the building has automated lighting controls. Interior furnishings have been selected that are green friendly.

Ten studio classrooms face onto and enter from a central two-story round tapered greenhouse "hub" structure that contains a "Discovery Forest" exhibit. This public exhibit will stress the significance that plants have on all living things including life support, food and medicinal products; their aesthetic value and the need for conservation. Live Central and South American plants and animals, a waterfall, fishponds and a "Shaman's Hut" will be highlights of the exhibit.

Information and images provided by glaserworks.





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conceptual design

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appendices

enhancing education through site and design



School of Environmental Studies

HGA

Apple Valley, Minnesota

SES opened in 1995 in the Minneapolis-St. Paul suburb of Apple Valley as a public, 400-student, 11th- and 12th-grade "high school of choice." Also known as the "zoo school" because of its active partnership with the Minnesota Zoo and its 12-acre site on zoo property, the school embraces project-based learning with an environmental theme. A number of students work with zookeepers and scientific staff in studying animal behavior, keeping animals active and challenged, and promoting public transit to the zoo.

"I feel like I'm not learning in a box of fluorescent lights like I was in my first years in high school," says student Kelly Carlin. "I'm learning in a classroom, and I'm learning outside by a pond. I'm learning in a local park. I'm learning at the zoo, working with people who are doing stuff in the field. ... We do a lot of stuff that has a significant impact on the community." Like all SES students, Carlin came to SES, which admits half of its students based on lottery and the other half based on an essay, after attending his neighborhood "home high school" for his freshman and sophomore years. The school reflects the district's ethnic makeup, which is about 92 percent white.

"We spent a great deal of time figuring out what was the best way students could be educated, and we came to some basic ideas," explains SES teacher Tom Goodwin, one of the creators of the school. "One of them was students should be workers, and teachers should take less of a central role. Another was that students should be able to move around and that there should be some sort of center of the school. ... And everyone's group, everyone's house, would more or less face that central location."

The construction of SES was an all-too-rare case of fitting the building to the academic program, says Principal Dan Bodette. "Once we fleshed out our entire two-year program (which took two years), then we went to the architect and said, 'Architect, please design a building that will meet our needs, our expectations for how kids are going to learn best.'"

The building that architect Bruce Jilk ultimately came up with in consultation with educators, parents, and community members focuses on giving the school a family feeling. Students and teachers are grouped into "houses" -- 110 or so students and three or four thematic studies teachers who are teamed up for three hours every day. When the entire house meets, tables and chairs may be arranged in a semicircle or rows. If community members are coming to watch student presentations, the configuration changes, as it does when small groups work together on projects or when the area needs to be cleared of furniture to have a large, open space. The building speaks to the collaborative relationships among students and staff and to the idea that students are supported to go as far with their learning as they are capable. Each house includes a shared office for its teachers, and the door is always open. Students form relationships with the other teachers, students, and staff through electives, projects, Socratic seminars, and general mingling in the community areas. <http://www.district196.org/ses/>





- CLASSROOM
- RESOURCE
- LAB & OFFICE
- PERFORMANCE
- PHYS. ED.
- BLDG. SERVICES



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WMEP Interdistrict Downtown School

Cunningham Group Architecture

Minneapolis, Minnesota

As a multicultural learning center, this award-winning K-12 school embodies a cooperative effort to establish an integrated, interdistrict magnet school for 600 students. The school intends to utilize the diverse downtown environment and all its resources, making appropriate and full use of advanced technologies, supporting hands-on experiential learning, and enhancing multicultural learning, exchanges, and community-building.

Cunningham Group's design of the new school and its space program reflects this goal by providing focused instructional "houses" with labs for hands-on work and shared whole-school space. Six of these centers for the elementary, middle and secondary levels also feature ancillary personal and activity spaces. Embracing a "learning while doing" philosophy, the school partners with neighboring business, government and arts communities, utilizing these partnerships and facilities as external labs.

Further characterized as a "green living school," the institution established an environmental focus early in the design process that evolved into clearly defined goals related to resource efficiency, daylighting, indoor air quality, materials, reuse/recycling, and building systems. The design of the school helps educate youth on how their actions and the built environment affect the natural environment through understanding the school's air, water, energy, and material systems. Innovative in its design as an environmental teaching tool that provides tangible examples for learning, the school's response to these goals ultimately creates a living curriculum from which students acquire knowledge and life-skill learning related to a sustainable future.

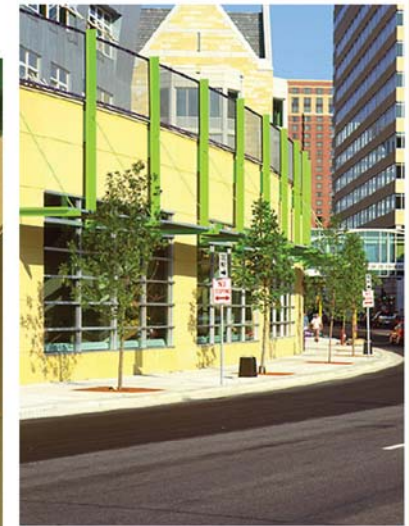
IDDS features the following:

- A design that encourages experiential learning inside and outside the building, with community partnerships and labs located in downtown Minneapolis;
- Large gathering places and home-like smaller spaces that foster community-building experiences;
- Labs for large, messy and wet projects;
- Partnership with the University of St. Thomas School of Education;
- A high standards-based curriculum that is interdisciplinary, multicultural and experientially driven;
- A music program with internal resources and MacPhail Center for the Arts that develops talents and enhances academic learning;
- A K-12 physical education program in partnership with the downtown YMCA.

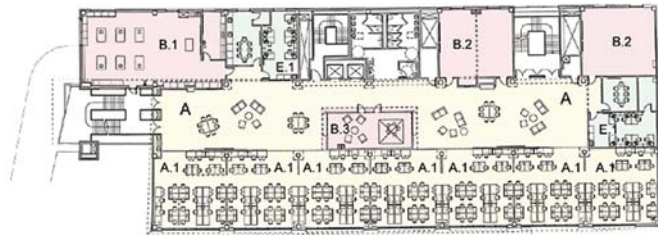


<http://www.wmep.k12.mn.us/idds/>

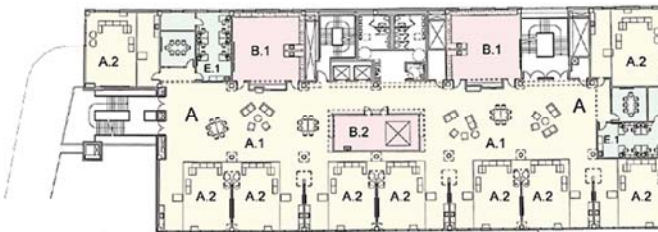
http://archrecord.construction.com/projects/bts/archives/K-12/04_WMEP/overview.asp



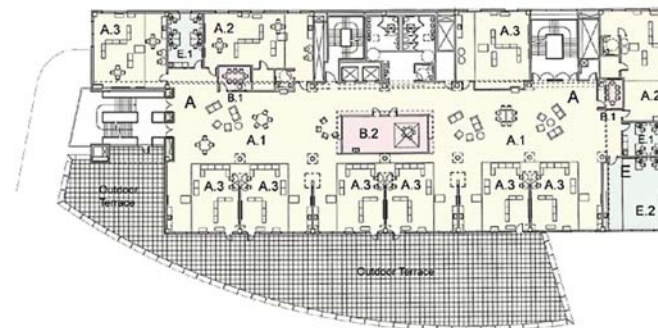
4th Floor



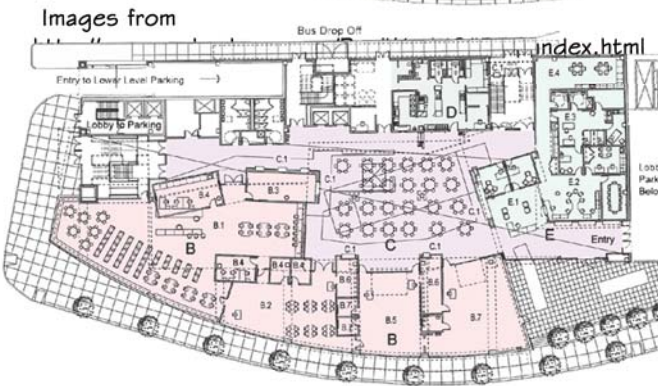
3rd Floor



2nd Floor



1st Floor





Earthworks

BNIM
Kansas City, Missouri

Earthworks is a hands-on learning environment, designed in conjunction with the Learning Exchange, that seeks to teach children how the 'earth works.' It is located within Kansas City's vast Hunt Midwest 'Subtropolis,' a 50 million square foot subterranean complex created by limestone mining operations in the early 1900s. Situating Earthworks in such a setting allowed the facility to take advantage of the natural insulative properties of a cave. It also offers students an exciting and memorable environment outside the classroom. An irregularly shaped space was created to host activities related to the five different ecosystems: soil, prairie, pond, cave and forest. Each ecosystem is connected to the next by a sinuous wooden walkway. Dioramas for each ecosystem lead directly to shelters for pedagogical experiments. Today Earthworks hosts 10,000 third- and fourth-graders annually.



<http://www.bnim.com/fmi/xsl/portfolio/index.xsl?token.pnum=93020.01&token.pid=pr8-1&token.cat=cat-8>



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enhancing education through site and design

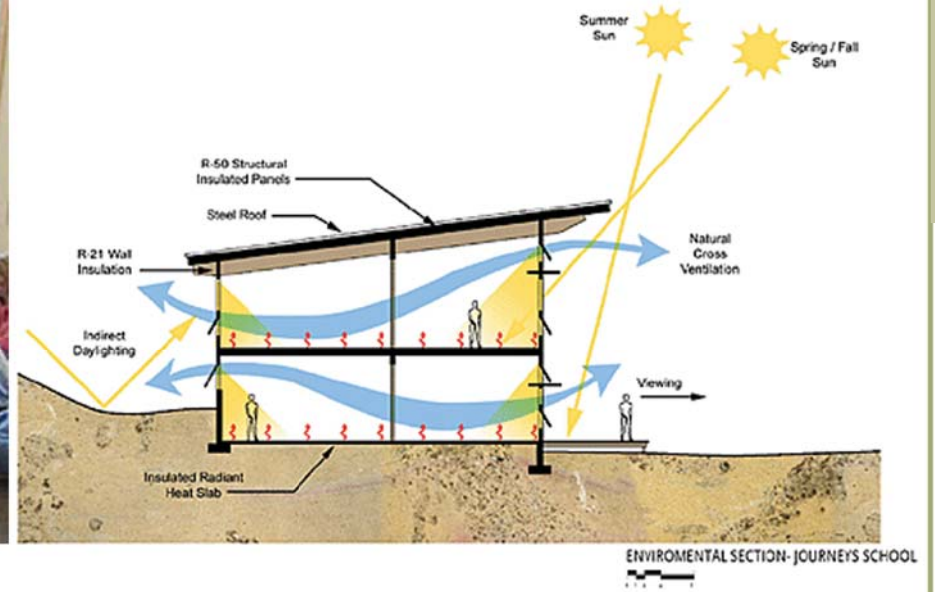
Teton Science Journeys School

Mithun Architects and Hawtin Jorgensen
Jackson, Wyoming

Carefully integrated into the landscape, two residential lodges, five educational buildings, a dining hall, maintenance building and welcome center were designed from a green perspective, using environmentally friendly materials with low-level organic compounds and using minimal resources. Natural lighting and innovation in space design have resulted in a learning environment in which students thrive. And since Teton Science Schools depends upon wildlife to fulfill its teaching mission, the entire site was prepared to avoid impact on established wildlife migration paths. The site planning approach placed most of the buildings on the northern side of the valley. This area offered better solar access and moved buildings with high intensity uses farther from wildlife sensitive tree cover. All two-story buildings and most of the single story buildings were built into the hill, thus minimizing their scale of these buildings. Site and building designs were intended to be educational tools in and of themselves, exhibiting environmentally intelligent design in the Greater Yellowstone Ecosystem.

Studies were done to make sure the school and surrounding areas were as non-disruptive to existing wildlife and plan communities as possible. Reducing the building footprints, keeping the footprint narrow to maximize daylighting, solar gain and natural ventilation was also important. no air conditioning is needed and heating is done through natural gas boilers and radiant heated concrete floors. During construction, topsoil was stockpiled for reuse during landscaping which includes native plants only. Structural systems such as roof panels, wood shear walls, and concrete slabs were left exposed on the interior, eliminating need for extra finish materials. Metal roofs, wall panels, and fibers cement siding provided durable, fire-resistant exterior cladding.







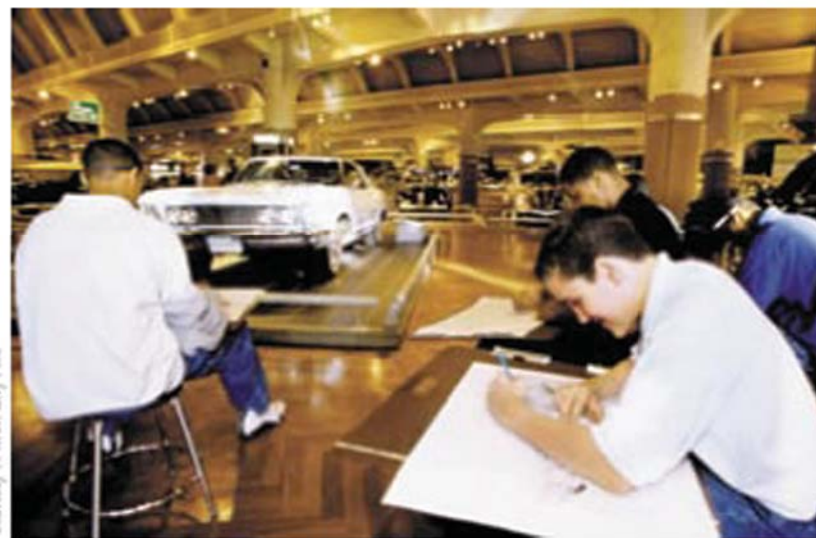
Henry Ford Academy Deerborn, Michigan

Designed to serve as a model for educational reform, we started Henry Ford Academy to prepare students to meet the challenges of the 21st century. The school's rigorous academic curriculum incorporates hands-on activities, interaction with professionals in the community, and teamwork.

Henry Ford Academy is the nation's first charter school developed jointly by a major corporation, public education and a nonprofit cultural institution. Located in Dearborn, Michigan, the school has been in operation for 10 years.

Ford contributes substantial input to Henry Ford Academy, but the true power of the school lies in the direct, hands-on involvement of more than 400 individual Ford employees who serve as tutors, mentors, lecturers, curriculum advisors, student project sponsors, project partners and coaches for thousands of hours each year. Ford volunteers serve all 390 students and their families, as well as the 32 Henry Ford Academy teachers, administrators and support staff.

In addition, as Henry Ford Academy's host institution, The Henry Ford provides students with a truly "public" high school experience that has a tremendous impact on their personal and academic development. The students' presence on the Ford Motor Company campus exposes them to a much broader spectrum of people than they would encounter in a traditional, stand-alone high school. Students are frequently called upon to provide assistance to visitors, collaborate with museum staff on joint events and serve as unofficial ambassadors of the organization.



<http://www.ford.com/our-values/ford-fund-community-service/education-america/henry-ford-academy/ford-academy-478p>

Conceptual Design

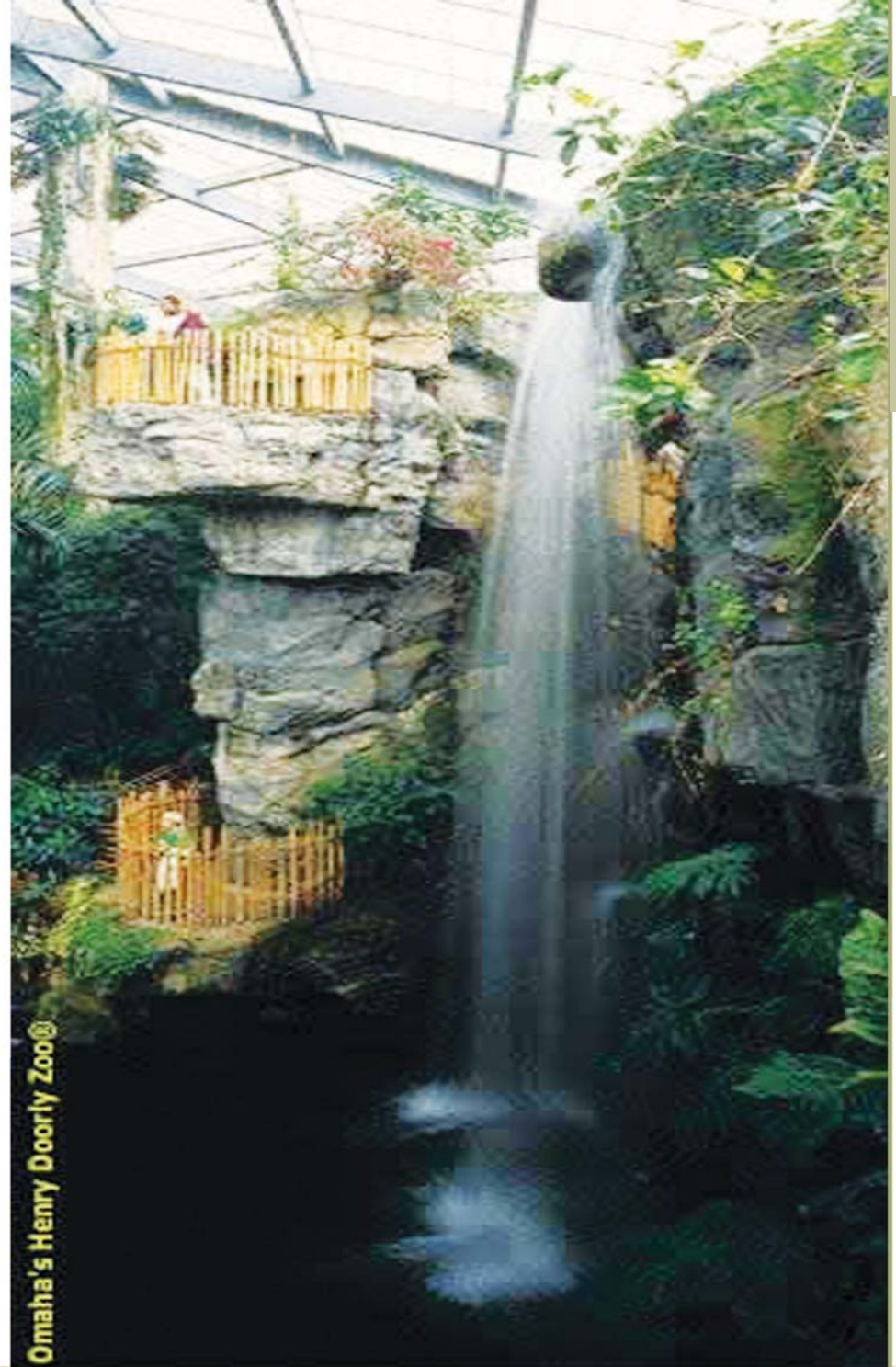
77 early ideas

80 first renditions

82 mid-semester review

96 revisions/process

100 end of semester review



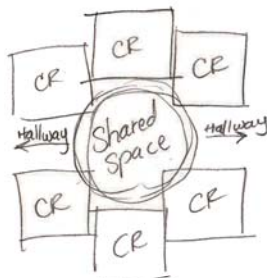
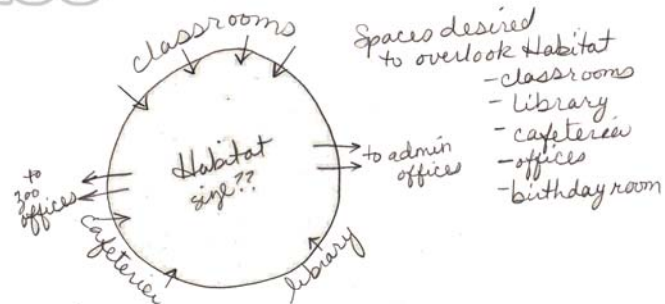
Omaha's Henry Doorly Zoo®



SCHOOL AT THE ZOO:



Early "scribbling" attempting to identify how the spaces interact with the habitat and how classroom pods may be organized

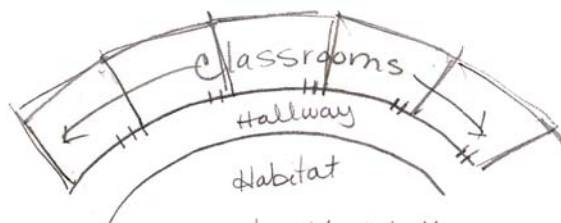
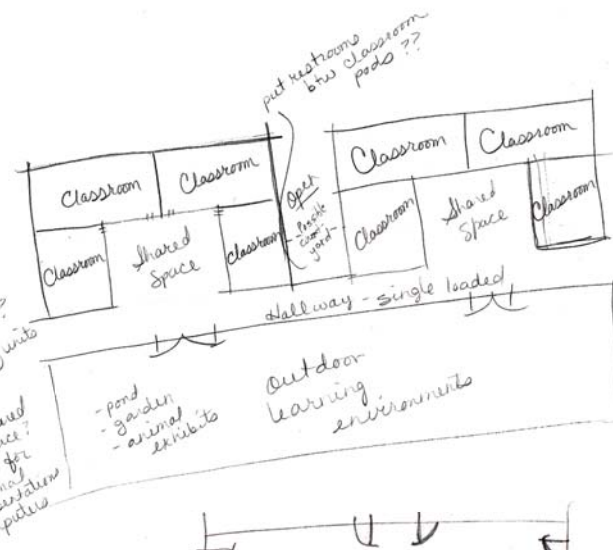


What is relationship to indoor habitat?

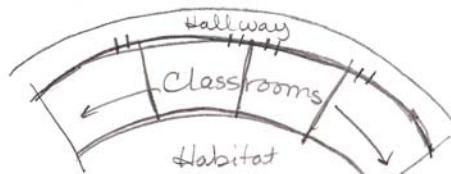
- arrival holding units

What goes in shared space?

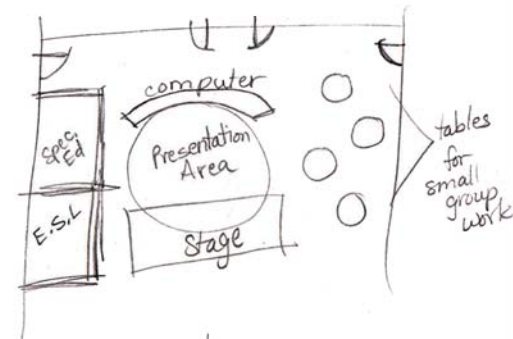
- place for animal presentation
- computers



- windows look out into hallway
- students enter classroom from hallway - overlook habitat

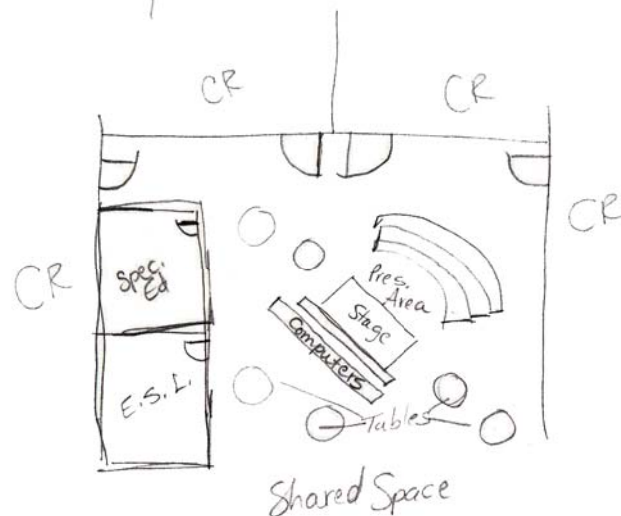
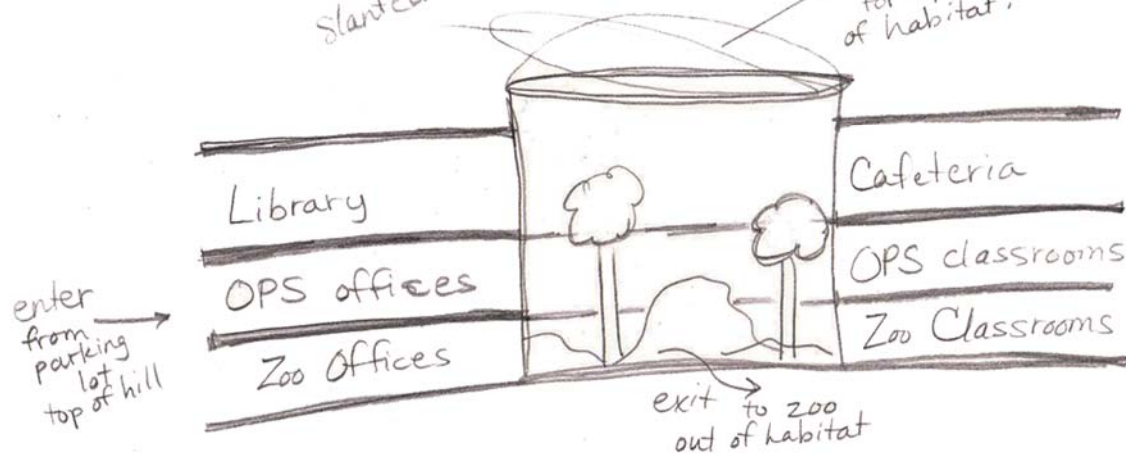


- Hallway "behind" classrooms
- Classrooms overlook habitat
- enter classrooms from hallway (do not see habitat until inside classroom)



Slanted like Cincinnati Zoo?

done for top of habitat?

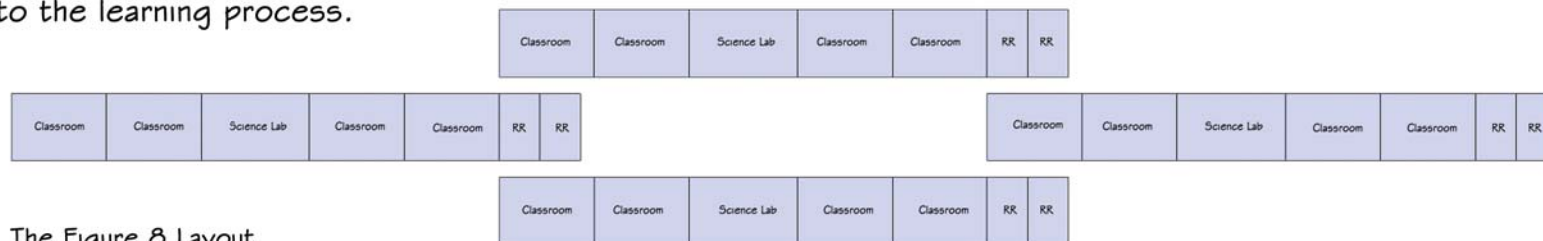




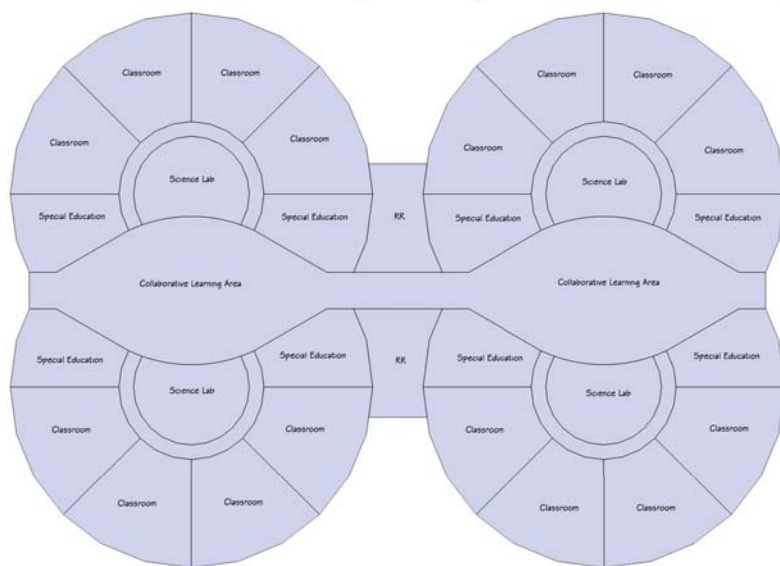
Classroom Layouts

As a former teacher, the classroom's layout and shared space adjoining it are very important to me. I started my design exploration by examining different classroom "pods" and the relationships among the spaces. Based on research, I believe the "fat-L" is the shape best suited to the learning process.

"The Dove-tail" Layout: In this layout, circulation spaces weave in and out of the classroom groupings. The shared space is small and narrow. The many uses expected to occur in the shared space would not fit in this configuration. Students from some of the classrooms would be required to walk quite a distance to use the shared space. This disparity and inconvenience makes the shared space less desirable for use.



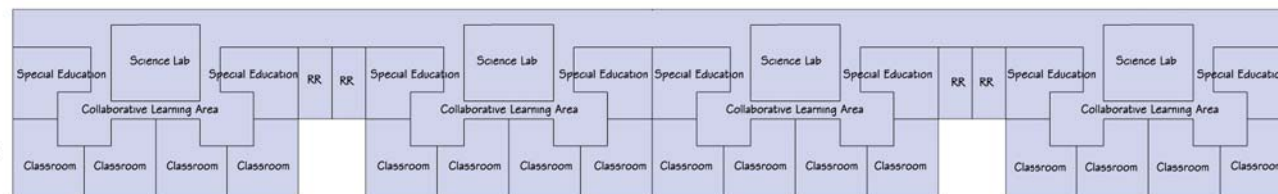
The Figure 8 Layout



The Dove-tail Layout

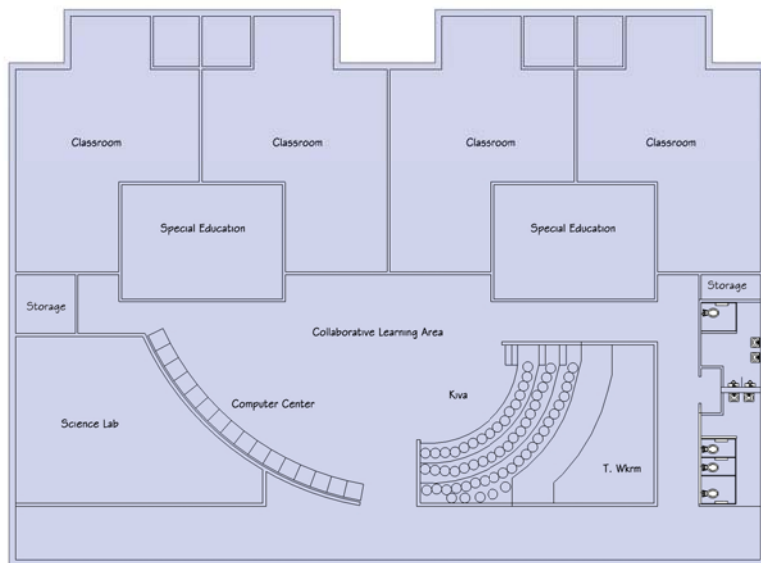
"The Figure 8 Layout": This layout is fun and unique, but it is also more difficult to create a logical relationship with the rest of the building. Odd-shaped classrooms are not desirable by teachers. L-shaped classrooms are not a possibility with this configuration. A couple of classrooms would not have exterior windows and the shared space is totally enclosed. Skylights or a raised roof with clerestory are options to address these issues.

The Notches Layout



The "Notches" layout includes L-shaped classrooms and convenient shared spaces. It's single-loaded, long narrow design allows for maximum exposure to the sun (if oriented correctly). There are many spaces conducive to learning "corners" and it is a logical layout. But it is a bit boring.

"The 'H' Layout": All of the grade levels are in close proximity which allows for easy cross-grade level groupings and collaborative teaching. Again, several spaces, including the share spaces do not receive any natural light. L-shaped classrooms are possible with this layout. Repetition makes wayfinding more predictable. Large, open shared spaces allow for many uses. But it is visually boring and reads too much like a traditional school or institution.



The House Layout

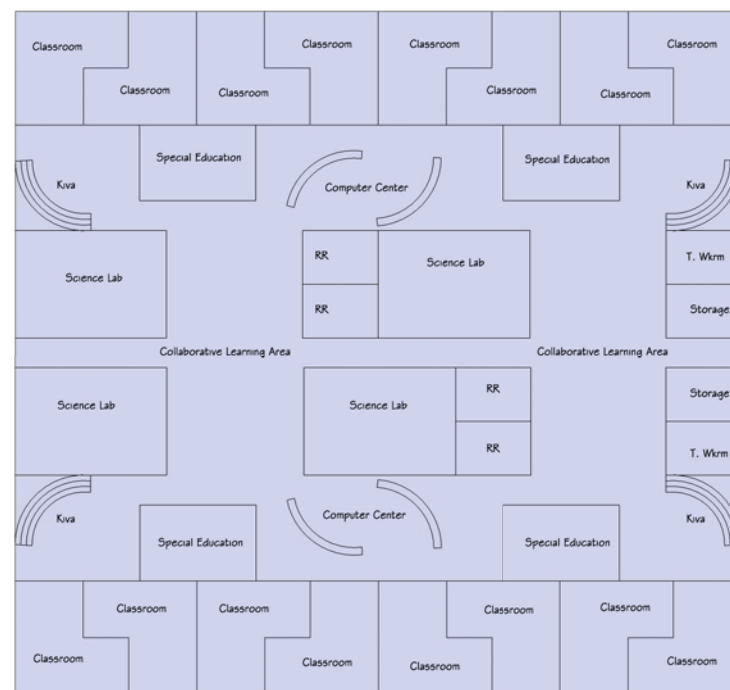
"The House Layout": This is my favorite. The "pod" seems to make sense and fit together well. There is large space and smaller space for group work. The curves seem to embrace the students as they leave their classrooms. Some light from the hallway (if remains single loaded with windows to the outside) could make it way into the shared space, teacher work room and science lab. Several variations could be considered when attaching other houses to this one.

"The Square Layout": Very similar to the "H" layout where all grade levels are in close proximity. Lots of available shared space...too much? Several spaces do not have access to natural lighting. The layout is visually boring and too "blocky."



The "H" Layout

















The Square Layout

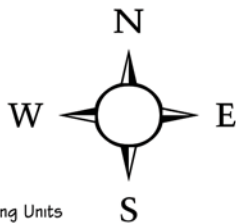


Building Layouts

Using approximate square footage for the various programmatic spaces, I began creating various building layout configurations and arranging them on the selected site. Using the Cincinnati Zoo School as inspiration, at this stage in my design, the indoor habitat was round. Some views have a south-east perspective; others have a view from the north-west.

First Renditions

-  Circulation
-  Classrooms
-  Science Labs
-  Group Gathering Space
-  Special Education
-  Teachers' Workroom
-  Restrooms
-  Administration
-  Theater
-  Gymnasium
-  Cafeteria
-  Library
-  Art
-  Music
-  Habitat
-  Animal Holding Units



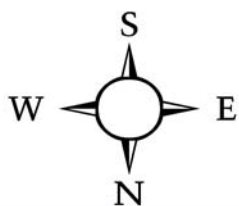
At this point in my process, my layouts were linear with no to slight curvature. Grade levels (pods or houses) were kept separate but linked by (usually) a single-loaded corridor with south-west exposure. I had concluded that for security reasons and to lessen distraction from visitors, separating the school from the habitat was best.



All of the iterations are long and linear with a strong southern exposure. This is for many reasons:

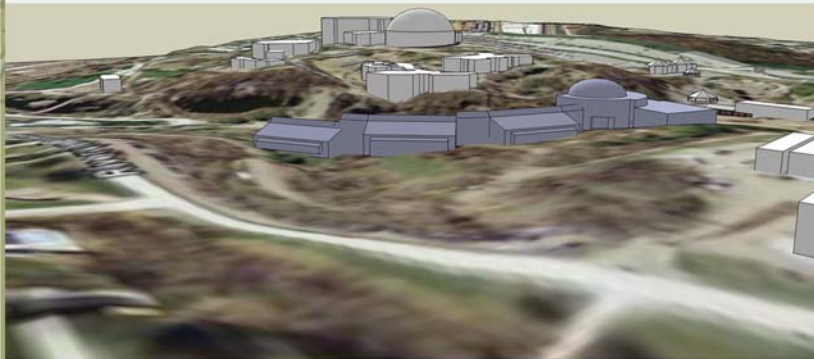
- long, linear buildings have more opportunity for sunlight to reach the interior spaces
- the site is conducive to a long, linear building that follows the contours of the hill
- this type of layout reduces the need for stairs and ramps
- having separate pods linked together in a long linear path is more likely to ensure equality among spaces

But...this type of layout makes for a very long building with great distance from special areas (gym ,etc.)

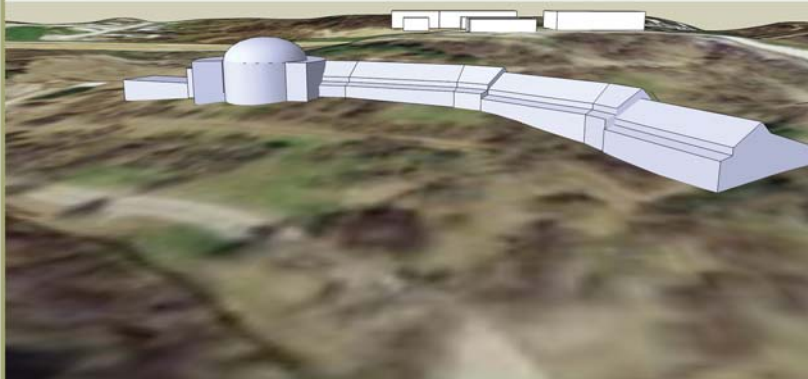




View from northeast



View from southeast

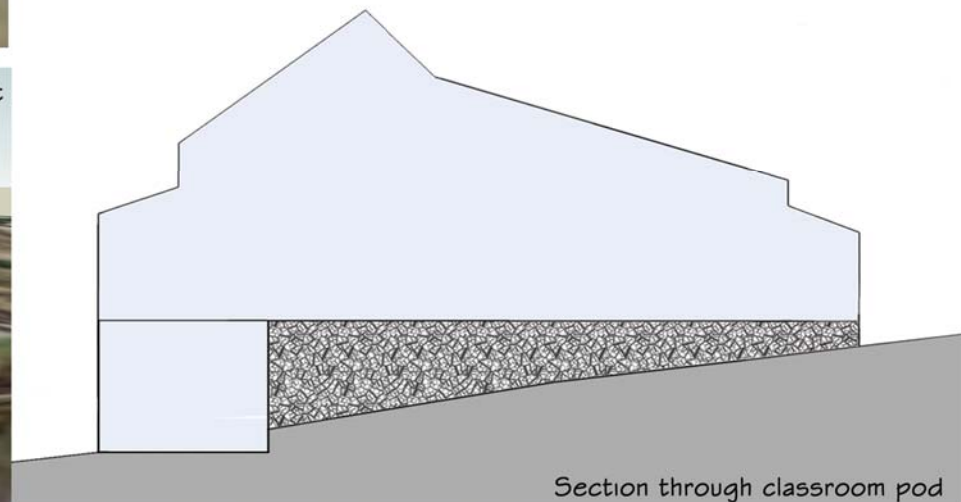
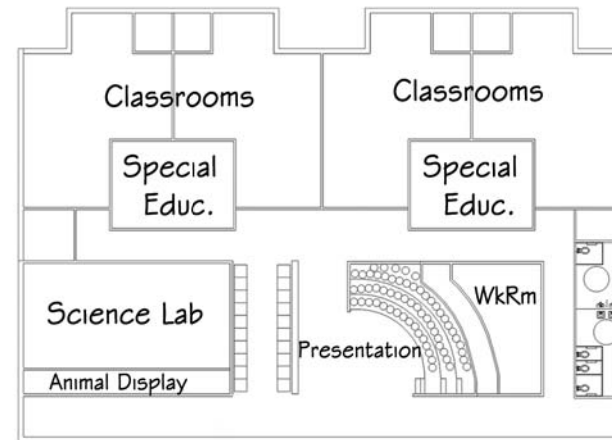


View from southwest



Design Iteration #1

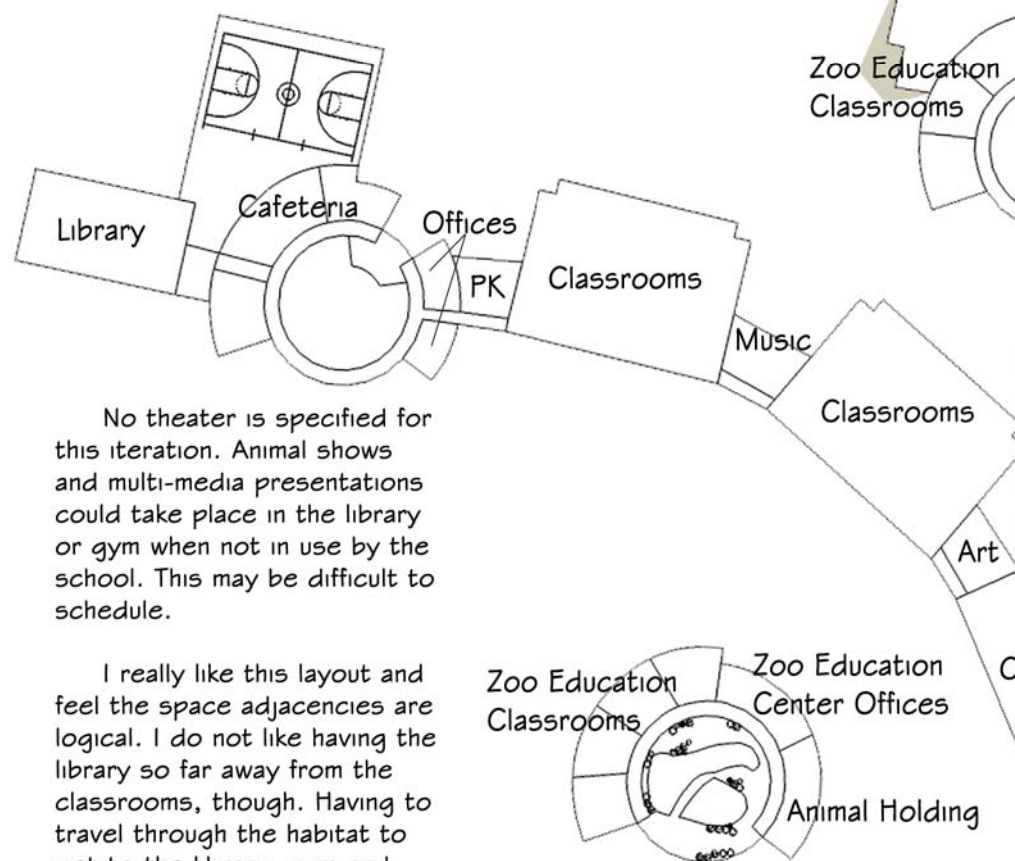
Reminiscent of a farm shed, this design ties into the architecture of Nebraska (family farm) and is ideal for harvesting daylight. A slight curve is created by turning each classroom house slightly. The "links" between two houses can be special areas, restrooms, mechanical rooms, storage, etc. Reading alcoves and teacher offices look to the north. Animal holding units can be placed below the classroom pods. The round habitat can be designed to remind viewers of grain elevators or silos.



Section through classroom pod

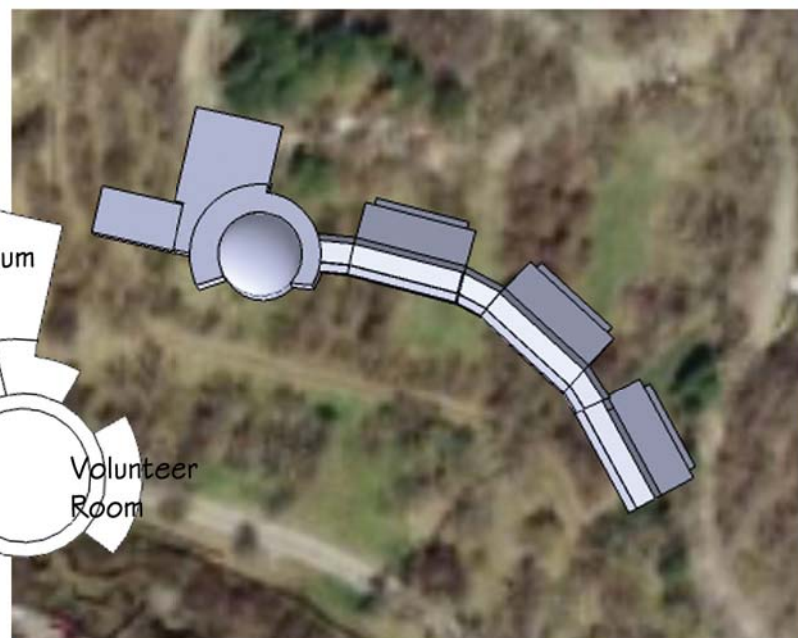
By having the zoo education department offices and classrooms embracing the habitat, visitors will have a logical and obvious knowledge as to where to find zoo employees in the building. This location is also convenient for zoo staff who may need to give tours, present animals, or welcome visiting schools at the zoo for field trips.

The library and gym are quite a distance from the school. The positive result of this is the pathway students will take (directly through the habitats) in order to access these spaces.



No theater is specified for this iteration. Animal shows and multi-media presentations could take place in the library or gym when not in use by the school. This may be difficult to schedule.

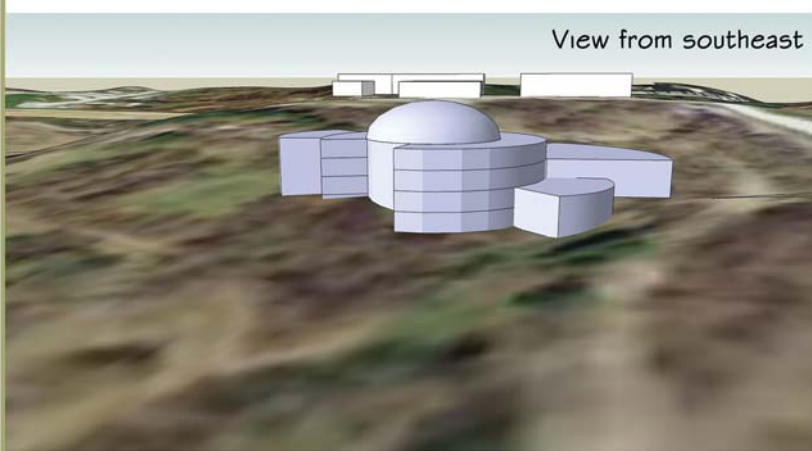
I really like this layout and feel the space adjacencies are logical. I do not like having the library so far away from the classrooms, though. Having to travel through the habitat to get to the library, gym and cafeteria will be a continual reminder that this is not an ordinary school



View from northeast



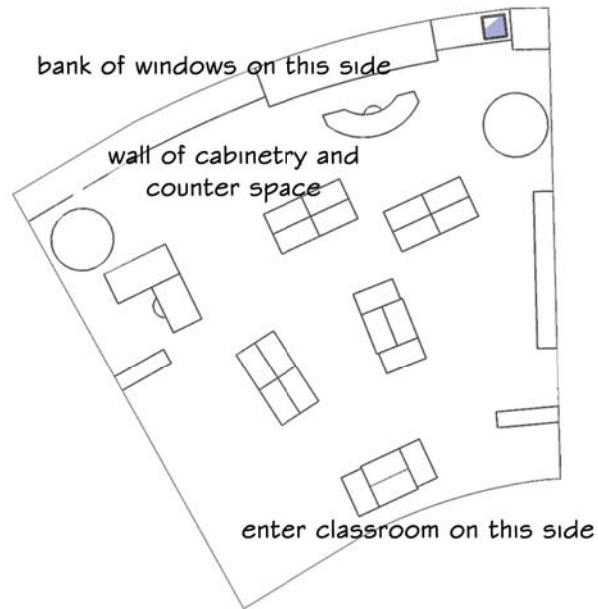
View from southeast



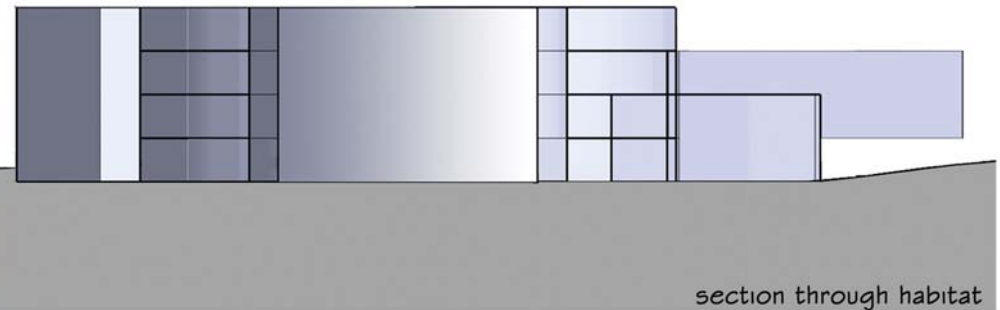
View from southwest



Design Iteration #2

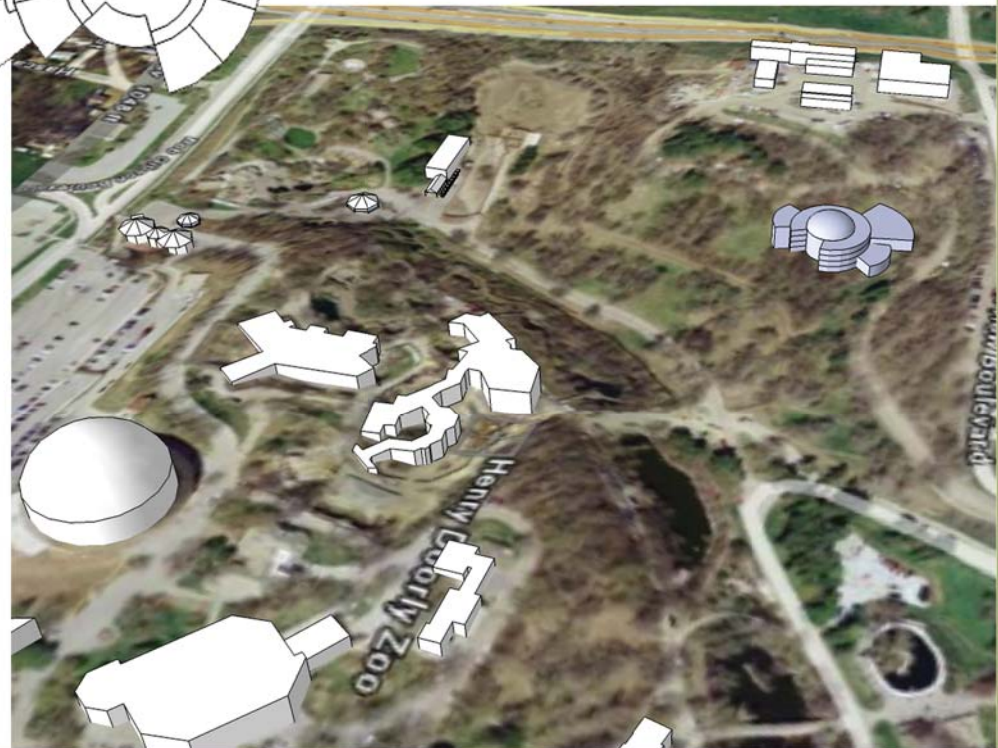
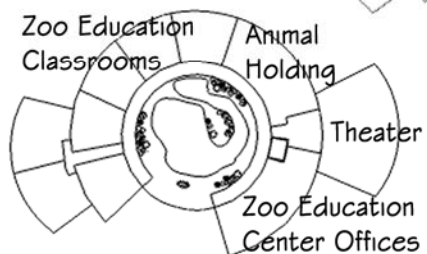
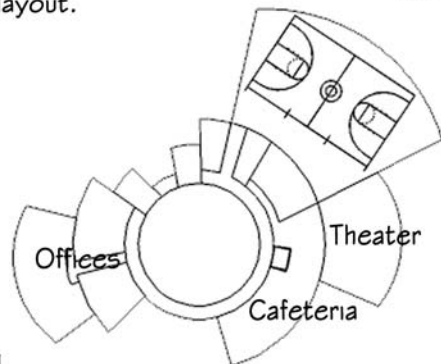
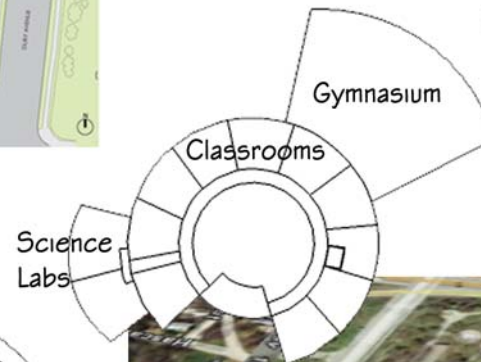
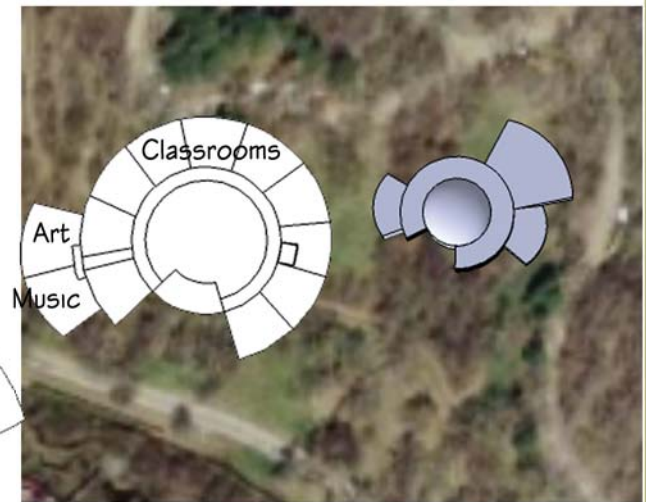


The round habitat was the driving design determinant in this iteration. I like the idea of all of the spaces embracing the habitat. Odd shaped spaces result, though, and most teachers prefer parallel walls that furniture can securely be placed against. This classroom space, with its abundant square footage, allows for many layout options. Especially difficult to place is the gymnasium, but this shape is ideal for a theater or presentation space. I think this layout has great potential.





This design iteration was highly influenced by the Cincinnati Zoo Education Center. But the school portion of the center is in the rectangular area of the plan - again addressing the teachers' preference for a rectilinear classroom layout.



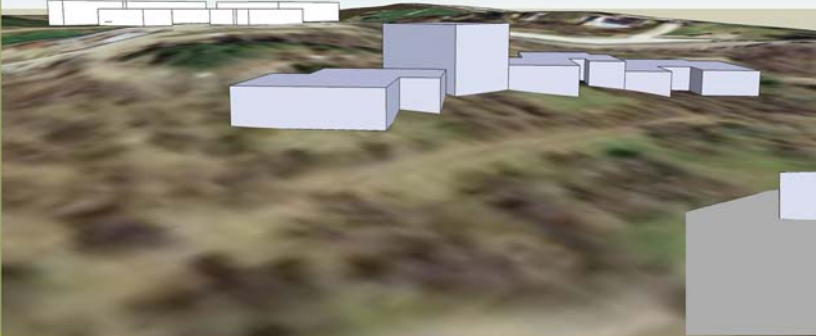
View from northeast



View from southeast



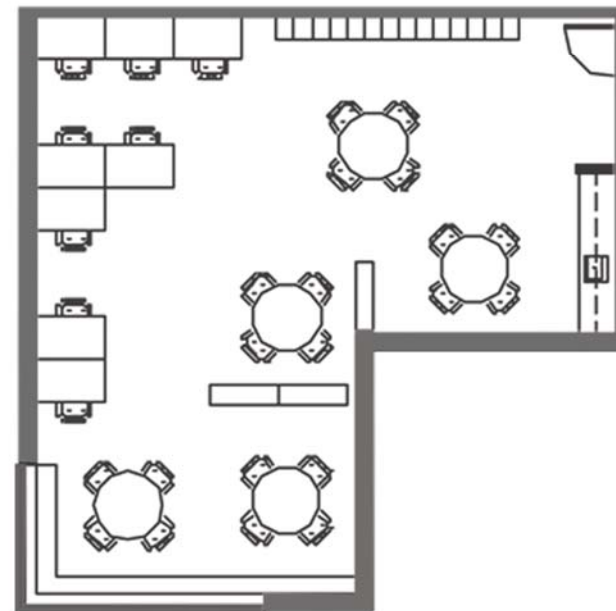
View from southwest



Design Iteration #3

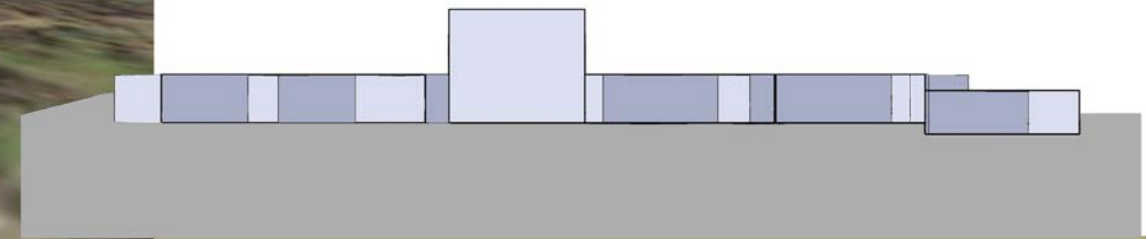
In this iteration, the habitat is square rather than round, although a round habitat could work as well. This design is based on circulation and multiple small collaborative learning spaces. Each learning area is relatively close to all classrooms. Cross-grade groupings would be convenient in this layout. The L-shaped classroom is easily placed within this layout, and the shared spaces offer many opportunities for varied activities. The journey to the cafeteria and gym requires the students to pass through the habitat, which is enjoyable.

Overall, this iteration does not seem to fit the site as well as the others and may still be too similar to the traditional school setting.

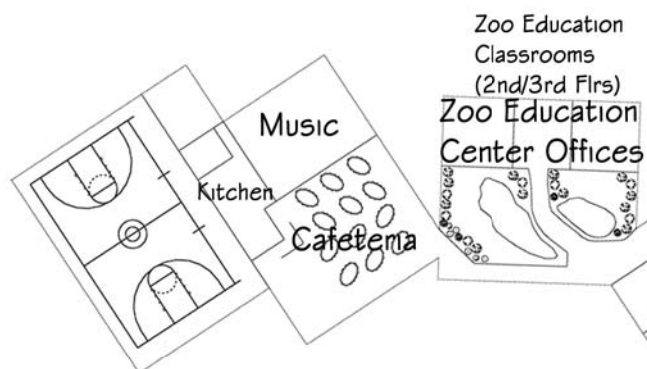


“Fat L’ Classroom

<http://www.designshare.com/index.php/articles/th>



SCHOOL AT THE ZOO:



Another desire I have for this zoo school is the opportunity to travel to the zoo and other outdoor spaces with convenience and ease. This would required exterior doors leading from the classrooms or shared learning spaces directly to the outdoors. Having to travel through the building and exit out the habitat is not convenient. In this iteration, there is no equitable location for exterior doors within the "school"

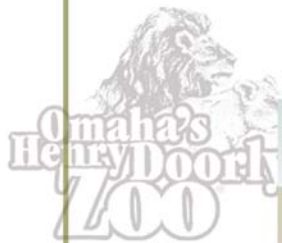


Outdoor activities include experiments and observations at a pond, bug collecting, gardening, "recess," soil sampling, water collection and testing, animal care, and weather experiments (among others).



<http://www.abingtonfriends.net/Library/Images/ImageLibrary/3-outside-write.jpg>

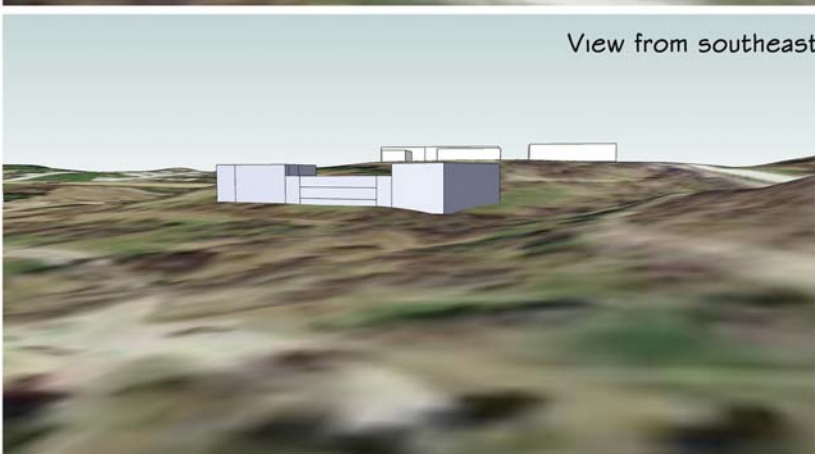




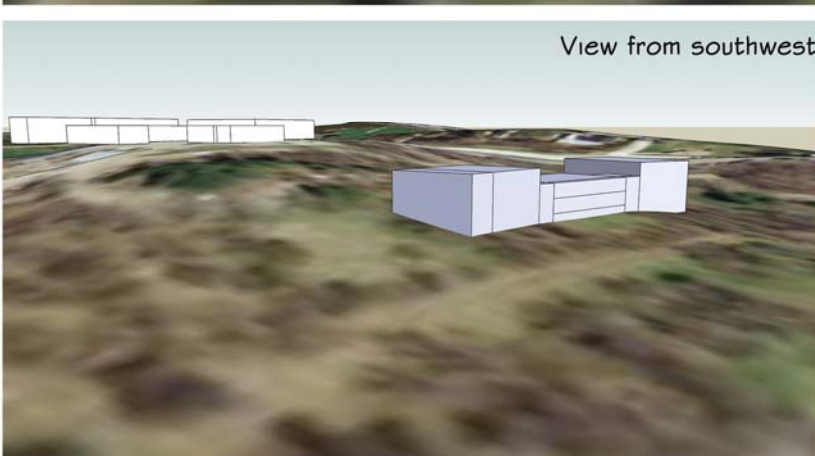
View from northeast



View from southeast

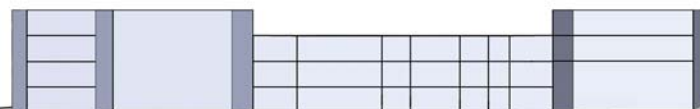
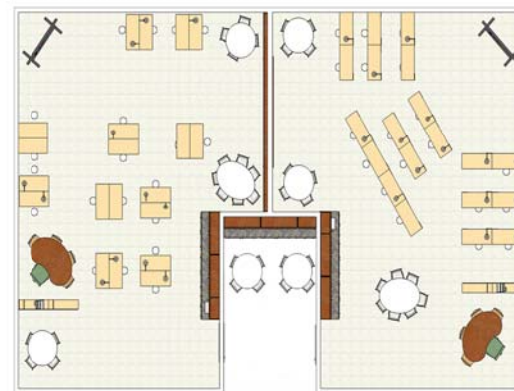


View from southwest



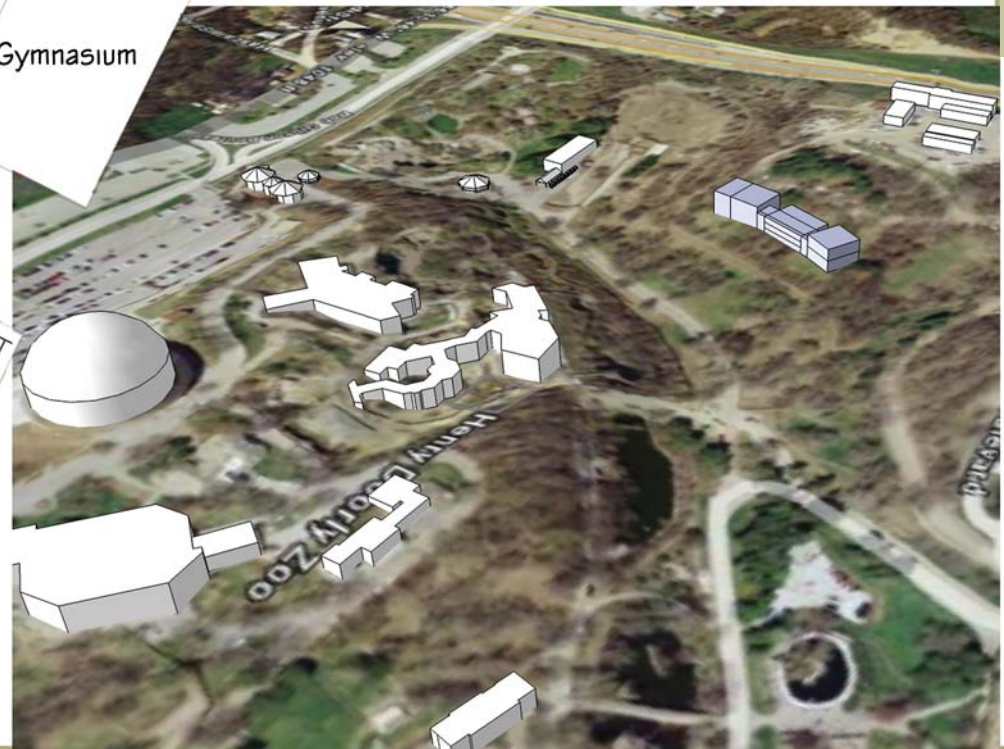
Design Iteration #4

My attempt to break away from the round habitat was the design influence of this iteration. With the habitat at one end, the special areas at the other, and the school in the middle, my preliminary idea was to create bookends. Although this is a logical scheme and would be very easy to embellish and improve, it did not make the school "different" from other school designs. I did not want this school to look like a traditional school.

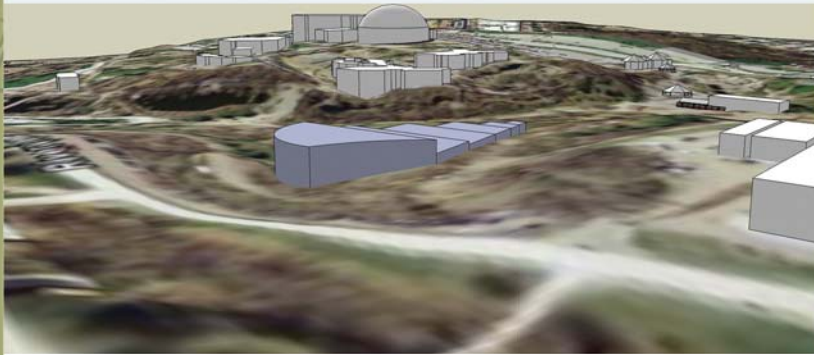




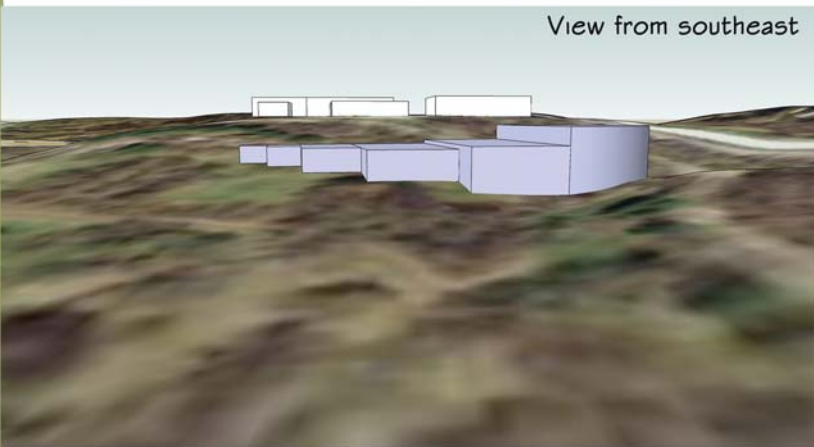
This floorplan has the “heart” of the building the school, which is apropos. The offices as the linkage space would aid in security related matters, but having them on different floors would make communication less convenient. Although the classroom pods are spacious and conducive to learning environments, cross grade level groupings are less likely to occur.



View from northeast



View from southeast

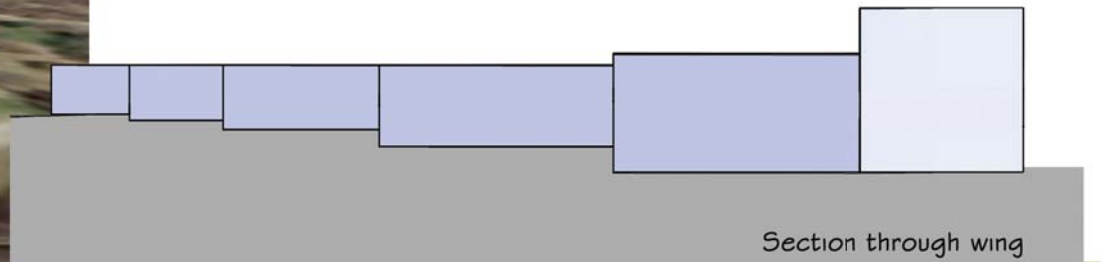
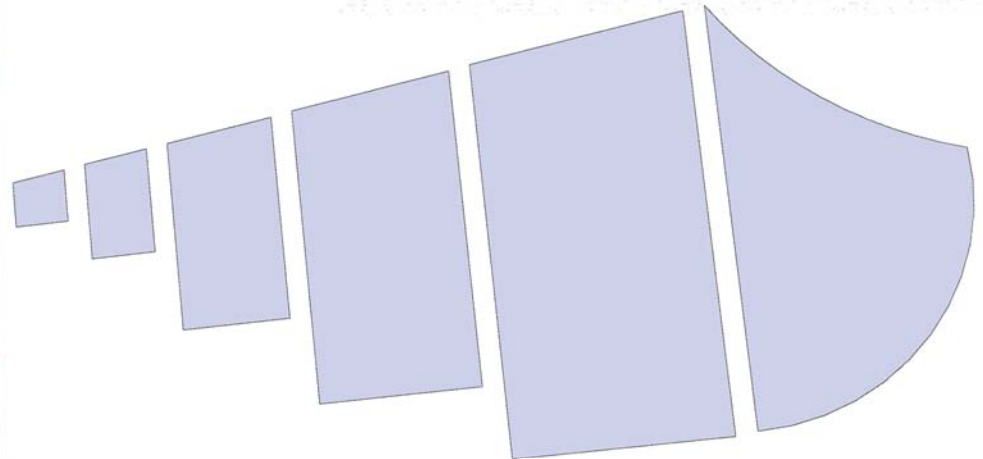


View from southwest



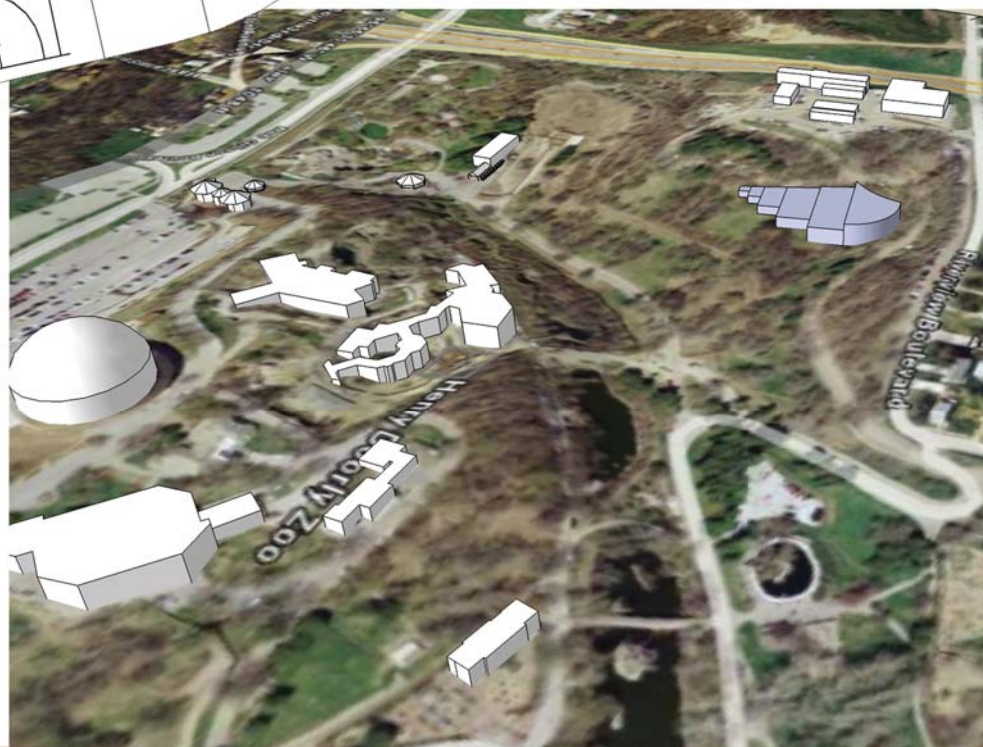
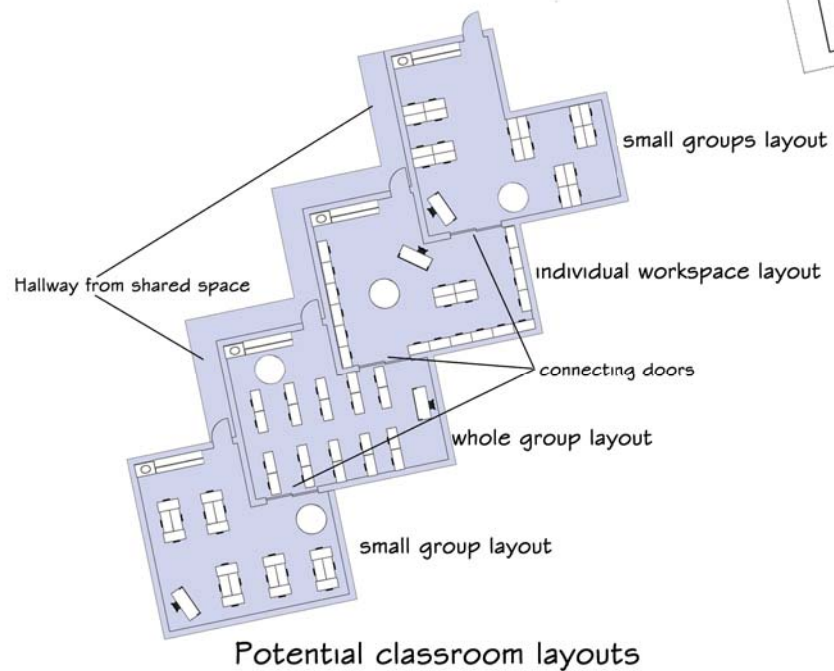
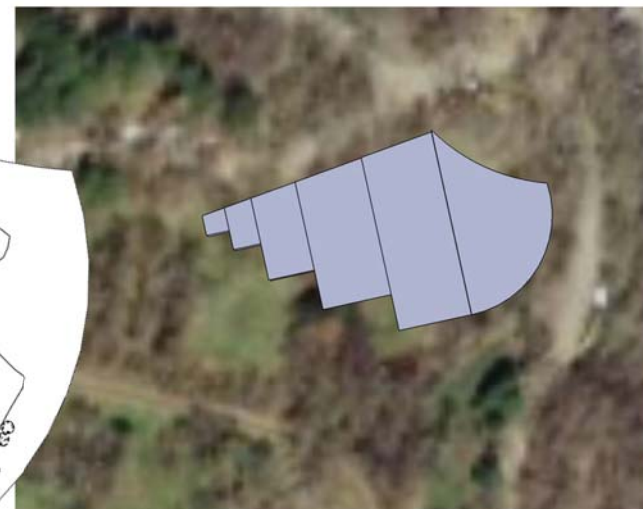
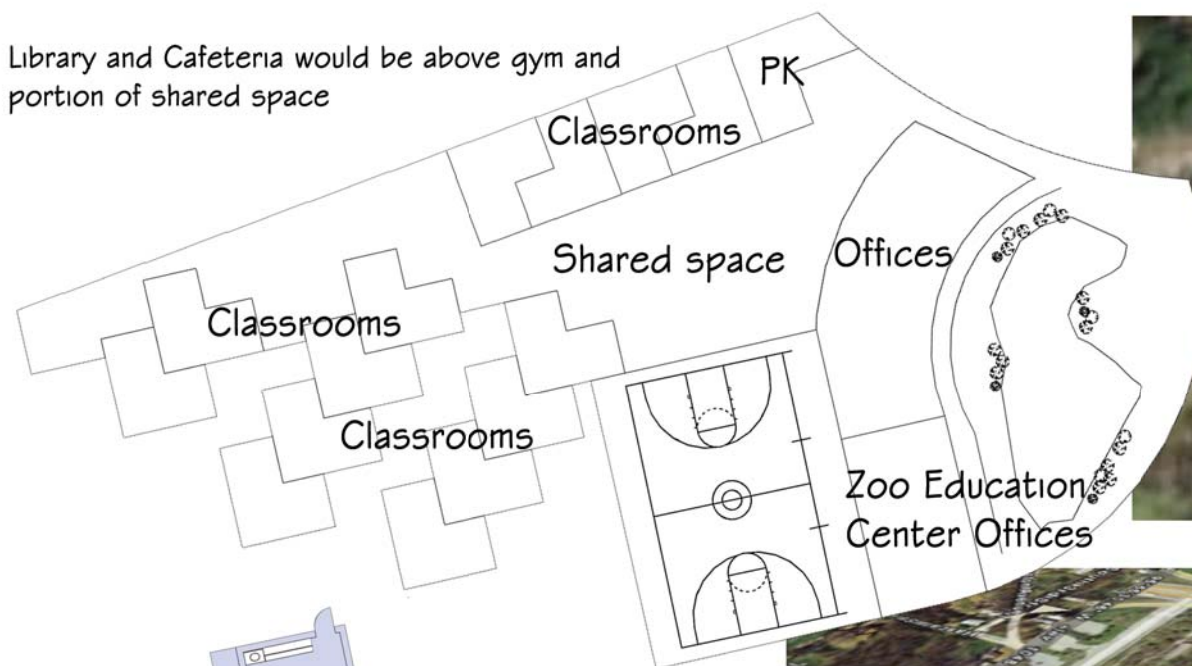
Design Iteration #5

In my attempt to use animals as my design influence, a wing was the driving force behind this design. The layout is unique and allows for many external views and opportunities for natural lighting. But it is not a very logical or cohesive plan. I do believe there is much potential to improve it, though.



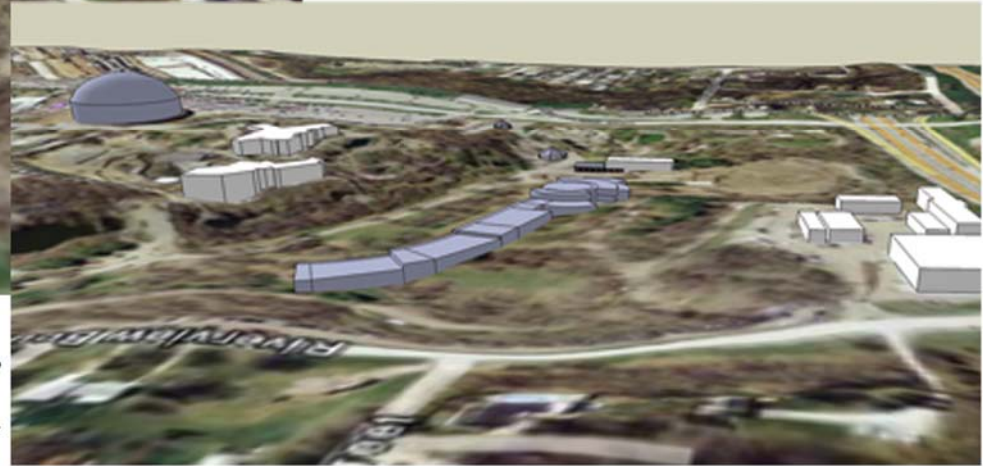
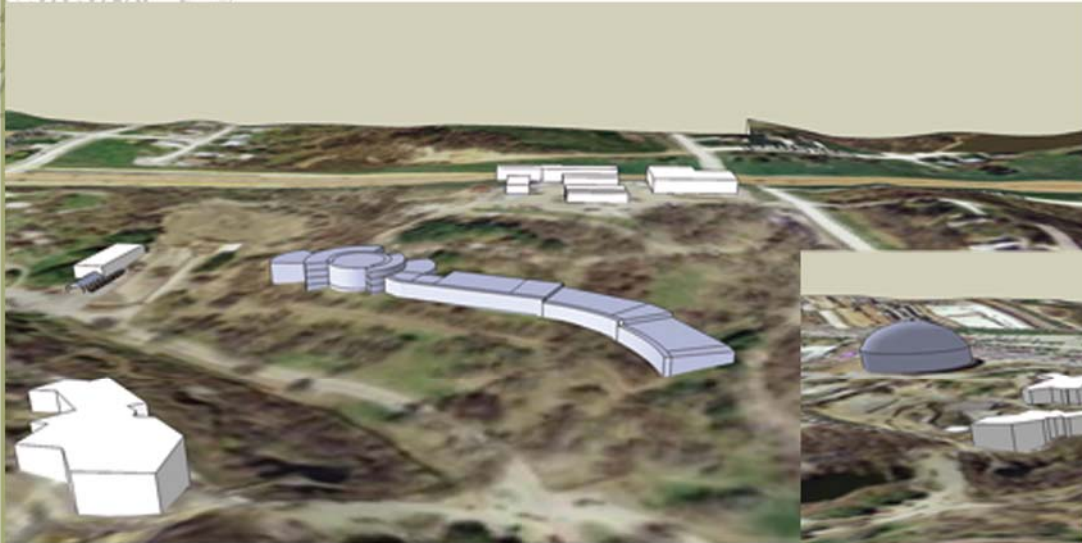
Section through wing

Library and Cafeteria would be above gym and portion of shared space

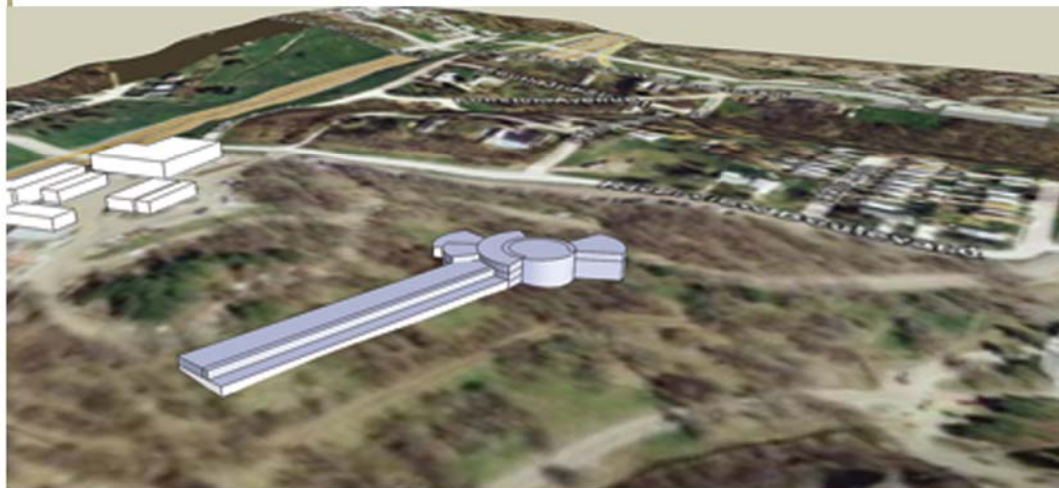


Additional Design Iterations

These two pages are extra schemes I explored but did not define as in depth as the ones on the previous pages.



The images above and to the right are of the same iteration from two different angles. I liked this rendition because the classroom pods stepped down in response to the site contours. I liked the gentle curve of the building and felt this had great potential for further exploration. In general, it is very similar to the first design iteration and the two could easily be combined.

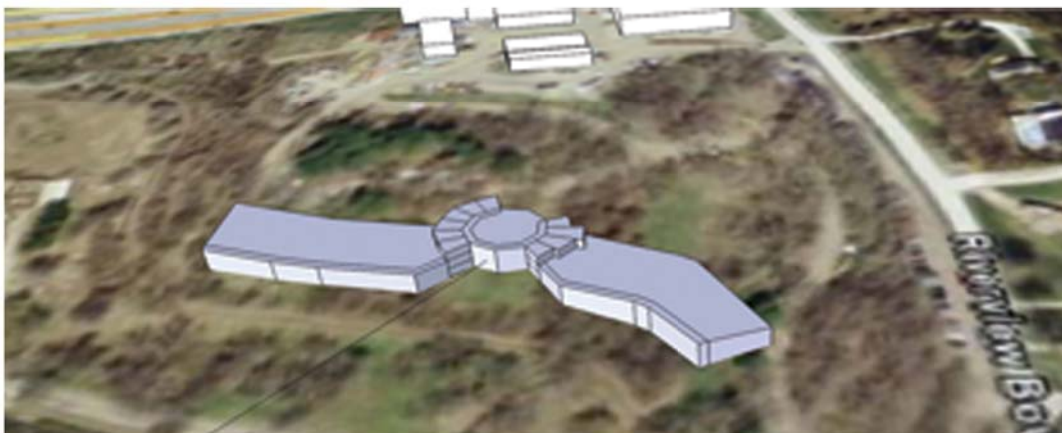
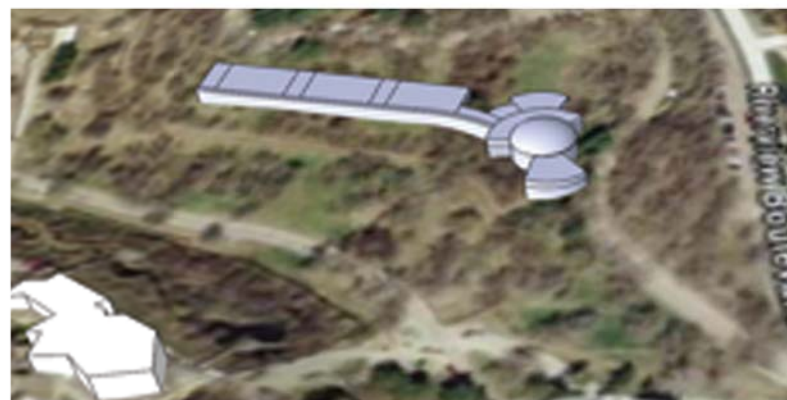


The iteration to the left is a revision of the round iteration with the classrooms removed and placed in a long, narrow strip. Having the animal holding units below the classrooms would allow a potential outdoor space on the roof. This space could be a roof garden and experimentation area.



Another rendition with a square habitat. I actually like this habitat design better than my other square habitats. The classroom areas do not seem logical or equitable. the design does not seem to work well with the site. the "roof on top of a roof" offers great potential for a roof garden or other outdoor learning space.

The design to the right is a variation of the long, narrow strip of classrooms, but in this iteration, the entire classroom house is placed along the strip. This one seems to fit better with the site, but it seems too separated and different from the rest of the building. The design does not seem cohesive.



Reminiscent of a fan blade, this design was an attempt to get away from a rectilinear layout. It is too wide (not much natural light getting into the inner portions of the building) and it is illogical. Of all of my designs, I like this one the least.



Design Thesis Committee Members:

Jim Dyck of The Architecture Practice
 Jim Berg of BVH
 Mark Hoistad, Asst. Dean, College of Architecture
 Patricia Morgado, Professor, College of Architecture
 Lindsey Ellsworth, Instructor, College of Architecture
 Guy Trainin, Professor, College of Education
 Keith Sawyers, Professor Emeritus, College of Architecture
 Nate Krug, Professor and Mentor, College of Architecture

Comments included

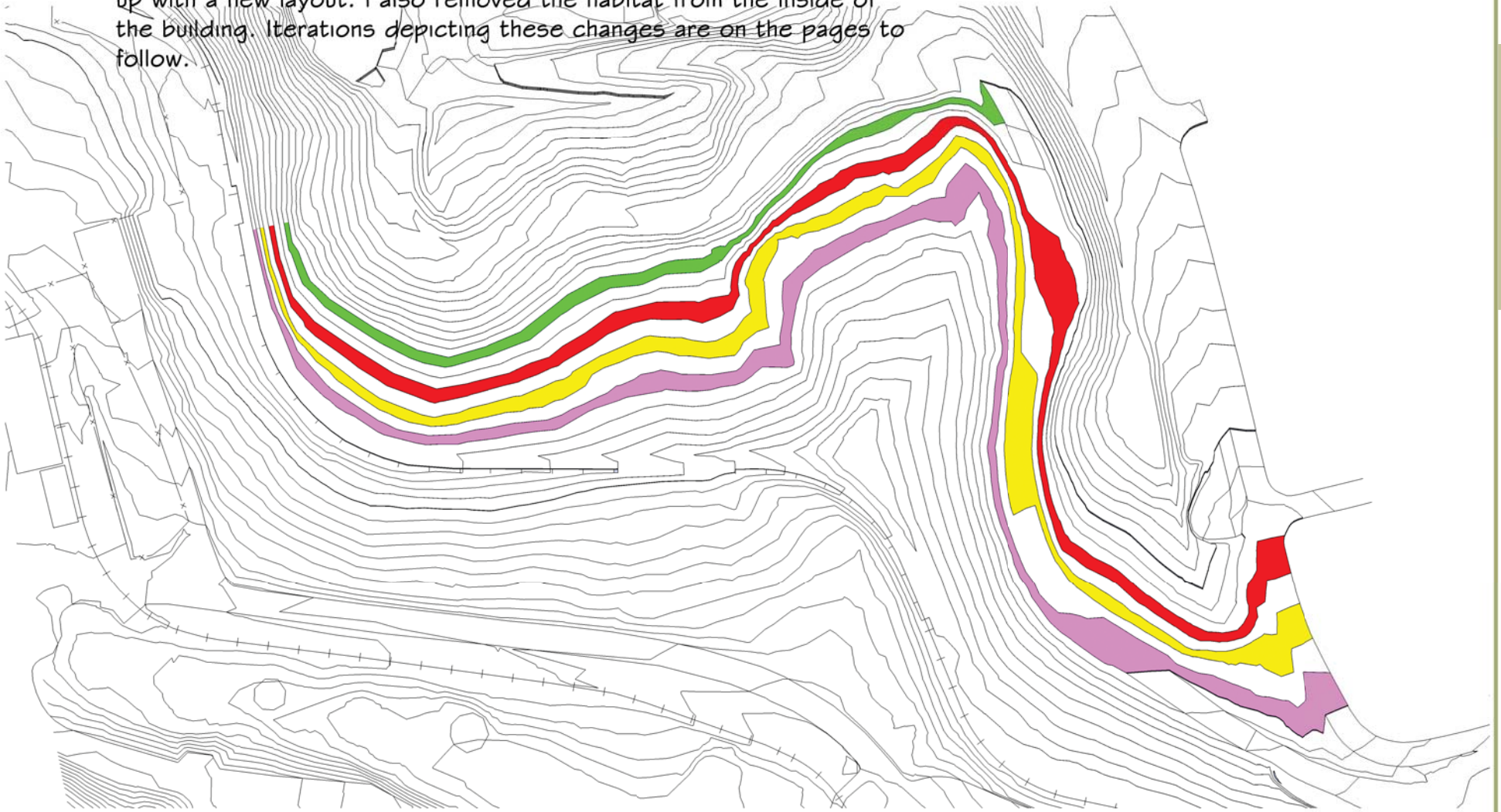
- habitat is "too literal" and should be taken out of the building
- a round habitat is too self-enclosed and cut off from the zoo (round embraces itself)
- use the site more...sink the building into the hill rather than having it sit on top of it.
- don't use the railroad tracks (for the zoo train) as the guiding line your layout should follow - use the site contours
- separate "houses" for classroom pods makes them too independent - make cross grade groupings more enticing
- think about how to incorporate the outdoors in the design
- capitalize on the southern exposure - take advantage of the natural lighting opportunities

General consensus was that Design iteration #1 was the best and had the most potential for further development.

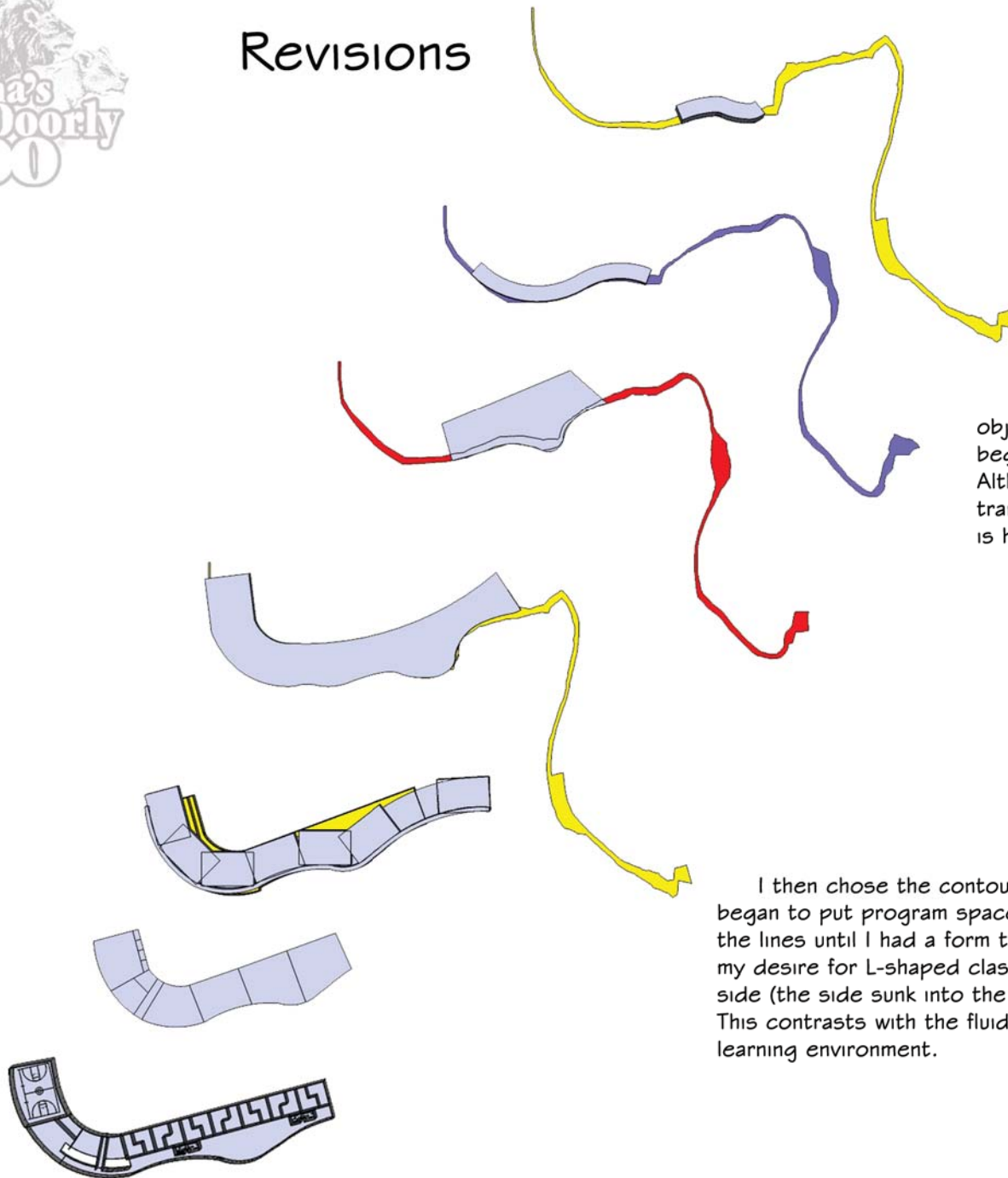
Positive comment was that the vast volume of work I presented allowed for much discussion and most advice.

Conceptual Design Process

In response to the comments made at the mid-semester review, and by suggestion of my mentor, Nate Krug, I decided to use the site contours to guide the form of my building. I identified several different contour lines to direct the new design and eventually came up with a new layout. I also removed the habitat from the inside of the building. Iterations depicting these changes are on the pages to follow.



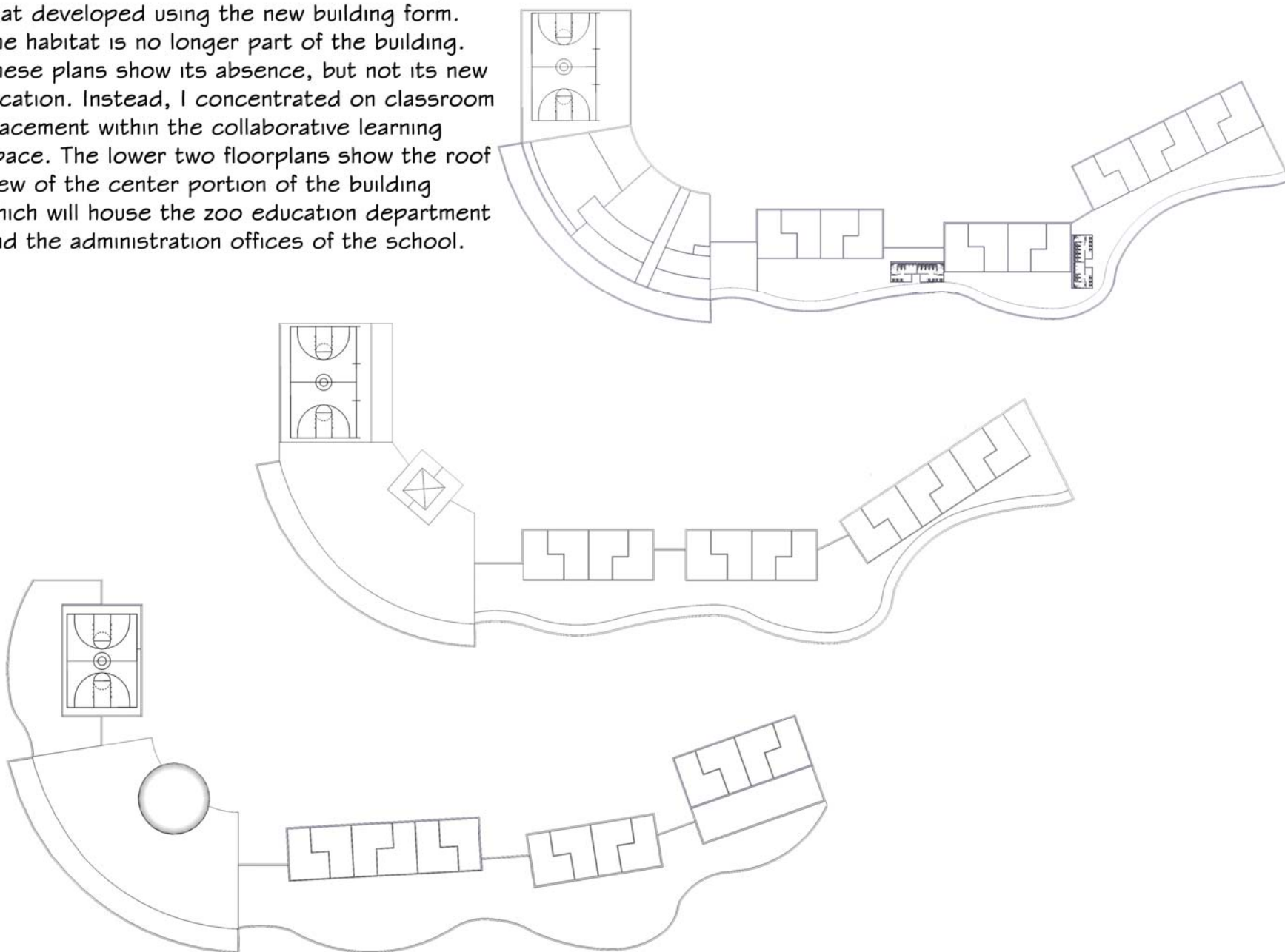
Revisions



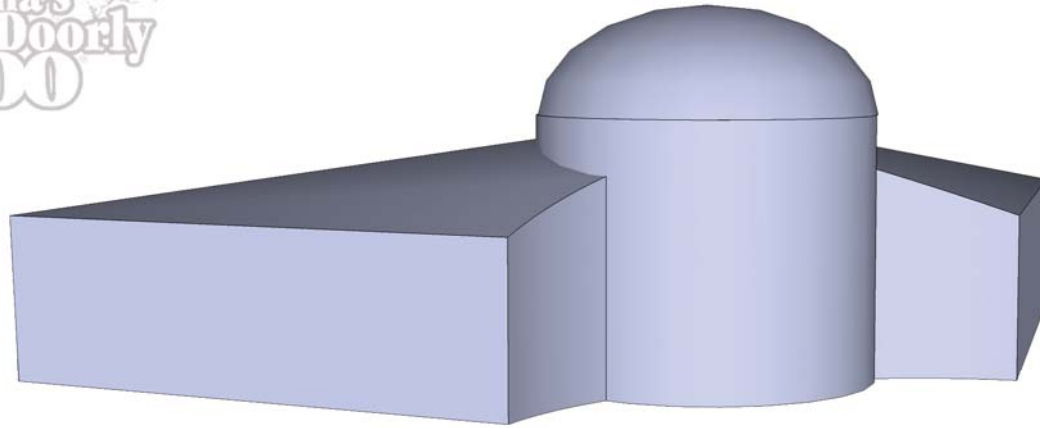
I created several different massing objects on the various contour lines to begin to inform my new building shape. Although contour lines are somewhat arbitrary and malleable, using one as a guideline is helpful when trying to make a change.

I then chose the contour line that best suited my needs and began to put program spaces within. I continued to manipulate the lines until I had a form that seemed to work. Still very tied to my desire for L-shaped classrooms, I decided to make the north side (the side sunk into the hill) a linear form for classroom space. This contrasts with the fluid, serpentine space of the shared learning environment.

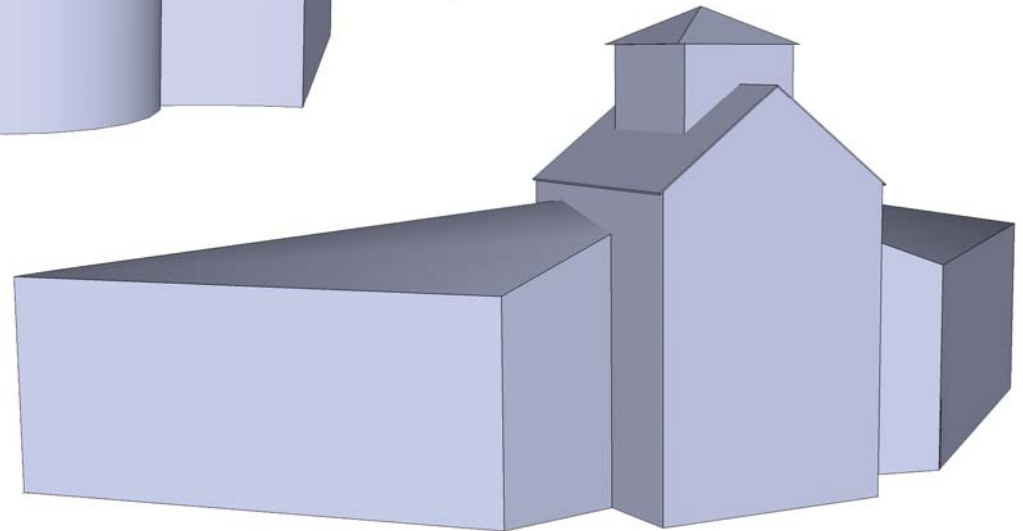
These are some variations of the floorplans that developed using the new building form. The habitat is no longer part of the building. These plans show its absence, but not its new location. Instead, I concentrated on classroom placement within the collaborative learning space. The lower two floorplans show the roof view of the center portion of the building which will house the zoo education department and the administration offices of the school.



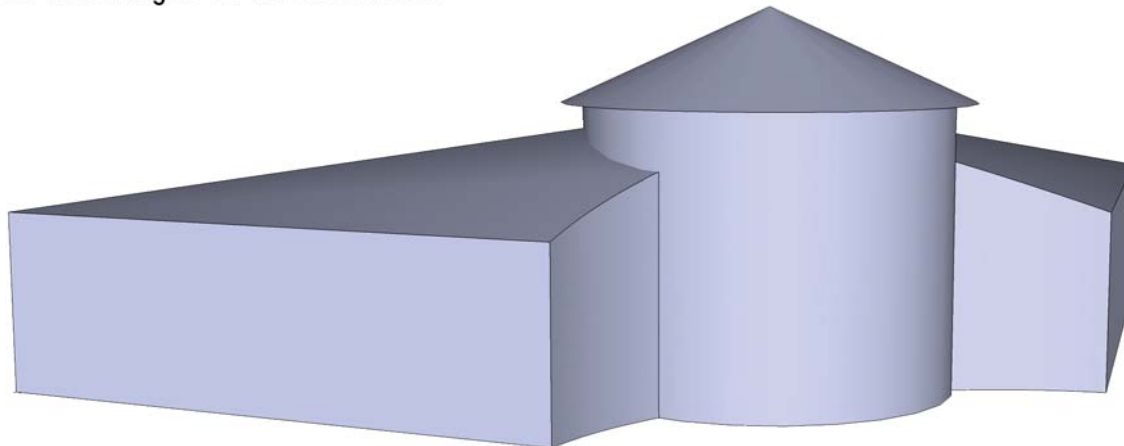
Revisions



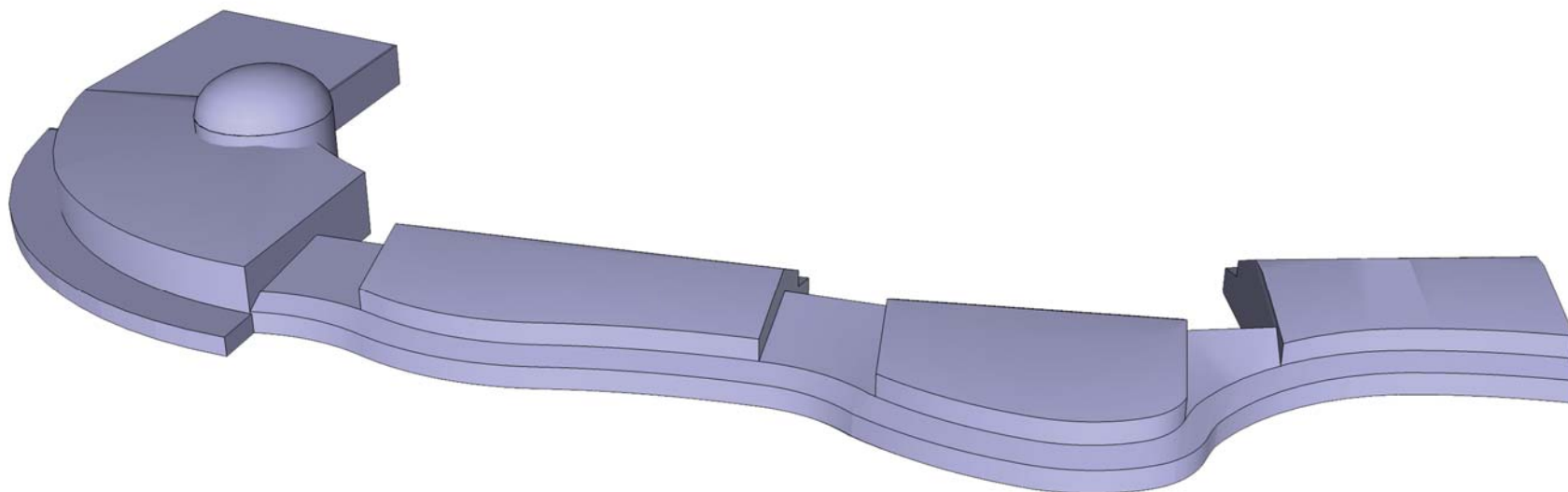
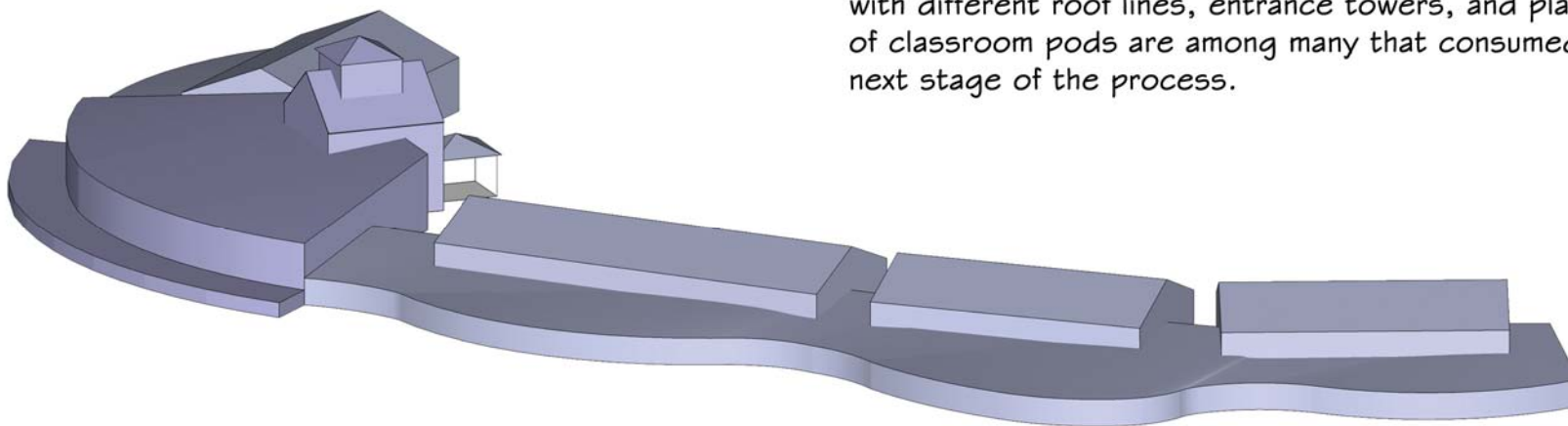
Once I took the habitat out of the building, the center portion seemed to lose its identity. Therefore, to bring some grandeur back to the entrance, I decided to make a tall entry and lobby area. These are three iterations of how to express this entry.



Because at this stage I was using Nebraska farm architecture to inform the roof lines of the building, the entrance needed to also reflect rural design. I chose to experiment with silo, grain elevator and grain bin roof designs. I also, due to my intense desire to include a habitat within the building, decided to incorporate a "mini" garden with trees, plants, and a few small animal exhibits in this entry. This decision justified the height of the entrance.



These two iterations of the whole building (exterior) with different roof lines, entrance towers, and placement of classroom pods are among many that consumed the next stage of the process.



The end of semester review was a “silent” critique in which no verbal presentation was allowed. The facing page contains my presentation boards. In addition to highlighting the research I gathered, the following items were included on my boards in an attempt to best present my work of the first semester.

Research Questions:

1. How do children learn?
How can architecture enhance these processes?
How do students spend their time in school?
2. How do location and curriculum affect learning?
What unique features can distinguish non-traditional educational opportunities?
3. How does a school building influence learning?
What are the positive and negative effects of different building designs?
What is the optimal classroom design and layout?
4. How are school architects incorporating design to impact learning?
How can theory be translated to design?



How do children learn?

How do students spend their time in school?
How can architecture enhance these processes?

How students spend their time in school...

- 91.2% of class time in their seats listening to a teacher or working alone
- 7% working in small groups (which foster social skills and critical thinking)
- 62% of instructional time was in literacy or math
- 24% was devoted to social studies or science

Throughout the day...

- 11% talking
- 2% walking around purposelessly (3% walking with purpose)
- 4% teaching others
- 3% waiting

USA Today

- providing a variety of flexible spaces
 - personalized learning
 - project-based learning
 - distance learning
 - group learning
 - creating a visually rich, fun, and surprising environment
 - appropriate colors
 - daylighting
 - healthy building materials
- allow teachers and students to gather in a variety of configurations
- affect students' and teachers' mood, behavior, and productivity

Mission Statement:

To design an educational facility at the zoo that positively impacts the educational process.

- ◆promotes curiosity, wonder, and imagination
- ◆acts as teaching tool
- ◆symbolizes conservation and preservation
- ◆celebrates human, animal, and plant life
- ◆supports educational research and best practices



Optimal child-sized and child-appropriate materials (Source: University, West House, NY)



Exposed structural, mechanical, and other building systems to teach durability and offer opportunities for traveler exploration (Source: School of Science and Technology, Seoul, 200)



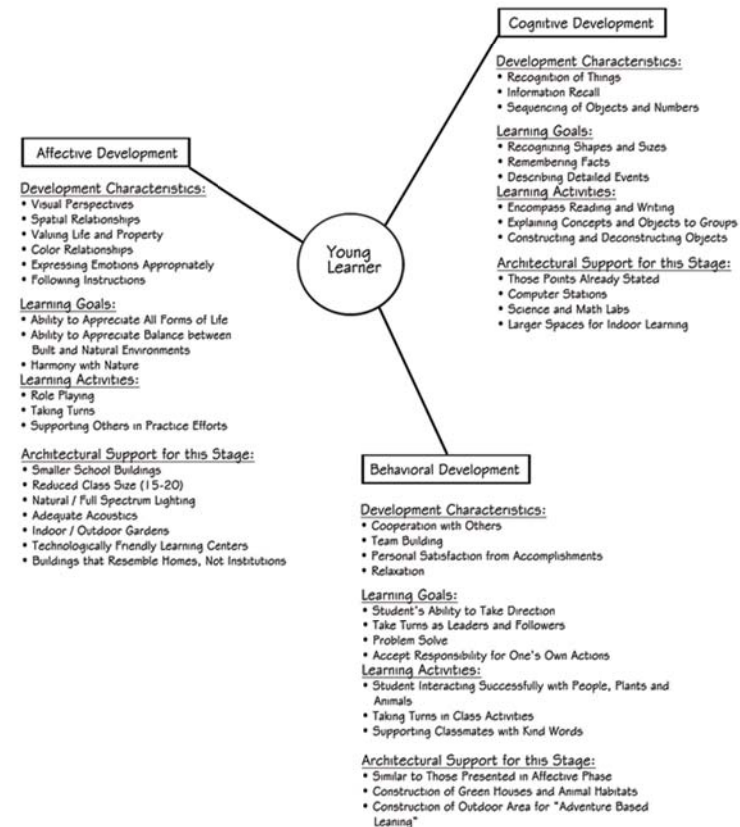
Green roof and other energy-efficient, environmentally-conscious features (Source: NY, NY)



Inclusion of nature in design and application (Source: University, Seoul, 200)



Appropriate space and configuration, lighting, acoustics, etc., for learning activities to occur (Source: University, Seoul, 200)

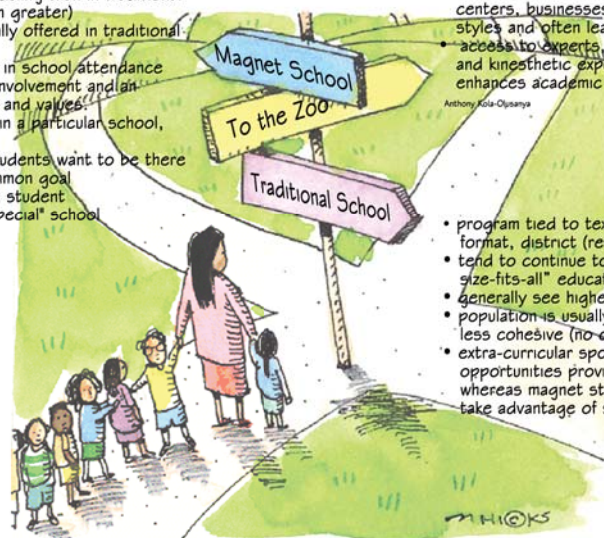


How do location and curriculum affect learning?

What unique features can distinguish non-traditional educational opportunities?

- programs are based on the premise that children do not learn in the same ways
- 55% are in elementary schools.
- generally employ higher levels of innovation in such areas as instruction, governance, parental involvement, assessment, grouping, and scheduling than in traditional public schools (student satisfaction greater)
- a specialty curriculum not generally offered in traditional schools.
- parents and students have a say in school attendance
- a strong commitment to parent involvement and an effort to mold student attitudes and values.
- because a choice is made to be in a particular school, there is usually less conflict
- improved attendance because students want to be there
- a sense of working toward a common goal
- increased self-esteem because a student feels "special" for attending a "special" school

Deer County, Georgia Schools

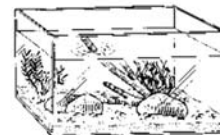


- creates a valuable new community asset that reaches beyond the traditional function of a public school
- by combining uses, costs are shared, facility investments are maximized, and community needs are better met
- educational activities at zoos (and museums, nature centers, businesses, etc.) support diversity in learning styles and often leads to life-long science learning
- access to experts, opportunities for visual, auditory, and kinesthetic experiences, and self-directed learning enhances academic achievement

Anthony Kola-Ojisanja

- program tied to textbook content and testing format, district (response to No Child Left Behind)
- tend to continue to employ "factory-style, one-size-fits-all" education
- generally see higher teacher/student ratio
- population is usually larger, more diverse, and less cohesive (no common bonds)
- extra-curricular sports, arts, and social opportunities provided within school building whereas magnet students may have to travel to take advantage of such offerings

Distinguishable Features:



- Plants and animals in the building
- provide space for displays of plants and animals
- must allow for optimal viewing yet ease of access for care and cleaning



- Take care of plants and animals in building
- display heights at child working level or steps in place
- safe materials that can withstand less students with immature agility and coordination



- Go on a field trip to the zoo every day
- numerous and conveniently located exits for frequent outdoor activities
- provide measure of security and safety (key cards, door scanners, etc.)



- Work on projects with students from other classes and grade levels
- design spaces large enough to support groups of varying sizes
- include cabinetry/storage, resources, and work surfaces

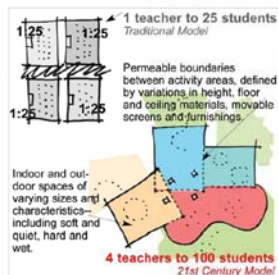
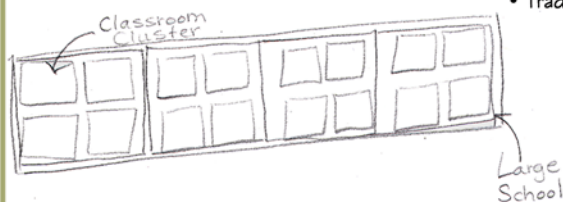
How does a school building influence learning?

What are the positive and negative effects of different educational facility designs?

What is the optimal classroom design and layout?

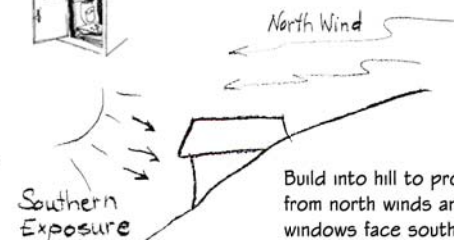
- School facilities affect learning. Inappropriate spatial configurations, distracting noise, thermal discomfort (too cold or too hot), light, and poor air quality and inadequate ventilation negatively impact students' and teachers' ability to perform
- Large school size has created alienation, is tied to increase absenteeism and higher drop-out rates, and lower test scores. The effects seems to be the strongest with students from lower socioeconomic groups.
- Large class size is not a clearly negative impact on learning, but how a school addresses this issue has far reaching effects since smaller classes require more classrooms or more schools.

- Traditional classrooms (virtual classrooms?) are being re-examined



- A more open-space plan for learning can lead students to feel exposed and insecure. Students need to have a sense of belonging and a place to "claim" - some individual space in addition to group and community space.

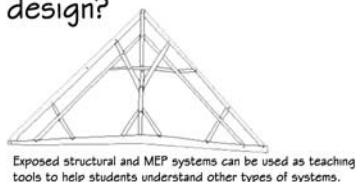
- Provide lockers, cubbies, or cubicles for students to personalize and make their own



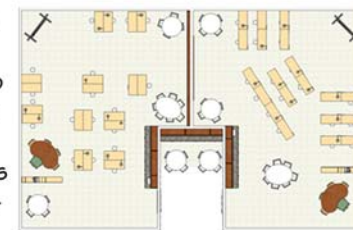
Build into hill to protect from north winds and have windows face south to harvest daylighting and benefit from heat gain

How are school architects incorporating design to impact learning?

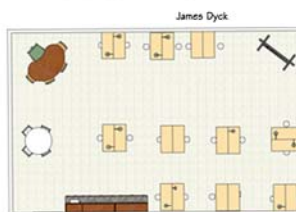
How can theory be translated to design?



The L-shaped classroom is the shape that best suits the modern, technological classroom of today. It provides a sense of separation, eases the perception of crowding, and offers a variety of grouping configurations. As long as there are no permanent barriers, the L-shaped classroom can be reorganized easily to accommodate various teaching and learning styles and activities. Providing five interior corners (which by their nature create "environment"), this classroom design offers the greatest advantages to educational processes. Having a perception of greater distance than there actually is, student off-task talking and distractions are lessened. Opportunities for small group, whole group and individual instruction are available with little to no reconfiguration needed. This design also lends itself very easily to the current trend to create collaborative learning spaces outside the classroom walls.



Two L-shaped classrooms and shared learning space between



The rectangular-shaped classroom lacks of space additional learning opportunities

Rectangular-shaped rooms allow the teacher good visual supervision. It is well suited to a teaching style of lecture and whole group instruction. Research has shown, though, that there is not an equitable visual and auditory accommodations for all students. The larger the distance between the eye and board, the less the legibility, and at a certain distance, the board loses its effectiveness. Lettering on the board is distorted negatively impacting beginning readers and writers.

	Instructor	
57%	61%	57%
37%	54%	37%
41%	51%	41%
31%	48%	31%

Percentage of participation in a rectangular classroom dependent upon location of desk in relation to central location of instructor

Classroom Configurations

An important component of this school design is the classroom configuration. A balance between dedicated classroom space and an open area for collaborative learning is the current instructional trend. Allowances for adequate supervision, opportunities for multiple groupings, and areas for quiet/secluded versus dynamic/active study are all required considerations for the design of these spaces.

Linear - classrooms placed along corridors

- able to share resources when classrooms are clustered
- convenient access to collaborative learning spaces (allows for optimal peer tutoring opportunities) when classrooms are clustered
- single loaded corridors allow all classrooms to have views to zoo
- double loaded corridors are less equitable (views/day-lighting)
- linear design is less energy efficient (greater perimeter)

Clustered Pods - all grade levels clustered together

- able to share resources
- convenient access to collaborative learning spaces (allows for optimal peer tutoring opportunities)
- compact design is energy efficient
- very center focused (secluded from zoo and rest of school)
- inequitable views and daylighting opportunities

The self-contained classroom is no longer a viable paradigm for 21st-century learning. Schools today must provide a variety of settings in order to successfully facilitate learning in a technological age. Creativity in curriculum, building design, site location, means of community involvement, and scheduling seem to be the required forms of action for school districts. As public discontent leads to dwindling tax dollars allotted for building projects, designers realize that the school districts cannot afford the school building itself to be a mere shell for housing students. It must be a learning tool in and of itself. A few ways in which a building can be an asset to the community and a learning tool for students include

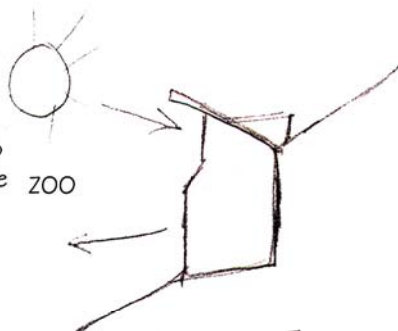
- exposing the ductwork for the heating and ventilating systems, as well as other utilities and the structure of the building so students can learn about systems, structures, angles, and other aspects of science and math that can be compared and transferred to other life applications
- energy-efficient and energy-renewable elements like daylighting, indoor air quality, natural building materials, recycling, rainwater collection and natural vegetation to foster an understanding, appreciation and response to the world
- incorporating visual, auditory, and kinesthetic features that use sensory means to elicit curiosity and wonder, and transfer knowledge
- integrate virtual (technology) and tangible methods of research (sun dials, weather stations, rainwater collection and reuse, etc.)
- taking advantage of non-traditional site locations where other entities share the costs of the facility, act as mentors and experts for the students, and foster a community/school bond

National Summit on school

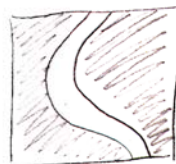


Design Determinants

- orient building toward zoo
- integrate building with site
- harvest daylighting



- interesting yet clear circulation



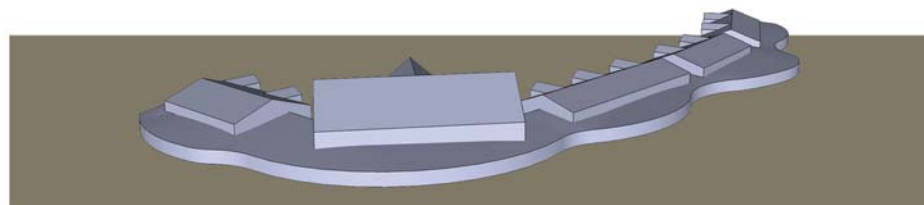
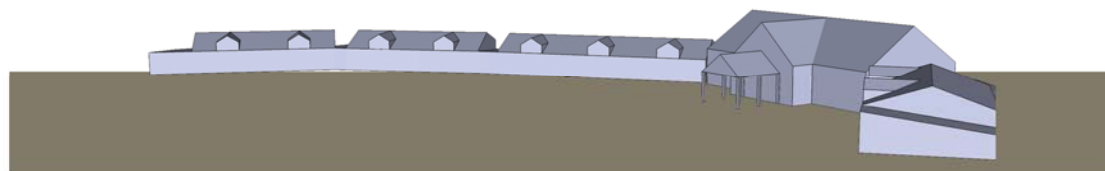
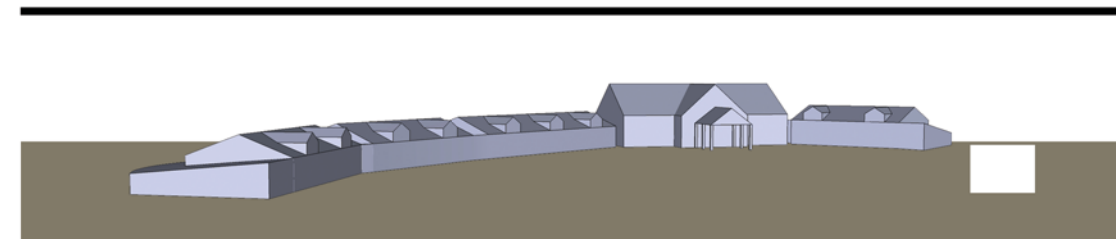
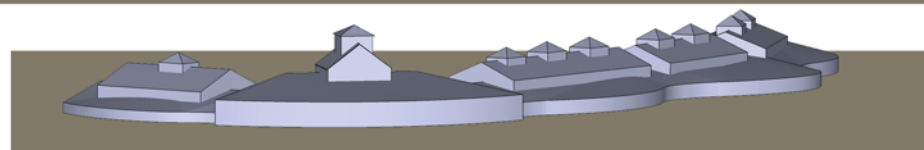
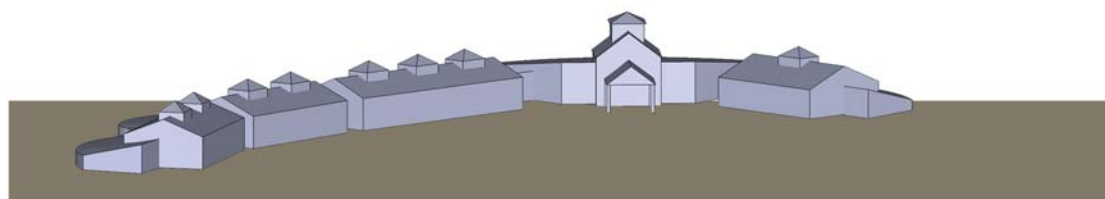
- security and safety of students visitors, and animals



- differentiate school from traditional school buildings

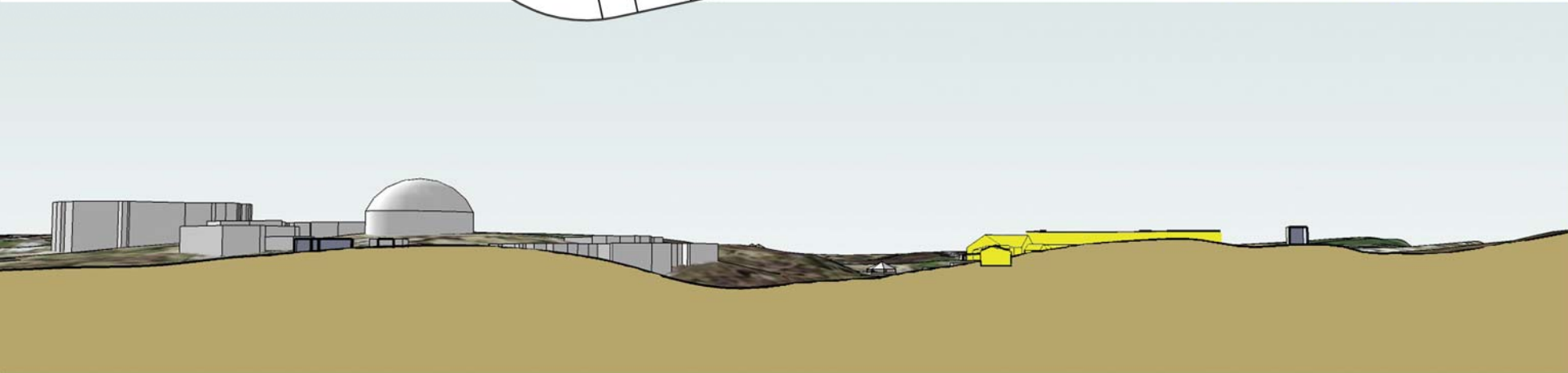
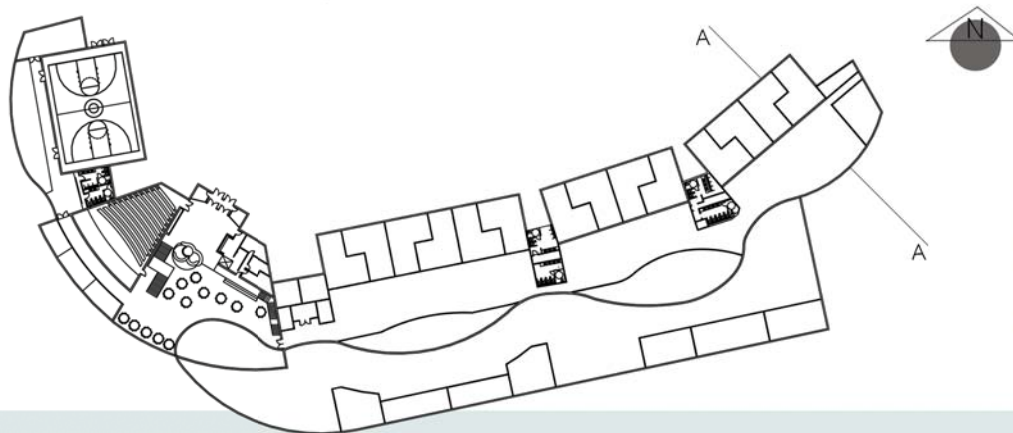


- incorporate architectural features that best enhance the learning process



As seen on the facing page, I presented two iterations for the final review in December. The floorplans were the same, but the two iterations were different by how the (now outdoor) habitat was to be connected to the school. In one design, the habitat was a series of small huts connected with boardwalks. In the other, the habitat was actually an extension of the school in which the shared learning space overlooked the habitat.

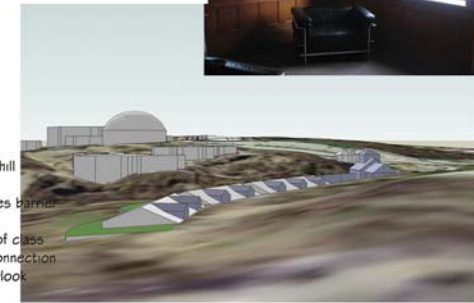
Another variation between the two designs is the entrance/lobby area. One iteration had the grain elevator roofline while the other roof was a simple shed.



Appeal Review for Faculty Consideration

Comments from the silent review revealed concerns about how the architectural design features I proposed were actually related to the research. The committee members also felt the chosen case studies were not varied enough in type and location. They also wanted to see a larger section drawing. In response to the comments, the following images and narratives were added to the presentation boards for the verbal appeal review.

The appeal review was successful with a vote of one less than unanimous granting my continued work on this thesis project.

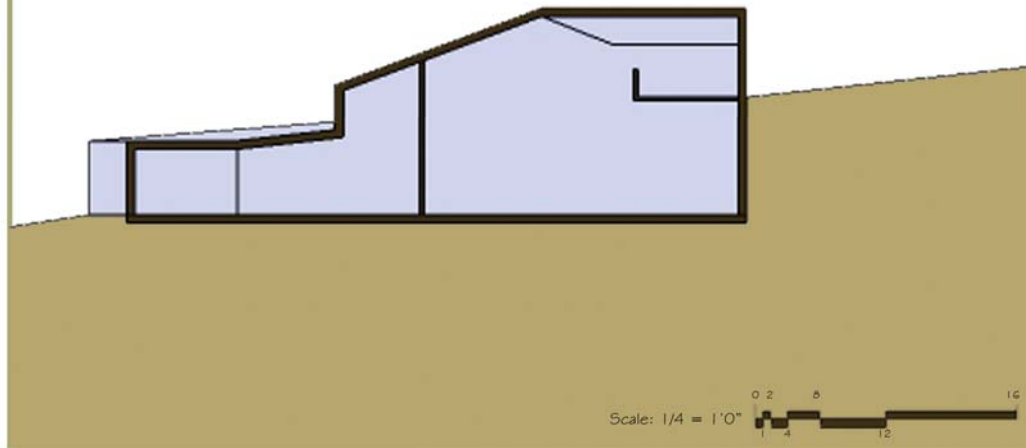


Strengths:

- fluid design relates to hill
- "snuggles" into site
- building follows contours of hill
- interesting form
- habitat out of building creates barrier between school and public
- habitat in within in sightline of class
- room pods creates visual connection
- science labs and library overlook habitat
- waterfall in lobby brings nature inside

Weaknesses:

- need more space for program
- lots of steps
- need to get light in interior rooms
- lack of cohesiveness
- students do not travel through habitat
- fewer exits limits access to zoo grounds
- little relationship to zoo
- need to bring more nature inside building



Additional Research Findings

The impact of moving from the industrial age through the technology age to the knowledge age spanned the boundaries of work, family, and community. The skills needed to effectively fulfill the roles and responsibilities in the three areas were far different than those needed for the industrial age. The last two decades of the 20th century saw youths and adults: (a) working and living within systems of different cultures; (b) actively participating in the global economy; (c) contributing new thinking to work, family, and community by engaging in team work creating new products and solving problems; and (d) managing their own lifelong learning. To fulfill the roles and responsibilities, youths and adults sought more active, relevant opportunities to learn the skills required to actively participate and make contributions to their work, to their families, and to their communities. The new roles, responsibilities, and expectations of the learners indicate changing learning processes.

Changing Learning Processes. Dede (1993) described the changing learning processes that were needed to prepare learners for the work place and in society. The different learning processes needed to change from “the more traditional classroom-based, discipline-focused, learning-by-listening approaches” to “just-in-time, life- and work-focused, and learning-while-doing approaches” that were linked to everyday situations (p. 3). The changing learning expectations needed for transformation in work, family, and community roles and responsibilities required new, more active learning processes. According to Skolnikoff (1994), educational institutions needed to provide programs in which learners learned to think and became participants in the larger world.

Collaborative, project-based learning teaches many of the above skills through the active process of designing, developing, and producing products in the forms of information, service, or goods. This learning process occurs through grouping learners into various sized groups depending upon what learning activity is taking place. Direct and guided instruction is often presented to larger groups of learners by a faculty member or teaching team. Exploration and discovery can occur with or without a faculty member and can happen individually, in small groups and teams, or within larger groups. Project work more often happens in teams and includes community and business members as resource people and advisors for the projects.

Structural Aspects

- Flexible spaces
- Spaces with visible infrastructure
- Adaptable space
- Layered spaces
- Space with durable building materials and finishes
- Space with core or fixed elements

Functional Spaces

- Focus lab spaces
- Classroom spaces
- Presentation spaces
- Practice spaces
- Process galleries, studios & display spaces
- Project space
- Home base
- Informal learning space
- Collaboration incubator

Group Size

- Variable size space
- Individual workspace
- Faculty team spaces



Furnishings

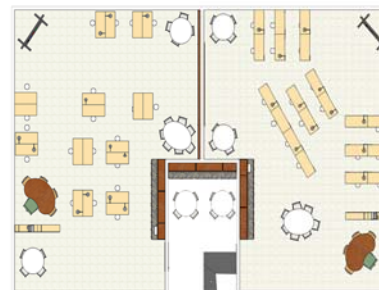
- Spaces with versatile furnishings
- Display spaces
- Space with variable lighting

Psychological/Physiological Support

- Spaces that provide sense of belonging, ownership and pride
- Spaces with access to food and beverage
- “Get away” spaces
- Zoned spaces
- Caves
- Natural light
- Spaces for transportation support

Adjacencies

- Access to community
- Adjacent and nested spaces
- Visibility
- Connections among people and spaces
- Resource, supply and storage spaces
- Space and furnishings technology



In response to comments by the review committee, I examined two additional building types as precedent case studies.

K.C. Deramus Education Pavilion
BNIM, Kansas City, Missouri



- beautiful setting that incorporates nature.
- window design allows daylight harvesting
- exposed structure teaches about design and construction
- space for display
- stone facade (natural materials?)
- great views in back

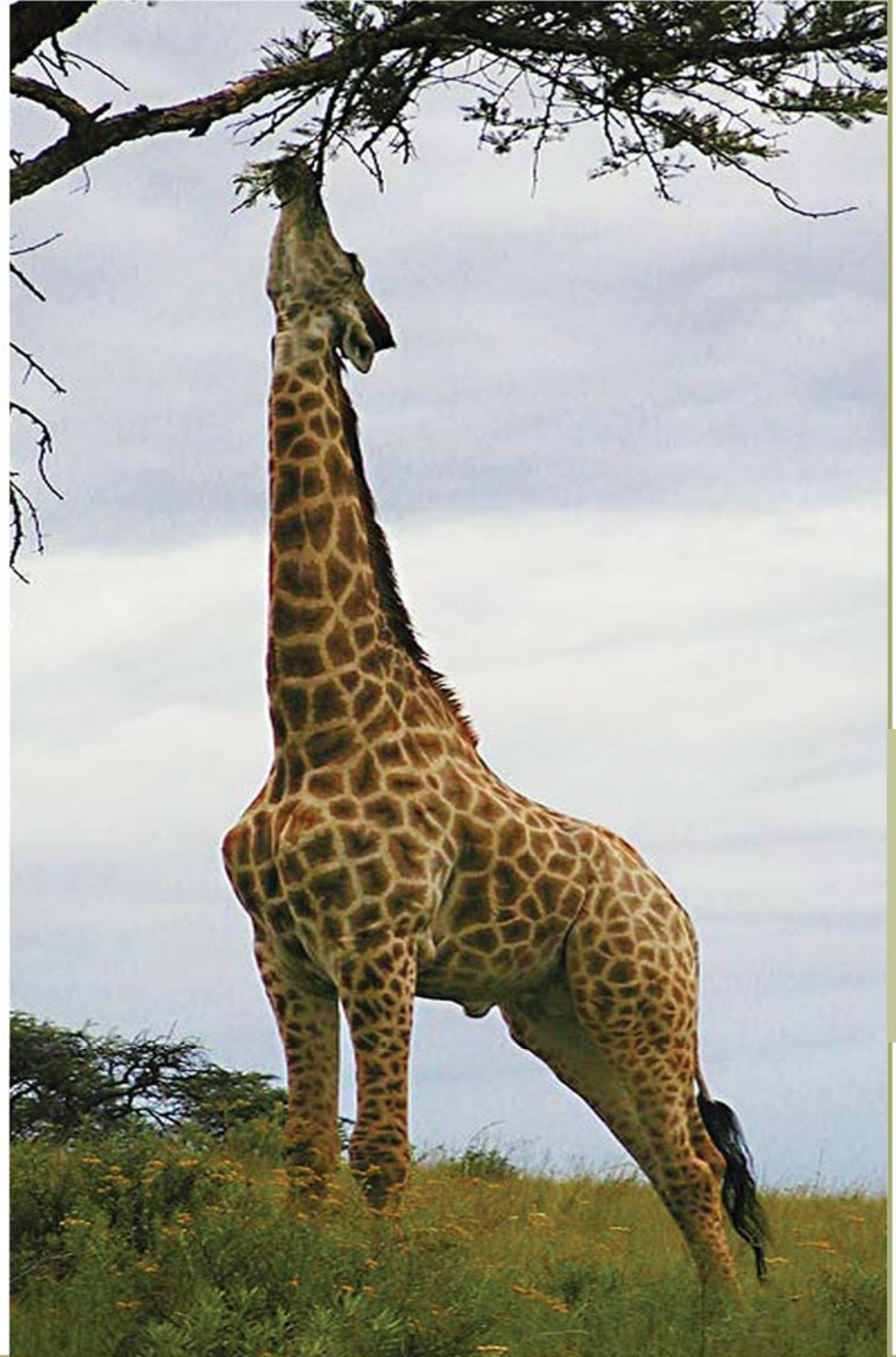
Lincoln's Children's Museum
The Architecture Practice, Lincoln, NE



- except for staff offices, meeting rooms, and restrooms, no fixed walls
- exposed structure (although masqueraded by paint)
- all interior spaces are fabricated displays
- VERY interactive and child centered
- child sized, child appeal
- learning through play
- all "architecture" seems to be on exterior
- all applied design



Final Design



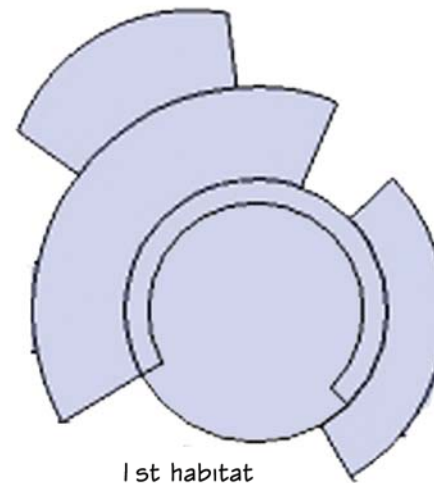


SCHOOL AT THE ZOO:

Final Design

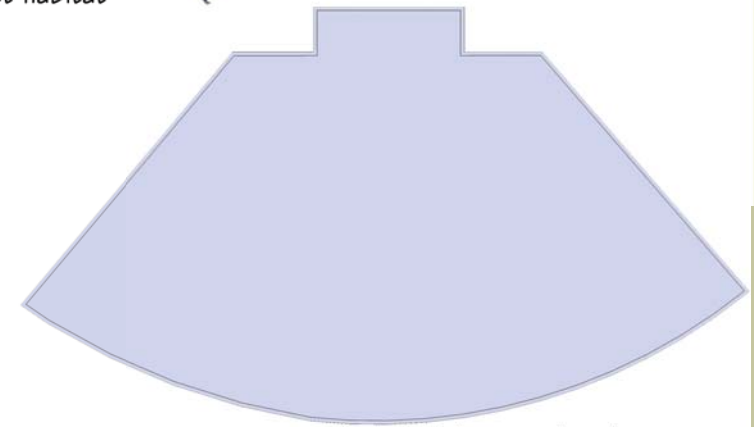
After semester break, I decided to re-evaluate my design and revisit the original intentions I had back when I wrote my proposal the Spring of 2007. Concerning the school, my goals were to positively impact education through architecture. To do this, it was imperative that I incorporate the design features I identified during my research even if the recommendations from my review committee did not support them. It was also very important to me that this building *feel* differently to the students and visitors. I did not want a traditional school building. I did want an indoor habitat, and I did want animal and plant displays inside the building. So I brought the habitat back inside the building - taking into consideration the comments made during last semester's reviews.

Concerning the project as a whole, two goals drove my work: to incorporate my building into the site and to make the building (as a teaching tool) as sustainable as possible. Site work and sustainability were the two areas on which I focused the second semester.



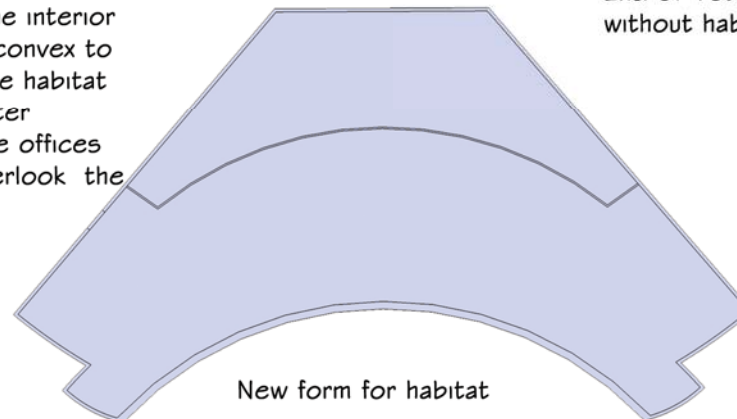
1st habitat

The original habitat was round with classrooms and offices surrounding it. Deemed "too self-enclosed" and "too literal" I removed the habitat from the building and replaced it with a bell-shaped form housing offices and a theater.



End of 1st semester design without habitat

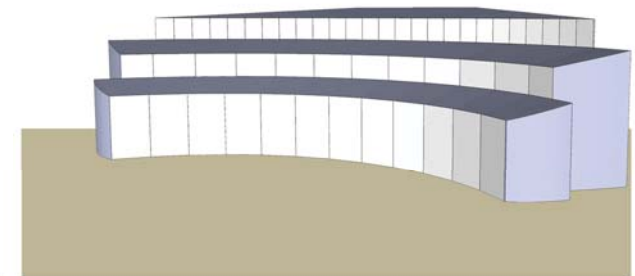
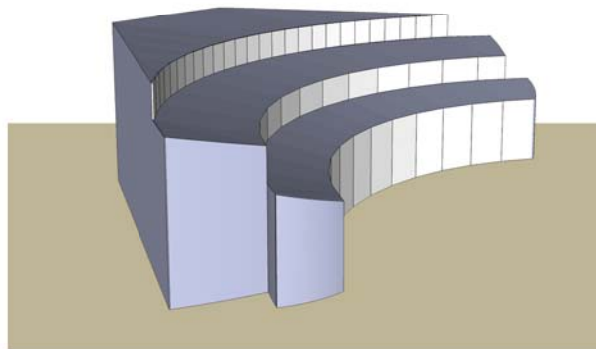
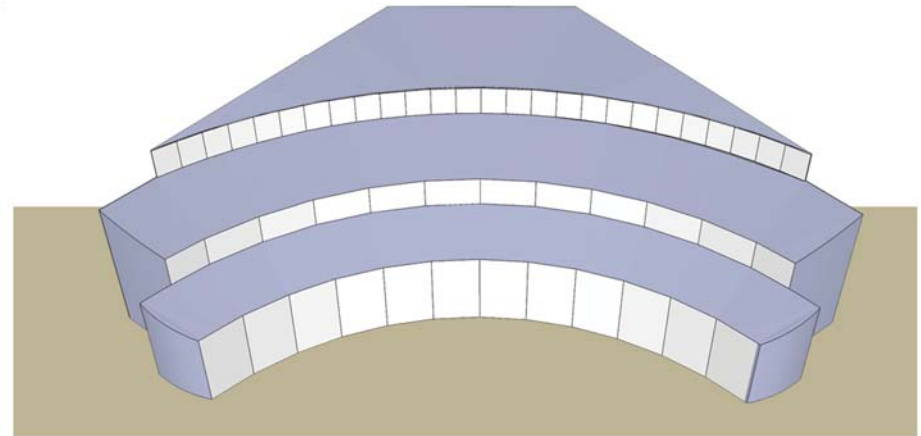
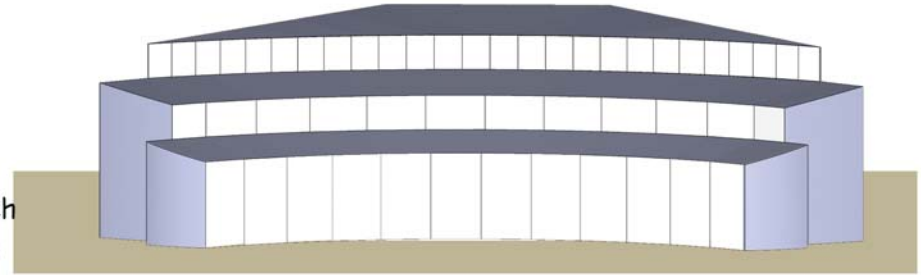
After deciding to return the habitat to the interior of the school, I changed the curve from convex to concave. I hoped that this would keep the habitat from "embracing itself" and create a better connection to the zoo. In this design, the offices and classrooms would still be able to overlook the habitat as they did in the round version.



New form for habitat

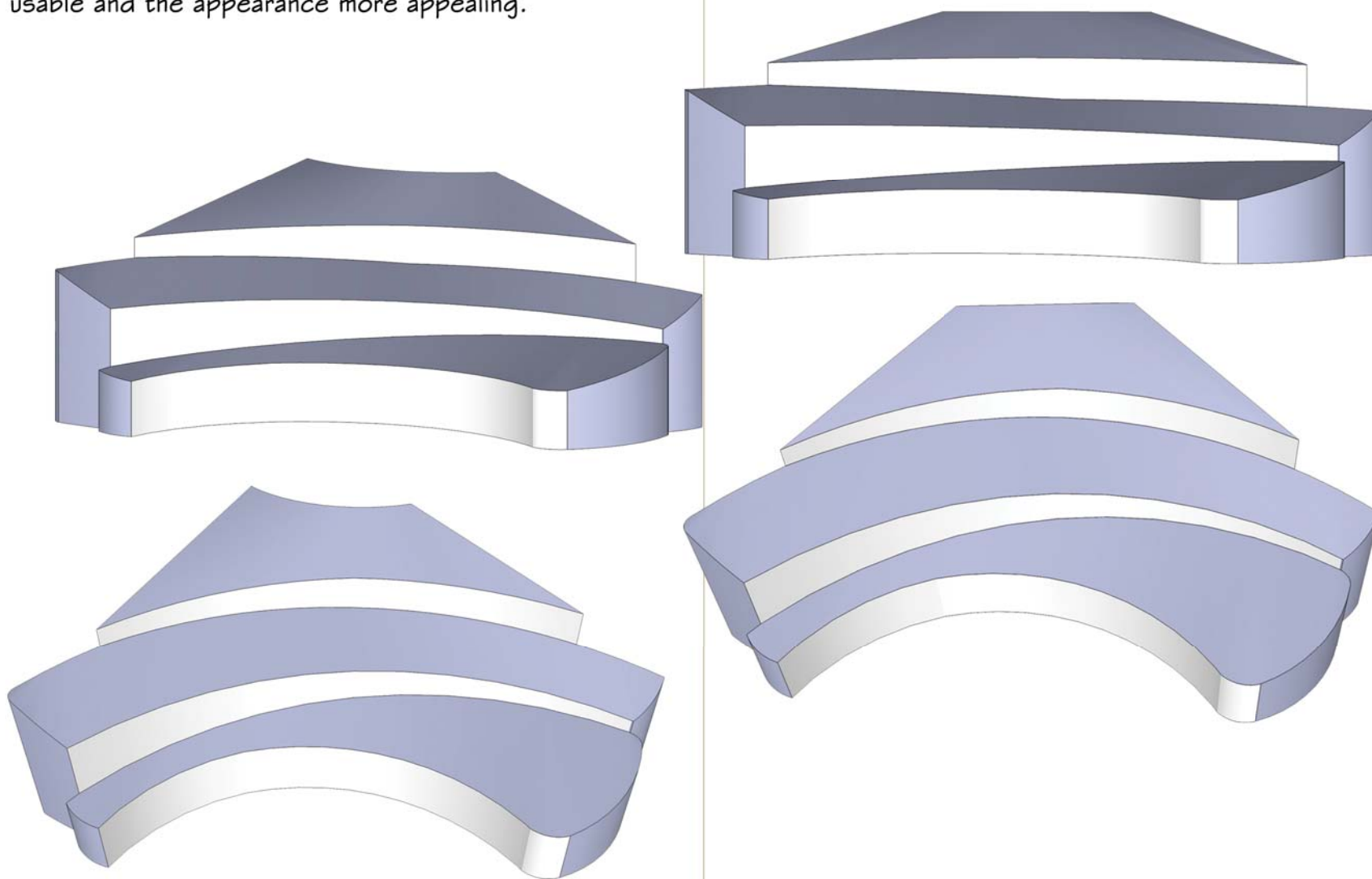
Early changes

The habitat's new form evolved through three design iterations. It started out as a three tiered, uniformly graduating semi-circle. After discussions with a mentor, I was challenged to once again break free of symmetry and uniformity by changing the angles and slope of each tier. The first iteration of this more dynamic design had sharp unusable corners and rounded ends that did not fit well with the other portions of the building. The final iteration of the habitat maintained the sloped and graduating tiers, but the top floor and north end returned to the original rendition and are therefore now more usable.



First iteration of new indoor habitat

In all other ways the same, the final iteration of the new indoor habitat (far right) differed from the more dynamic redesign of the first habitat (facing page) by decreasing the slope and angle of the top roof making the space more usable and the appearance more appealing.



Other Changes

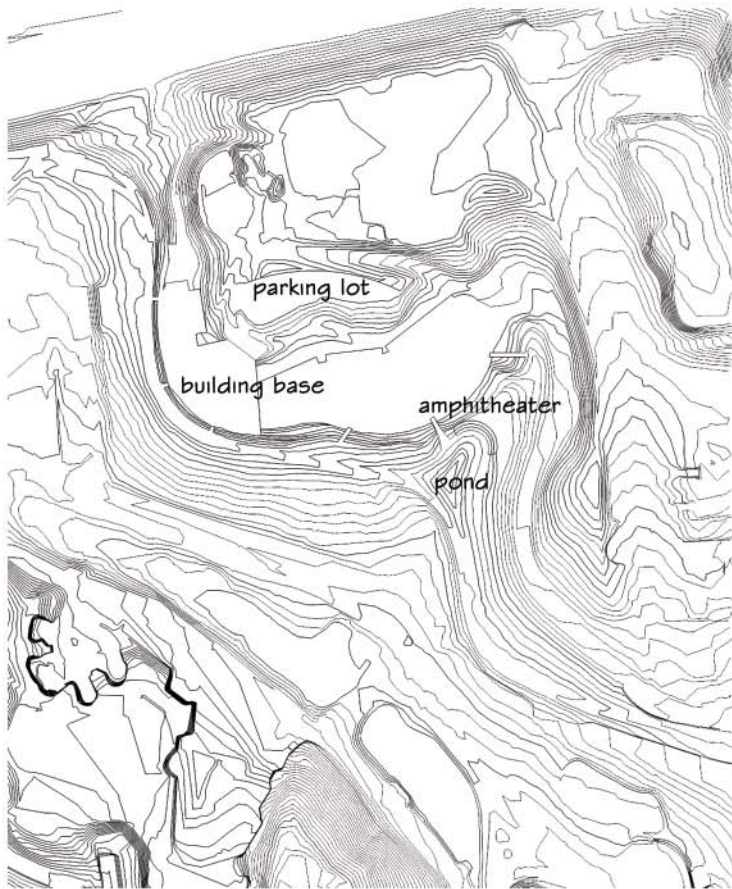
Other changes made from first to second semester were due mostly to site development. I raised the “school” portion of the building to make it level with the 2nd floor, which is the entry level on the north side. By raising this, I eliminated the need for the students to descend stairs to get to their classrooms. I also chose to raise the classrooms two feet above the shared learning space. This was to add height to the classrooms on the outside of the building (for daylighting and visual appeal) without raising the ceiling height of the classrooms. This required placing ramps and stairs within the shared learning space to accommodate the floor level changes. Finally, floorplan changes were made to help delineate learning areas, provide for restrooms and teacher workrooms, and incorporate research-indicated design features.



section through “school”

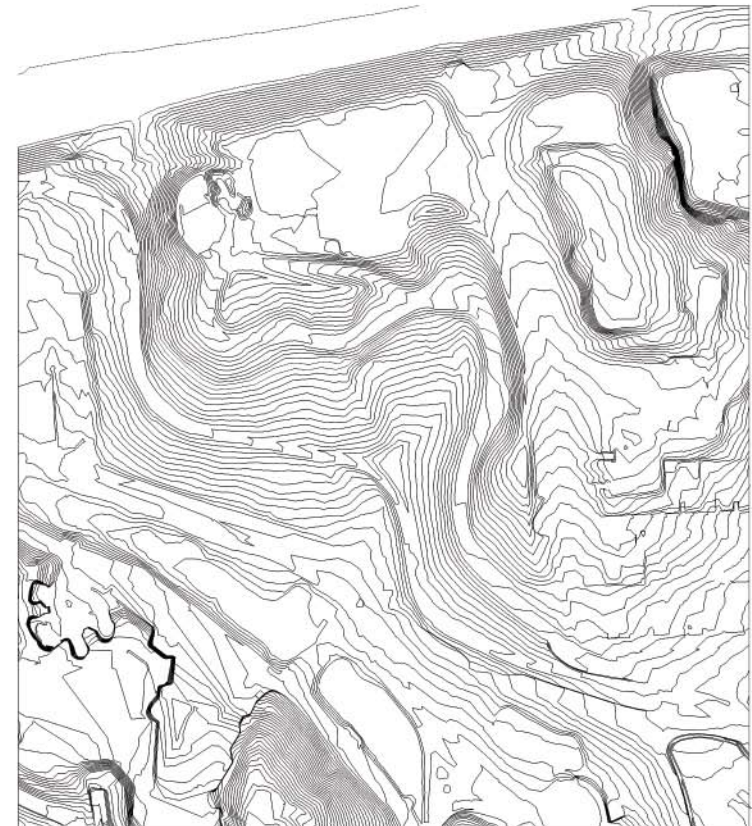
Site Contouring

The contour drawing below shows how the site originally appeared (and still does today). The drawing to the left depicts how the site has been recontoured to suit the requirements of the three parts of the zoo school. This site is very hilly and has uneven terrain. Manipulating the “ground” was difficult and in doing so, I learned much about site design and have a greater appreciation for those who do this on a regular basis.



Four flat areas were developed using retaining walls and by manipulating the contours. One area is the parking lot which has a long curved wall holding back the soil on the north side. Stairs and a ramp lead visitors and staff down from the 30 space car lot. The other flat areas support the foundations of each of the three parts of the building. Stairs again lead visitors and students up or down from the zoo to the building and vice versa.

Another special feature designed into the site is an outdoor “amphitheater” along the pond that allows for outdoor lectures and classes. It can also be used for overnight visits as a campers’ gathering space.



Lee G. Simmons Elementary School

Named after "Doc" Simmons, the director of the Henry Doorly Zoo, this zoo school houses a K-6 elementary magnet school that focuses on science, math, and the environment. The zoo's education department, including the staff, the docents, the animals used in educational programs and their keepers are all located in this building. This is the starting point for all school zoo tours; it is where summer camps, Saturday classes, and special group meetings are held; and it is a place where animal shows, multi-media presentations and guest speakers may be seen.

To accommodate all of these activities, the building was split into three parts: two serve the attending school students (although one is also open to the public), and the other serves students, visitors, zoo employees, and the community. The habitat would be designed by a consulting firm specializing in zoo habitat design, but preferably it would be home to animals that are native to the various prairies around the world (including and at the forefront - Nebraska's).



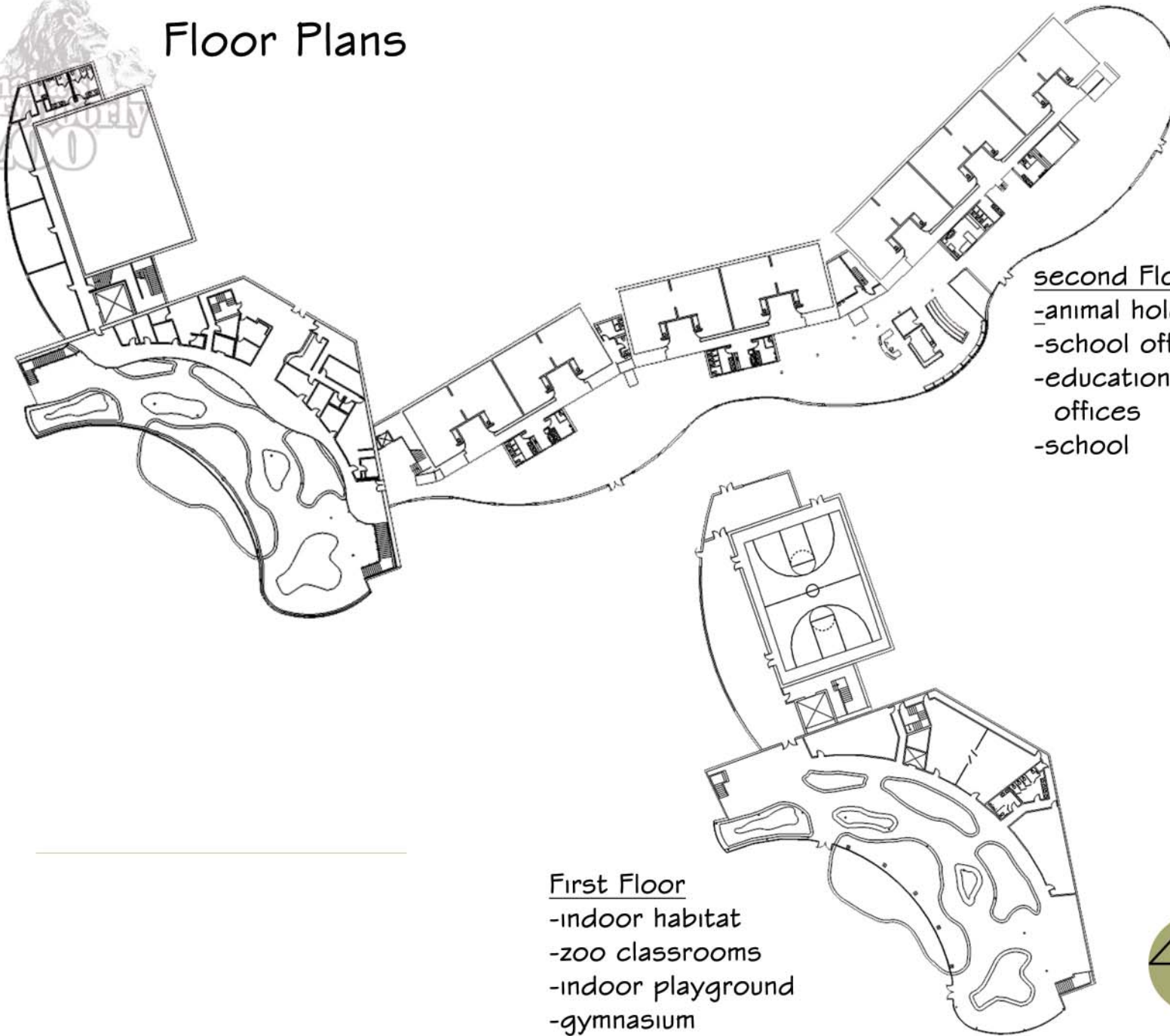


Because the north entrance is not protected from the wind, and in stark contrast to the openness of the the south side, this side of the building has limited windows and doors or other openings through which the cold north winter wind could enter.

The building can be entered from the north or the south. School tours will arrive at the north side of the building and disembark here. They will check in at the front desk and a zoo educator will greet them. Visitors who entered the zoo from the main gate will enter this building from the south side in the habitat, perhaps stopping at the train stop after a ride around the zoo.



Floor Plans



second Floor

- animal holding rooms
- school offices
- education department offices
- school

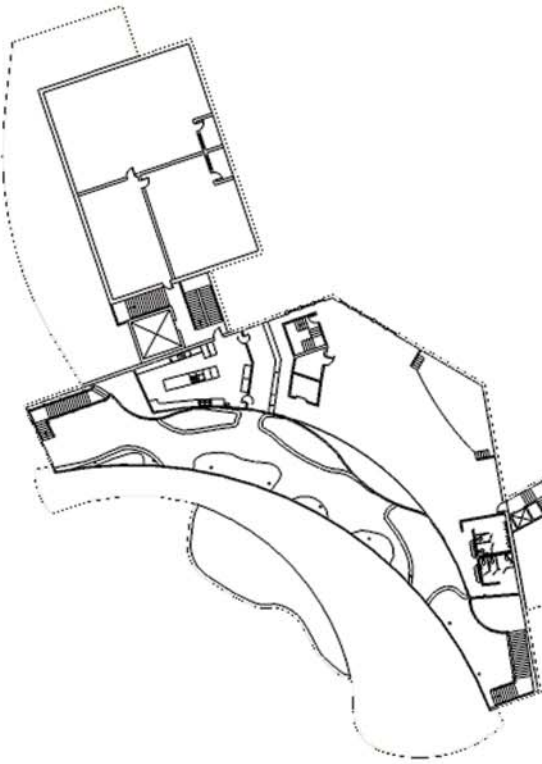
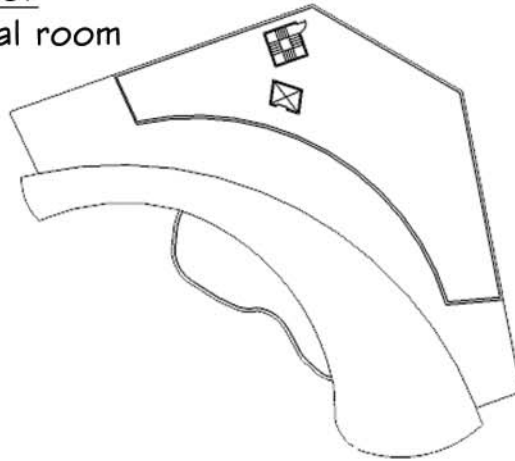
First Floor

- indoor habitat
- zoo classrooms
- indoor playground
- gymnasium



Fourth Floor

- mechanical room
- storage



Third Floor

- art room
- music room
- cafeteria
- roof garden

A Building That Teaches

One of my goals in doing this project was to incorporate architectural features that would positively impact the educational process. Making the building a teaching tool is one way to meet this goal. According to the research stated earlier, having exposed structural and mechanical systems can help teach students about how things work, how things are put together, and how our actions affect these things. These systems can also be translated through comparison to structures in other entities such as plants and animals.

In this building, several types of structure are used to provide a variety of examples of systems. The habitat is a steel structure with a glass curtain wall. The gym also has steel structure but instead of wide flange beams, steel trusses support the upper floors of this part of the building. The school has wood trusses. The school also has a concrete structure including columns and a waffle-slab support for the garden on the roof.

To help students learn about mechanical systems, not only are many unique and environmentally responsible systems used, the room in which these systems are controlled is not closed off as in most buildings. Instead, a nice picture window invites students to watch the workings usually hidden to the users' view. Also, a small glass window, suggested by the architects at Architecture for Education, is placed in one of the interior walls of the rest-room to show the piping systems and other mysterious events happening within the wall cavity.

Upper right: Steel columns and beams support the habitat while a glass curtain wall provides beauty and light.

Middle: The columns of the habitat change in size as one progresses from the entrance to the zoo classrooms.

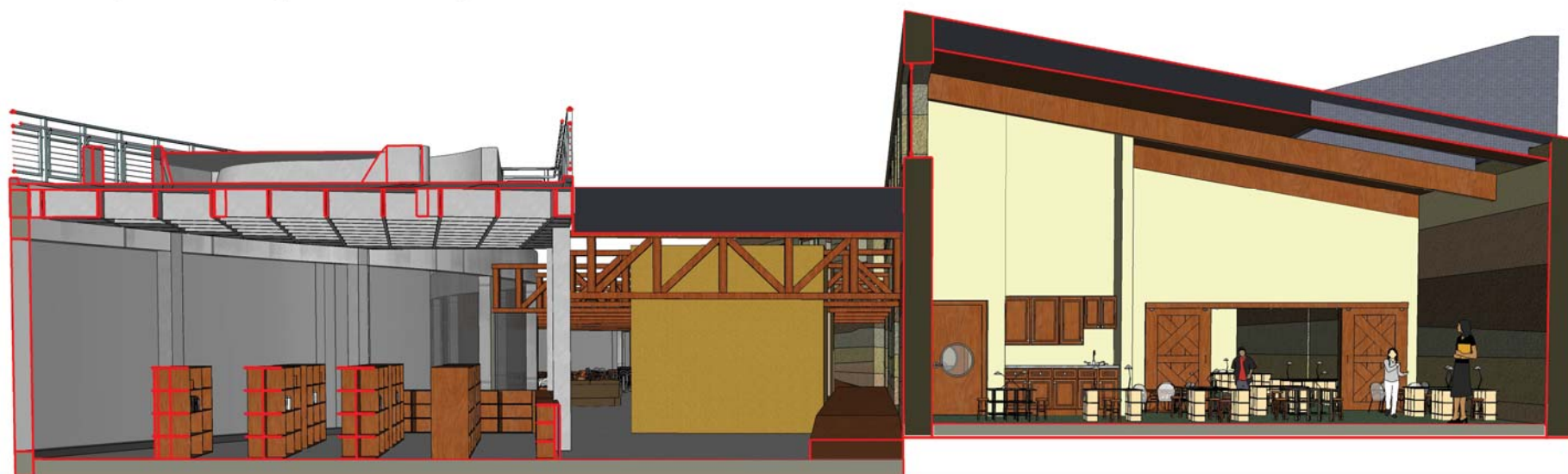
Bottom right: Approximately 20 steel trusses support the upper floor above the gym. Heavy wood beams in the classrooms above support the roof.





The library area has built-in window seating and a performance stage for animal presentations, student plays, public speaking events, and movie presentations. Above the library is the roof garden. A concrete waffle slab and concrete columns “beef” up the structure to support the added weight of the growing beds filled with soil, the students walking around, and snow on the roof in the winter.

A section through a classroom and the library further depicts the varied type of structure that can be found in this building. Heavy wood beams support the roof of the classroom. Wood trusses support the roof over the shared learning environment. And a concrete waffle slab provides the additional support needed for a roof that will be walked upon and upon which a garden will be placed.



Sustainability

Another goal I had for this project was to incorporate as many environmentally sound products as possible. Again with the added bonus of creating great learning opportunities, using alternative energy sources complements the tenets of a curriculum based on science, math, and the environment and supports the zoo's conservation and preservation goals.

Many features have been implemented in this building

Solar panels on the dormer window rooftops

Wind turbines along the roof edges

A geothermal heat pump system with drill fields in three locations (the energy used to run this system will be offset by the energy created by the solar panels and the wind turbines.)

Concrete floors in the shared learning space to capture the heat gain from the sun pouring in the south facing windows.

Clerestory windows in the classrooms to bring in extra light from the sun and cut down on the use of artificial lighting.

Roof garden and "green" roofs on the gym and school parts of the building. The green roofs will be planted with a shallow rooted prairie grass. Green roofs maximize the energy efficiency of a building.

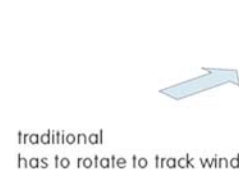
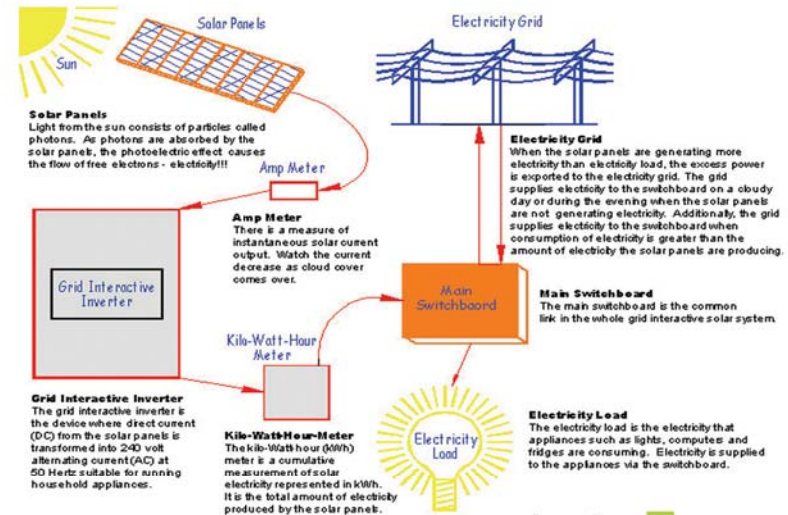
Water collection will be put in place wherever possible.

Indoor plants help oxygenate the air.

Glue-laminated wood trusses and beams require fewer trees be cut down in the production of the material.

Rammed earth walls are made of an earth product that is abundant and natural.

Abundance of glass windows allow natural lighting to replace the need for artificial lighting. Sun shades on the exterior of the windows reduces solar heat gain in the summer.



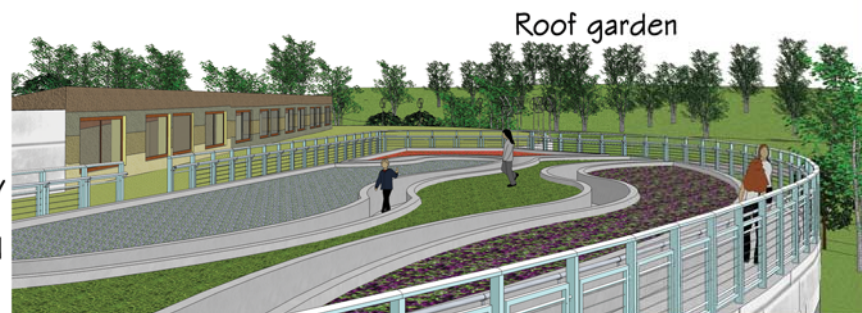
1. Three "S" shaped blades are tapered to shed noise
2. The vertical axis is easy to integrate with existing tracts and buildings
3. The helical (twisted) design captures turbulent winds and eliminates vibration
4. Central compression spar, dependent on conditions
5. The blades, spars and torque tube are made of robust carbon fibre, and all moving parts are sealed to minimize maintenance
6. The direct drive in-line generator has autoholdings and peak power tracking and is incorporated into the mast





This page shows the application of nearly every environmentally-conscious item listed on the facing page. These sustainable practices will be experienced by the students at this school every single day. The hope is that through this exposure, the students who attend this school will be more attuned to the responsibility we all have to take better care of our earth.

The roof garden (right), different than the “green” roofs over the gym and the shared learning space, has large concrete planters, about 24 inches deep in which plenty of soil for growing vegetables and flowers can be placed. A specially designed planter will have drainage holes on the sides for water to seep out. Drainage and water collection systems will also be part of the roof garden design and student study.



The Classroom

When I began this thesis project, my first concern was what was happening in the classroom space. As a former teachers, I was approaching this design problem from the viewpoint of “what would help the teacher do better job teaching and how could I make his or her life easier through architecture?” As I went through the research process, I discovered I was attacking this problem from the wrong direction. I needed to see this through the viewpoint of the learner and thereby, the job and success of the teacher would naturally follow.

The L-shaped classroom, discussed several times through out this thesis, seemed to be the best shaped for the classroom form. Although I did not utilize the “fat-L” as I had hoped (due to the already large size of my building) I did implement a modified L-shaped room that will still allow several configurations of desks to meet a variety of learning approaches. I also added a “barn door” between the classrooms to facilitate cross-grade or larger group mingling. It also allows teachers to create one large U-shaped room with two teachers rather than two separate rooms with one teacher each.

Finally, the desks and chairs were of importance to me. I wanted children to feel as if they had their own dedicated space in which they could put personal effects and create a sense of identity. I also specified ergonomic chairs for both the classrooms and some of the study areas out in the collaborative learning space. When children fidget, they make noise, they aren't paying attention and they get fussy. Comfort, through seating and lighting (each desk has a personal lamp) will improve the opportunities for academic growth.

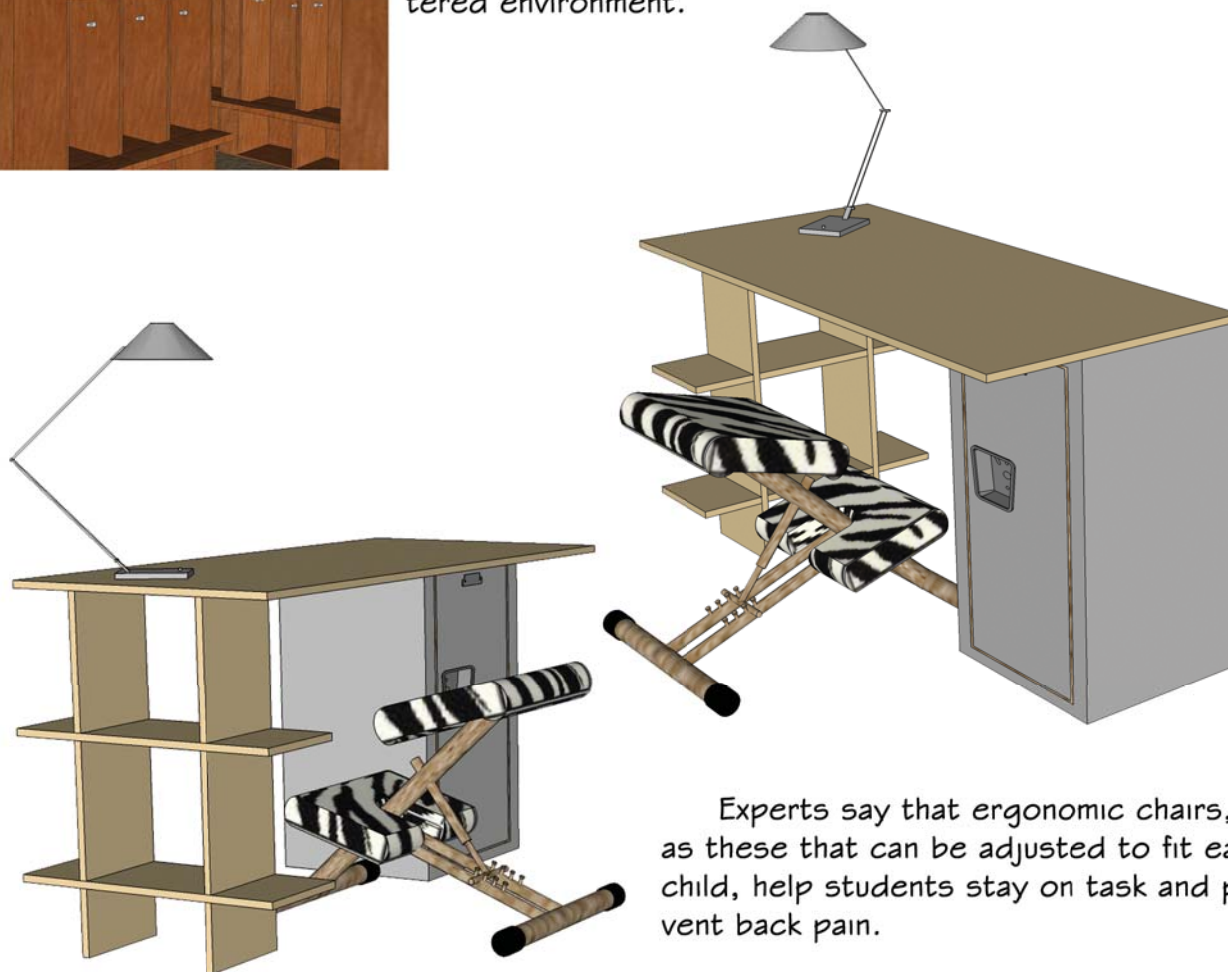




Coat and boot storage, always a concern for teachers, is located in the alcove between every two L-shaped classrooms.

Child sized furniture, facilities such as sinks and toilets, and door handles and windows are important in a child-centered environment.

Rather than lockers, which can be noisy and a safety or security concern, each student will have his or her own desk with a locker component. The desks also have open shelving to allow students to personalize their work area. To help reduce eye strain, each student will have a personal desk lamp.



Experts say that ergonomic chairs, such as these that can be adjusted to fit each child, help students stay on task and prevent back pain.

Auxillary Classrooms - The Special Areas

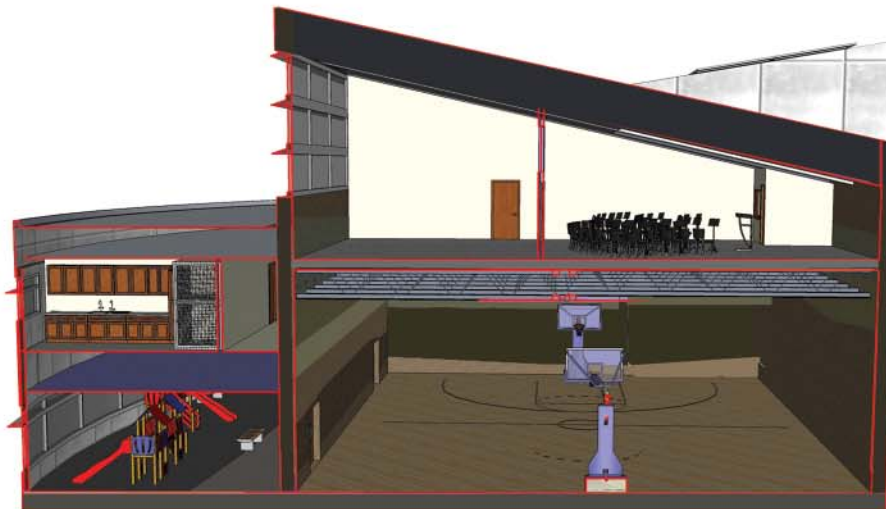
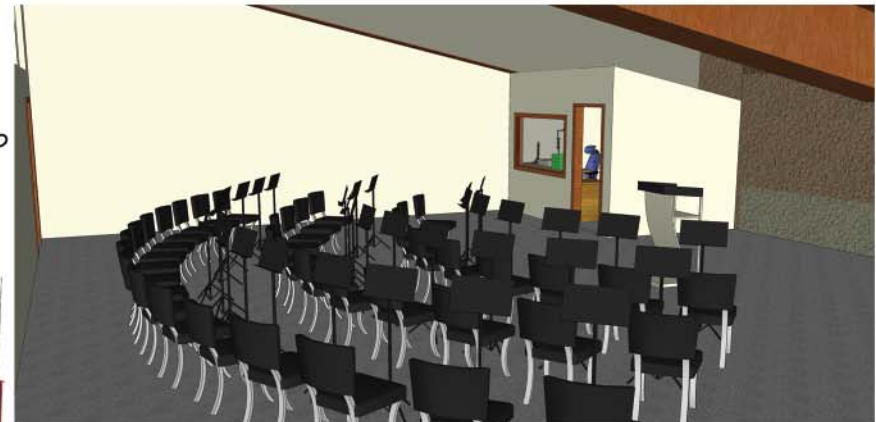
One of the pleasures the students at the Henry Doorly Zoo School will have each day is traveling through the indoor habitat on their way to the "specials" classes: art, music and P.E. These classrooms are in the portion of the building to the west of the habitat.

Lighting, acoustics, and ventilation are important to all three of these spaces. Specialists in these areas would be consulted to best determine how these classrooms can positively impact education.

Upper right image: The art room gets south light from the clerestory windows. This room also has a large dormer window to the north which gives a light often preferred by artists.

Middle image: The music practice room also has an ante area for guests, for students waiting for their practice times, and for small performances.

Lower right image: A small gymnasium has moveable basketball hoops so the space can be a variety of ways.

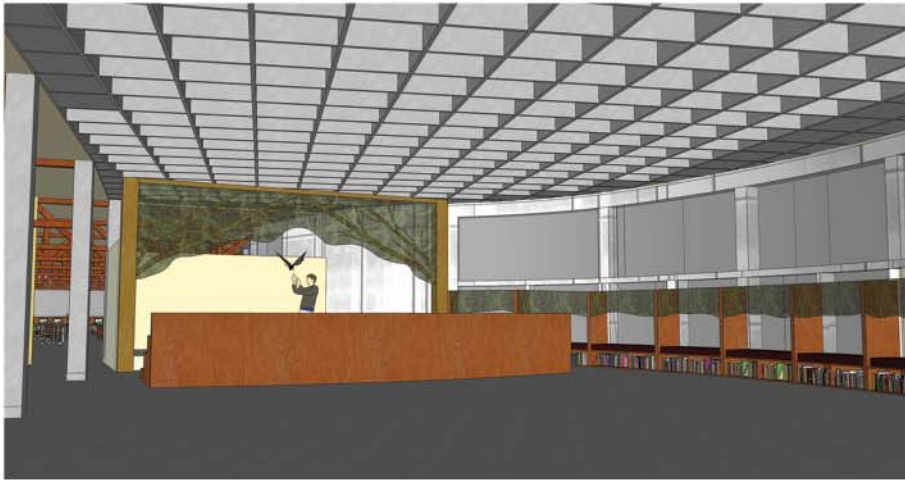


Section of gym and music room, animal holding room and indoor play-room

Other important educational spaces

Right: Two open-view science labs, with sinks and electrical outlets, allow students to work on projects while their teachers help and monitor students in adjacent areas. Yet, it is large enough for a class of twenty to work at once.

Below: This stage in the library will be used for student performances, animal presentations, speaking events, and a study area.



Above: Animals will be housed in this school. This room, with windows to the hallway allowing students to see the animals while walking by, will be used for animal holding, food preparation, animal health care, and general grooming needs.

Left: The library itself is a full-service resource center. It has study tables, window seats, comfortable chairs with computer tables, and a stage/kiva area.



SCHOOL AT THE ZOO:

Every Student's Favorite Subjects: Lunch and Recess

Ask any student what his favorite subject in school is, and he will tell you "Lunch and Recess!" Keeping this in mind, set out to make these areas of the school special. The playground at this school is indoor. Although it is available to all zoo patrons and their children, safety and security was the driving reason for placing it inside the building. Since the students will be taking daily visits to the zoo grounds, exercise will not be an issue. Fun, unstructured play is important for any child, and this opportunity will be available all year round no matter what the weather condition are.

The dining room, although serving food cafeteria style, this room is more like a restaurant with its beautiful view of the habitat. I chose to enclose it with glass rather than have it open to the habitat for safety and to keep smells and sounds out of the habitat. This room also has a stage for performances and will be available for zoo visitors use. school groups coming to the education center may met in the cafeteria for animal presentations.



Above: Indoor play equipment ensures students will have unstructured, fun play everyday, even during bad weather. This space will also be a retreat for zoo visitors on hot days touring the zoo with little ones who want to run.

Right: Floor to ceiling windows showcase the habitat below of the zoo school cafeteria. The tables can be folded up and stored below the stage to make room for visitors watching an animal presentation.





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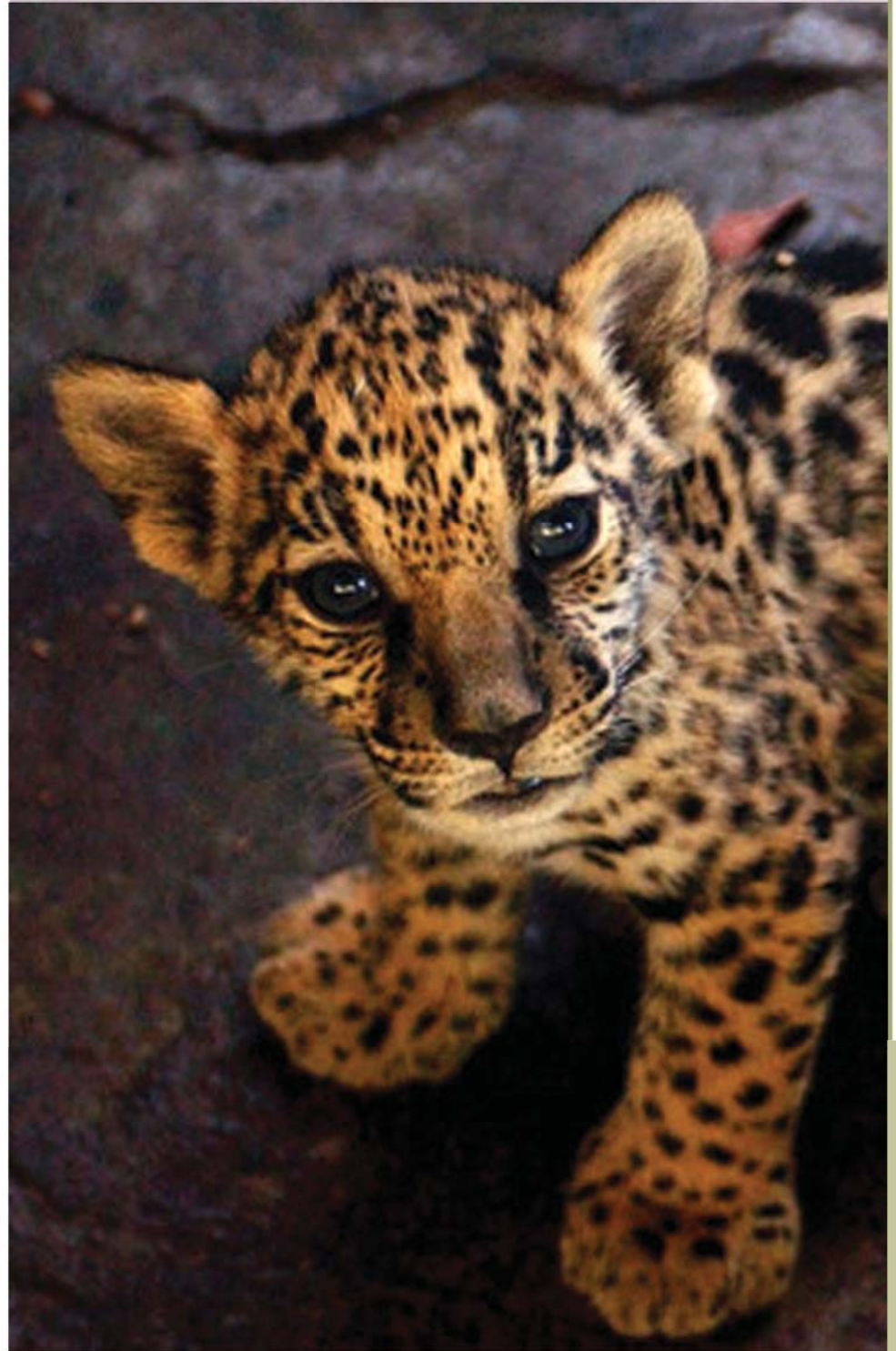
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Appendices

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Elementary Level Optimal Facility Guidelines

INFORMATION PREPARED FOR CONSIDERATION with the PLANTS COMMITTEE AGENDA
Action Item No. 2
Monday, August 1, 1994 - 1:00 p.m.

Page 1

Description of Space	Optimal Facility Guidelines			Optimal Facility Guidelines		
	Quantity	Assignable Area	Total ASF	Quantity	Assignable Area	Total ASF
1. Classrooms						
PreK/Kindergarten	2	1,500	3,000	3	1500	4500
Grades 1 thru 6	14	900	12,600	21	900	18,900
2. SPED Classroom	3	900	2,700	4	900	3,600
Unisex Restroom*	0	100	0	0	100	0
Breakout Room*	0	150	0	0	150	0
Storage*	0	80	0	0	80	0
3. Art Classroom	1	1,250	1,250	1	1,250	1,250
Kiln	1	150	150	1	150	150
4a. Vocal/General Music	1	1,750	1,750	2	1,750	3,500
4b. Instrumental Music Classrm	1	900	900	1	900	900
5. Gymnasium	1	6,800	6,800	1	6,800	6,800
6. Multipurpose Room (PE)	0	2,500	0	1	2,500	2,500
7. Stage(use music classrm)	0	900	0	0	900	0
8. Cafeteria/Multipurpose	1	2,500	2,500	1	2,500	2,500
9. Food Service(Satellite)	1	850	850	1	850	850
10. Planning Centers	3	200	600	3	200	600
11. Teacher Lounge	1	500	500	1	500	500
12. Counseling	1	130	130	2	130	260
13. Health Office	1	500	500	1	500	500
14. Administration	1	2,700	2,700	1	2,700	2,700
15a. Multiuse Rooms	3	150	450	4	150	600
15b. Multiuse Rooms	1	500	500	1	500	500
16. Family/Social Service	1	150	150	1	150	150
17. Community Room	1	550	550	1	550	550
18. Library/Tech/Media Center	1	4,000	4,000	1	4,000	4,000
Alcove	1	150	150	1	150	150
Equipment	1	850	850	1	850	850
Office	1	450	450	1	450	450
19. Building Services	1	900	900	1	900	900
20. Storage	1	1,300	1,300	1	1,300	1,300
Total Assignable Area			46,230			59,460
Efficiency (70%)			0.7			0.7
Total Gross Area			66,043			84,943

ASF/student(Rated capacity)= 119
GSF/student(Rated capacity)= 170

ASF/student(Rated capacity)= 101
GSF/student(Rated capacity)= 145

* Enlarged SPED area required in some elementary schools

enhancing education through site and design



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Lee "Doc" Simmons, Director - Henry Doorly Zoo

Danny Morris, Assistant Director - Henry Doorly Zoo

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SCHOOL AT THE ZOO:

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