HIGH SCHOOL CAMPUS DESIGN ELEMENTS FOR OUTDOOR-BASED EDUCATION AMENITIES

by

NINAH BUTLER

B.S., MidAmerica Nazarene University, 1999

A THESIS

submitted in partial fulfillment of the requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture/Regional and Community Planning
College of Architecture Planning and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2013

Approved by:

Major Professor
Huston Gibson

Abstract

The research conducted in this thesis explores the relationship between high school campus planning and the potential for high school sites to be used as outdoor classrooms. A review of the design of school buildings and the educational pedagogy that has influenced campus planning and design is presented before exploring current design practices. Precedent studies are offered as examples of exemplary design strategies for multi-use campuses. This leads to the question, “What variables allow future outdoor based education opportunities to be anticipated by site designers of high school campuses?”

Four units of analysis and their relationship with site planning will be addressed in this research: environmental factors, space requirements, building proximity, and activity type. A case study based on these units of analysis is used in a multiple case study investigation of three school campuses in the Wichita, Kansas area: Goddard High School, Eisenhower High School, and Maize High School. The methodologies of organization, implementation and analysis of the variables are presented. The patterns found from the multiple case study and the variables developed in response to these findings are offered and discussed. Finally design alternatives for the three case study sites and future research opportunities are provided.

Keywords: Landscape architecture, Site planning and design, Sustainability, Education, High school campuses, Learning landscapes, Outdoor-based education

Table of Contents

List of Figures

List of Tables

List of Maps

Acknowledgements

My gratitude and thanks to Huston Gibson, my major professor whose assistance and wisdom have steered me in the right direction through the entirety of this arduous process. I picked a pony and finished the race. I also offer my thanks to my committee members, Katie Kingery-Page and Lorn Clement whose assistance was invaluable at all the right moments.

Thank you to the principals and staff at Goddard High School, Eisenhower High School, and Maize High School for allowing me to visit the campus and talk with you about your school.

Dedication

To my friends and family who have seen me through from the beginning of this journey to the end: Dacia Brown, Bev Coons, Maria, Cait, Calvin, & Ty Robertson, Megan Sperry and "The Rest of You." I could not have done it without your prayers, phone calls, and laugher. Thanks for having my back.

For my Seaton Family: Alyssa Butler, Casey Gorrell, Kyle Koehler, Angela Mayer, Peiwein Wang, and Brandon Woodle, I had no idea what I was getting into; thanks for making it memorable and keeping the fire burning.

And to new friends made along the way, including Christopher Lynn, who has inspired me to move ahead with confidence.

Preface

This thesis is submitted in partial fulfillment of the requirements for a Master's Degree in Landscape Architecture for the author. It contains work done from January 2012 to June 2013. The supervisor on the project has been Huston Gibson, Assistant Professor, Landscape Architecture/Regional and Community Planning. Secondary supervision has been provided by Katie Kingery-Page, Assistant Professor, Landscape Architecture/Regional and Community Planning and Lorn Clement, Associate Professor, Landscape Architecture/Regional and Community Planning. The thesis has been compiled solely by the author; background text is based on the research of others, and every effort has been made to provide references to these sources. Case study research and conclusions are the sole findings of the author.

Chapter 1 - Introduction

Organization

The thesis is broken down into five chapters to cover the research and analyses of the topic. This chapter will introduce the topic and problem statement of the research; it then outlines the following chapters of the thesis.

Chapter two reviews the historic architectural types of schools from the mid-nineteenth century through to the present day. This review of architectural types focuses on general architectural features of school buildings as well as the importance of the relationships between the buildings and the site plans. The second section of this chapter will look at the educational pedagogy that was developing and influenced the design of schools and their relationships to the site. Finally, contemporary site design concepts that produce innovative school campuses will be reviewed. Precedent studies will be used to show exemplary models of integrated design use of BMP.

Chapter three describes the methodologies used to study and research the problem posed. The chosen method of research, the case study, is reviewed to show the efficacy of its use. The case study type will be broken down to clarify its use. There is also an explanation of the survey format used and its benefits and shortcomings as they pertain to the topic.

Chapter four will review observations made during the site visit, the data collected, any variation encountered and establish the key findings of the research completed during the case study. Initial data from the surveys and the site checklists will be compiled and summarized. Correlations between the surveys and the site checklists will be compared to understand the usability of the outdoor based education spaces from the three schools site(s). From this research, design recommendations have been given regarding the case study sites.

Chapter five is a summation of the practices used, the findings and their application to the sites visited. The potential for broader application of this thesis and opportunities for further research are also addressed.

Background

The design of educational spaces has been an evolving field of planning and architecture since the beginning of the nineteenth century when education was no longer exclusive to the upper class of society. With the awareness of a larger population in need of education came the need for facilities that could accommodate them and their needs (Burke & Grosvenor, 2008). Architects of the time such as, Wheelwright and Robson, focused on enclosure and control of educational spaces and subsequently the health of this population. Their design standards were influential for decades to come (Hille, 2011). Further change followed with the work of educational reformists and psychologists that contributed understanding regarding the needs of students and teachers in these spaces (Ormrod, 1990). In some instances proponents of architecture and education worked together to address those needs, as can be seen in the case of Frank Lloyd Wright and John Dewey. From these partnerships came schools that replicated the ordered diversity of the real world and encompassed the spirit of the Arts and Crafts movement (Dudek, 2000).

To varying degrees modern schools have more in common with the schools of Robson than those of Wright. Because of this lack of integration an increasing number of designers, educators and reformists are again working to create schools that link architecture, site planning and education. As the understanding of the needs of students has improved design has responded in kind. Examples of schools that offer opportunities for community connections, ecological designs and integrate the architecture of the site to further enforce and teach educational concepts can be found in resources such as, *Space and Learning* (Hertzberger, 2008), *Linking Architecture and Education* (Taylor, 2008) and *Landscapes for Learning* (Stine, 1996).

Another important element in design of outdoor based educational spaces is the access to resources provided to the end users from planners, designers and other users. A broad range of resources for the layman can be found on topics such as how to enhance the school campus as in *Greening School Grounds* (Grant & Littlejohn, 2001) and *Designing Outdoor Environments for Children* (Knight, McLellan, Haque, & Tai, 2006), integrate instruction *Schoolyard-Enhanced*

Learning (Broda, 2007), or leverage neglected schools to help restore communities (CU Denver, 2012). For the design community resources such as *The Language of School Design* (Nair & Fielding, 2007) and websites like *The American Clearinghouse on Educational Facilities (ACEF)* (American Clearinghouse on Educational Facilities [ACEF], 2013) compile information on the broadly related topics that connect on a school campus. The work of these professionals and many others are redefining what campus design means for the twenty-first century.

Research Focus

The initial research for this thesis was regarding the implementation of learning in an outdoor setting by the end user. Over time it became clear that this topic was difficult to examine since each case was different depending on the users and the related site. To reframe the research, focus was shifted from the implementation stage of design to the conceptual and planning stages of design.

Most research on the topic of school planning focus on the building and interior design (Perkins Eastman Architects, Perkins, & Bordwell, 2010). When attention is given to site planning it is often overshadowed by the initial and pressing task of acquisition, analysis and funding that falls into the category of things to take care of later. When attention is given to the design of outdoor educational spaces it is by the end users such as teachers and community members (Danks, 2010). The goal of this research was to bridge the gap between these two positions to allow designers to prepare the site for more detailed planning by end users.

Through the investigation it became clear that a limited amount of information was present on these topics at the high school level. The general consensus being that education at this grade level was more concerned with knowledge acquisition rather than experiential learning, despite research suggesting the opposite.

To combine these areas of research the topic of usefulness or usability and how to measure it needed to be addressed. Usability[1] assesses the ease-of-use of the site and the methods for improving ease-of-use during the design process (Nielsen, 2012). Another related quality attribute is utility, which refers to the function of the design. A design should be easy to

[1] See Appendix B: Nomenclature, for a complete definition of "Usability".

use and function as need, if a design is missing either of these attributes users will not put forth the effort to overcome the designs difficulty. Figure 1.1 shows the relationship between utility and usability. By measuring site variables based on usability a greater understanding can be gained of the end user's needs, which can then be applied to the planning stages of design.

Figure 1.1 Usefulness Diagram (Adapted from Nielsen, 2012)

Significance

Engaging students with the natural environment benefits both cognitive and physical development (Stine, 1996). The value that design firms place on the use of their design to address the emerging field of environmentally based education is on the rise (Louv, 2008). Designer's perspectives on the use and function of a space are changing to address all stakeholders involved rather than just the initial client. Successful use of the school site for outdoor based education requires input and buy-in from stakeholders such as teachers, students and community members (Danks, 2010). Such buy-in requires designers to create flexible spaces for the changing needs and requirements of those stakeholders. The design of exterior spaces should focus on creating opportunities for outdoor-based education for community members rather than static design plans.

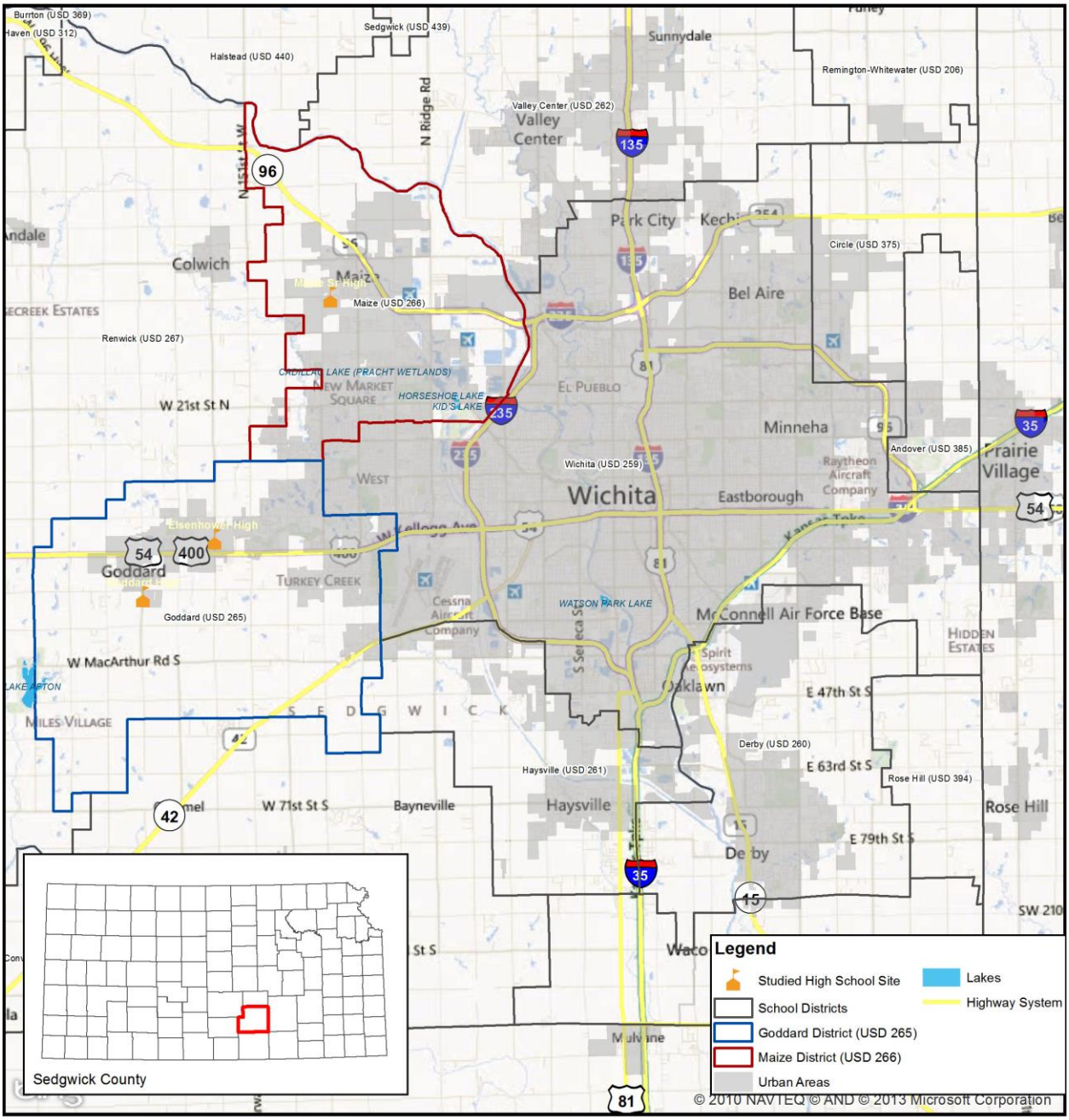
Problem

- How can future outdoor based education opportunities be anticipated by site designers of high school campus?
- What characteristics are essential so that high school campus designs may support outdoor based education?

Context

The schools; Goddard High School, Eisenhower High School, and Maize High School, chosen for the case study portion of the research are located in the greater Wichita, Kansas area. Their locations can be seen in Map 1.1. To maintain consistency between the case studies schools where chosen based on the following criteria; sample populations (a) within proximity; (b) school size; and (c) design criteria. In-depth explanation for each of these criteria will be given in chapter three. Initial research for case study locations began with internet searches for school districts in the Kansas City Metro area, the Denver Metro area and in the Denver County School District. These areas provided potential study samples large enough to locate the sample criteria. While conducting initial research the April/May 2012 issue of National Wildlife published the article, *Education: Not The Same Old Schoolyard* (Di Silvestro, 2012). In this article Goddard High School's award winning outdoor education site was presented as a model for multi-disciplinary educational opportunities. Further research into this district and county offered information on additional schools that would fit the case study criteria (Scribner, 2012).

Map 1.1 Wichita Kansas Reference Map



Map Information

Prepared by: Ninah Butler
Projection & Coordinate System: NAD 1983 UTM Zone 14N
Sources: KS DASC, USGS, ESRI, US Census, KSBOE

1 in = 3.63 miles
1 inch = 19,167 feet

File Path: F:\ArcGIS\01 Maps\map docs\sc_WICHITA_ref.mxd

Sedgwick County, Kansas School Districts

Sedgwick County is the location of the three case study sites in the greater Wichita area. USD 265 is located southwest of Wichita and USD 266 is located southeast of Wichita. Each district draws students from the city of Wichita as well as smaller surrounding communities.

APDESIGN
LANDSCAPE ARCHITECTURE / REGIONAL & COMMUNITY PLANNING
THE COLLEGE of ARCHITECTURE, PLANNING & DESIGN
KANSAS STATE UNIVERSITY

Chapter 2 - Review of Literature

The following chapter is a review of the literature relevant to the buildings, the educational philosophy and psychology and contemporary site design. While it is not an exhaustive inventory of all related literature on the topic it represents a thorough sampling of information relevant to the research context of this study. The presented literature has been refined to show the three areas of influence on the research from the mid-nineteenth century to the present. The first topic, historic architectural practices, looks at the major design influences on school buildings broken down into four eras; (a) 1850-1900 *Industrial Revolution Era*; (b) 1900-1950 *Post Industrial Revolution Era*; (c) 1950-1980 *Post War Era*; and (d) 1980-Present *Modern Era.* The second topic, educational pedagogy, identifies the theories that prompted changes in school design and is categorized as follows ; (a) behaviorism; (b) cognitivism;(c) constructivism and;(d) humanism. The final topic, contemporary site design, investigates models of campus planning that strengthen the relationships between user and site. The relevant models examined in this study are; (a) Nature Play; (b) Small Learning Communities and; (d) Universal Design.

Historic Architectural Design Paradigms

School sites have evolved from borrowed space and one room buildings into campuses built to house thousands of people. These transitions have been influenced by factors such as economics, health and welfare, materials, and psychology over the past two hundred years. When reviewing the changes that have taken place in school building practices, four major eras can be distinguished: 1850-1900, 1900-1950, 1950-1980, 1980-Present (Burke & Grosvenor, 2008). Each of these eras was influenced by changes in scientific understanding and design strategies that allowed for new opportunities to be tested in the field of school building design. These influences created shifting design paradigms that architects used to move school architecture forward.

As education was an emerging field at a time in history when there was an abundant amount of interaction between the United States and Europe, early pedagogy, educational policy, and building styles can be seen to influence both continents; therefore, this literature review includes background on education facility design in Europe and the United States.

1850-1900 Industrial Revolution Era

During the late nineteenth century public education and the buildings used for this purpose was still in its early stages. During this era buildings were utilitarian and architecturally simple. This utilitarian design can be seen in all aspects of the design of these schools. As the study of public education progressed through this time people's attention to building design began to encompass a greater variety of concerns. Overall layout, health and safety concerns began to be addressed in addition to student volume and teaching methods.

The need for public schools arose from the changes that came about during the Age of Enlightenment (seventeenth and eighteenth centuries) and the Industrial Revolution (1760-1840). During these periods in history concepts of democracy and increases in urban populations created a need to disseminate consistent information to a broader group of individuals. The initial goal of schools was twofold first was to impart the concepts of democracy to the growing population; (a) necessity of compromise; (b) equality of all persons; (c) majority rule with minority rights; (d) individual liberty; and (e) worth of the individual. Secondly to provide basic academic skills to individuals who would assume civil responsibilities and be participating members in the democracy. As immigrant populations grew in America, schools had the additional task of ensuring that the children of these immigrants would assimilate and learn not only English but "the American way"(Hille, 2011).

Utilitarian. Through the influence of such leaders as Horace Mann and policy changes such as the Education Act of 1870, the need for education of the populace became foundational to modern society (Parliament, 2013). To support the goals of these educational proponents and the broad goals of education, the need for specialized buildings arose. No longer were ad-hoc buildings viewed as appropriate for these purposes (Hille, 2011). The seminal text for standardized school buildings for the era was Edward Robert Robson, *School Architecture: Being Practical*. In response to health concerns surrounding the emerging working class and the

ability of the school master to accommodate the maximum number of children (approximately 40-60) Robson set forth the layout of classrooms and student class size (Dudek, 2000).

Typical urban schools of the time were built on a single block with one or two floors. Each floor was symmetrically organized around a central hallway and furniture was standardized consisting of individual desks that were bolted to the floor and organized in rows. Windows, the only source of light, were tall, narrow and encompassed two or three sides of the classroom. Exteriors were built from brick while interiors were made from wood (Hille, 2011).

Beaux Arts. Beaux's Arts design principles, referenced extensively in *School Architecture* (Robson, 1877) focuses upon composition and order based on hierarchy and symmetry. Principle characteristics of Beaux Arts architecture often seen in schools included: flat roofs, rusticated and raised first story, hierarchy of spaces from "noble spaces"—grand entrances and staircases— to utilitarian ones, classical architectural details: balustrades, pilasters, garlands, cartouches, acroteria, with a prominent display of richly detailed clasps (agrafes), brackets and supporting consoles (Fogle & Klein, 1986). These details focused and informed the users that this was a monumental building of purpose. Overall, the design of schools at this time was focused on utility rather than aesthetics. The building was the focus, and the site simply a location for the building. Some schools encompassed the entire lot on which they sat due to limited space in urban settings (Dudek, 2000). However, during the late nineteenth century, the Arts and Crafts movement was beginning and would later influence school design as educators and architects began to see parallels in the relationship between their fields.

The Arts and Crafts movement at the turn of the century was a reaction to the industrial, poor quality, machine-produced style of the time. The emphasis was on the aesthetics of design and the quality of handcraftsmanship rather than on the homogeneity and poor quality of mass -produced objects (Sullivan & Boults, 2010). The design aesthetics of this movement, which influenced the decorative arts, textiles, furniture, and other functional objects, was later incorporated into architecture. The goals of the Arts and Crafts movement included; simplicity in form without excess decoration, visible constructions, emphasis on materials, bold forms, and strong colors. These aesthetic principles resonate with the awareness of student needs at that time.

Architects of the Arts and Crafts movement, such as Frank Lloyd Wright and H.P. Berlage, attempted to create schools that offered amenities that were similar to homes and create more useful outdoor spaces. Their designs focused on including the following elements; consolidation of useable outdoor spaces, inside flexibility and multi-use space, de-institutionalizing of furnishings, lightweight and moveable furniture, natural materials, introduction of color, and domestic features such as bay windows and fireplaces, and reduced ceiling height (Hille, 2011). Despite the advances in ergonomic school design made during this era, many of these concepts would be lost in the functionalist design of the post-war era.

1900-1950 Post Industrial Revolution Era

Significant change took place during the first half of the twentieth century. Initially there was overlap between the two eras of design incorporating the aesthetics and amenities of the Arts and Crafts moment. This allowed designers of the time to create innovative building plans that allowed for merging of exterior spaces with the classroom setting. This trend continued into the thirties before being eclipsed by functionalist design. Concerns over student health and hygiene, addressed by functionalist design, were efficiently dealt with through the flexible, multi-use facilities of this architectural style. These trends paved the way for school design that addressed the needs of the users in a holistic way. However with the Second World War in the nineteen-forties brought school construction to a standstill due to the lack of resources and manpower. When construction did resume in the late forties design did not pick up where it had left off. Due to new materials and rising birth rates attention shifted to designing schools that would be affordable, easy-to-maintain, and utilitarian. A blend of the functionalist and modernist design types supported the needs of schools that were efficient to build, utilitarian and could also accommodate short-term educational needs and rapid growth (Hille, 2011).

Functionalism. For a brief period in the nineteen twenties and thirties the aesthetics of the Arts and Crafts movement influenced school in America and Europe; however, due to changes that took place during the Second World War, other pressing factors began to dictate school design. During the Second World War there was a decline in school construction due to reduced access to materials and a decrease in student population (Hille, 2011). Nevertheless, during the post war era many new materials became available thanks to changes in wartime

manufacturing improvements. Materials became lighter, reducing construction weight, and were less expensive allowing buildings to be built with greater speed, efficiency and flexibility. An additional benefit was that building plans would be more flexible and could accommodate the short -term educational demands of teachers and students.

With these changes in and the context of the new suburban environment school plans began to incorporate greater access and use of the outdoors. Buildings could be built with greater speed, efficiency and flexibility thanks to these materials. Additionally the post war baby boom began to occur and greater numbers of families came to be considered "middle class" This growing population created a boon in the building field and many new schools began to arise in green field and in areas along the outermost edges of cities rather than in the urban core (Hille, 2011).

Table 2.1 Functionalist School Model Variation

Functionalist Model Variations	
Loft/Open Plan	Flexible layout based on a contemporary industrial model that utilized moveable partitions and skylights.
Campus Plan	A group of separate, smaller and simplified buildings in a landscape setting with open outdoor circulation.
Pavilion/Finger Plan	A series of freestanding buildings with intervening courtyards and covered connecting walkways organized in a series with consistent orientation for natural light and ventilation.
Schools-within-a school	A large building divvied into neighborhoods with separate wings for different age groups and a centralized facility for shared activity spaces.
Cluster Plan	A collection of small schoolhouses or classroom clusters with connecting corridors or hallways that create a series of small scale intervening spaces.
Courtyard Plan	Classrooms organized in wings around a central outdoor multiuse activity space.
Hall/Forum Plan	A central indoor multiuse activity space surrounded by classrooms; with gallery circulation on the upper floors.

Post-War Functionalism. Buildings from the nineteen-forties and nineteen-fifties were usually one story, suburban schools with classrooms measuring 24 sq. ft. X 36 sq. ft., organized in wings along double laded corridors. Continuous full-height windows ran along the outer walls and provided natural light and ventilation for each classroom. Each classroom also had a door that could access the outside rather than an interior hallway. Interior corridors had skylights,

which provided light and allowed circulation of air. The roof was simple and low- pitched which allowed for drainage. Additional cantilevered overhangs provided sun protection along the perimeter. Interior roofs were at a lower scale, 9’6” rather than the 12’6” found in urban schools. Using these basic components, schools could produce a variety of plan types that are seen throughout many school plans nineteen-fifties (Hille, 2011). Overall the building was still seen as the focus of learning and connections to the rest of the site were limited to circulation and standard age appropriate play areas. See Table 2.1 for examples.

1950-1980 Post War Era

School design during this period changed with the introduction of new teaching styles and pedagogy as well as technology improvements requiring more flexibility in the layout of a school. Despite this the overall plan of schools stuck to the standards introduced during the functionalist period of design. As the modernist movement progressed into the seventies and eighties many architect and developers felt that school design had become disconnected from the populations it was meant to serve. To remedy this deficiency designers turned to the concepts of critical regionalism and contextualism for their designs. Each of these concepts focused on a different aspect of personalization of the site design, but both looked to connect locally through the following features; school identity, community use, student/teacher interaction, and the quality of the learning environment. While examples from the era are few in number, due to renovations and retrofitting rather than new buildings, a significant design feature of schools from the sixties and seventies is the open plan school.

Critical Regionalism. Critical regionalism is an approach to architecture that strives to counter placelessness and the lack of identity seen in the modernist style by using the geographical context as a palette for design. Critical regionalism does not strive to ignore the universality of modern design rather it seeks to blend these concepts with the traditions and materials of the architectures region (Jencks, 1987).

The term "critical regionalism" was first used by the architectural theorists Alexander Tzonis and Liane Lefaivre, and later modified by the historian-theorist Kenneth Frampton. Frampton takes this definition of cultural regionalism and points out that the fundamental

strategy is to, "*mediate the impact of universal civilization with elements derived indirectly from the peculiarities of a particular place*." (Frampton, 1983).

While some look at regionalism as a chance to "*nostalgically revive the hypothetical forms of a lost vernacular*"(Frampton, 1983). Critical regionalism looks to connect buildings with their surroundings in a way that is relevant to the era of technology and use, while still allowing people to understand the uniqueness of their location.

1980-Present Modern Era

Sustainability (Green Schools). At the beginning of the twenty-first century the grassroots efforts of communities focused on environmental aspects of school design beyond the building envelope. This strategy, to make schools environmentally sustainable, was a shift from the energy efficient, hermetically sealed buildings of the seventies. Eventually this became the Green Schools Movement we see in programs like LEED, Green Buildings, and the U.S. Department of Education's Green Schools Initiative. The term 'green school' includes a broad range of topics, their goals look to improve the efficiency of school structures, increase awareness of sustainability practices and empower the users of schools to advocate for these changes. The characteristics of a green school used by many groups are listed below (Karliner, 2013)*;*

- Conserves energy and natural resources
- Saves taxpayer money
- Improves indoor air quality
- Removes toxic materials from places where children learn and play
- Employs daylighting strategies and improves classroom acoustics
- Employs sustainable purchasing and green cleaning practices
- Improves environmental literacy in students
- Decreases the burden on municipal water and wastewater treatment
- Encourages waste management efforts to benefit the local community and region
- Conserves fresh drinking water and helps manage stormwater runoff
- Encourages recycling
- Promotes habitat protection
- Reduces demand on local landfills

These characteristics were defined by the U.S. Green Building Council, a nonprofit organization that developed what we know today as LEED standards[2] . A benefit of LEED is providing a common language for dialogue between site users and designers when discussing green school building features (U.S. Green Building Council [USGBC], 2013). The extent to which the concept of green school has permeated our culture can be seen in the establishment of the Green Ribbon School award by the U.S. Department of Education in 2011 (U.S. Department of Education [USDE], 2013).

Educational Psychology

There are many theories in education that influence school design; four main pedagogical theories of learning will be emphasized: behaviorism, cognitivism, constructivism (including design based learning), and humanism. These theories are the basis of educational design and continue to be used in most public school settings. In most public schools the educational theories initially played a limited role in the design of buildings and sites; however, in the early to mid-twentieth century, these very same learning theories would directly impact the layout and design of classroom architecture.

Behaviorism

Modern theories in education found their roots in the world of psychology and the study of human responses. As these studies progressed, they became the study of learning. One of the first theories to be studied was behaviorism. Behaviorism is the idea that learners are passive and only responding to environmental stimuli. As these responses are repeated they become a learned behavior (LearningTheories, 2013). In relation to learning, three processes relate to this theory. First, behaviorism focuses on observable behavior rather than the internal thought process, thus learning is a change is behavior. Second, the environment shapes the behavior; what you learn is determined by the elements of the environment, not the learner. Third, the principles of contiguity (how close in time two events must be for a bond to be formed) and reinforcement (any means of increasing the likelihood that an event will be

[2] See Appendix B: Nomenclature, for a complete definition of LEED Standards.

repeated) are central to explaining the learning process (Grippin & Peters, 1984; Merriam, Caffarella, & Baumgartner, 2007). Behaviorism's effect on classroom design was limited. While understanding that the classroom environment was considered important, it was not considered a factor to be integrated into the construction of school buildings and sites.

Cognitivism

Cognitivism places emphasis on processing stimuli from the environment rather than the stimuli and the overt behaviors that arise. The mental processes that are of interest include recognition, recall, analysis, reflection, application, creating, understanding, and evaluation (Merriam et al., 2007). The theories that make up cognitivism arose from the research of the Gestalt Psychologists[3] of the early twentieth century.

Gestalt psychologists realized that the perception of an experience is sometimes different than the experience itself. This understanding led Gestaltists to look at experiences as a whole rather than isolating each experience or event. Once these experiences are looked at together, patterns arise that would not be evident on an individual basis (Ormrod, 1990). From this understanding, two key assumptions arose. First, humans structure and organize experiences and information. Second, prior knowledge plays an important role in learning and how we organize the experiences and information. Based on these two observations, it was determined that learning requires reorganizing experiences in order to make sense of stimuli from the environment so that they can be applied to new experiences.

Jean Piaget's studies of knowledge and the age related learning processes in the nineteen-twenties did not have a great impact on cognitive theories until the nineteen-sixties due to its incompatibility with the behaviorist models of his time. Since then, Piaget's theories have played an important role in education. It provides a holistic theory that incorporates language, logical reasoning, moral judgments, and concepts of time, space, and numbers. The key components of Piaget's research proposed the following; (a) people are active processors of information; (b) knowledge can be described in terms of structures that change with development; (c) cognitive development results from the interactions of individuals with their

[3] See Appendix B: Nomenclature, for a complete definition of "Gestalt Psychology".

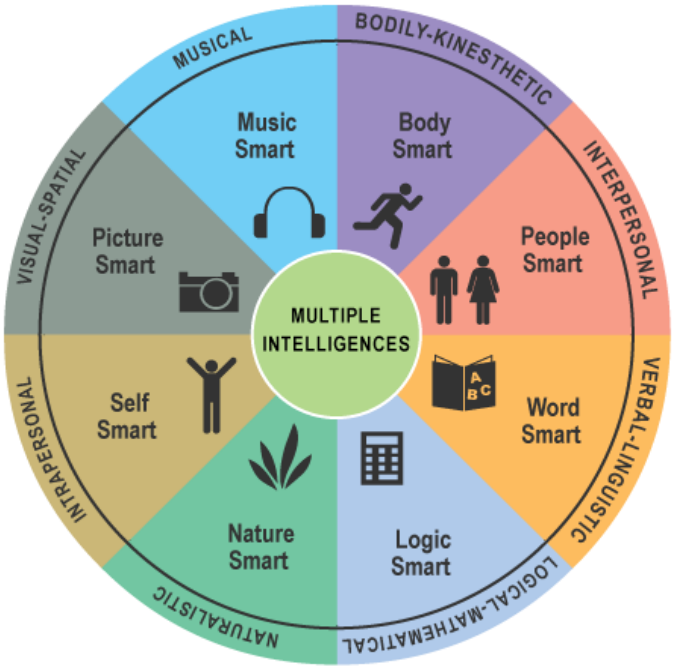
physical and social environments; (d) the ways in which people interact with the environment remain constant; (e) cognitive development occurs in distinct stages; and (f) he rate of cognitive development us controlled to some extent by maturation (Ormrod, 1990).

Another psychologist that influenced the ideas of cognitivist learning was Jerome Bruner. Unlike Paget, Bruner focused on environment and experiential factors. Bruner emphasized that learning took place through discovery, which he saw as a process of rearranging or transforming evidence in such a way that one can go beyond the evidence and construct new insights. Bruner's instructional theory involved a three step, simultaneous process; (a) acquisition of new information; (b) transformation, the process of manipulating knowledge to make it fit new tasks; and (c) evaluation, checking whether the way we have manipulated information is adequate to the task" (Ormrod, 1990).

Constructivism

While Piaget and Bruner were looking at learning from the internal perspective of how people process and interpret stimuli, another group of psychologists were looking at the external process of how people construct knowledge rather than how they acquire it. Constructivists found that knowledge was constructed through first hand experiences with their environment. Since the school site is the primary learning environment, it is a significant learning theory related to the design of school campus.

Figure 2.1 Gardner's Theory of Multiple Intelligences
(Source: Sarah the Theater Ed, 2013)



Constructivists[4] believe; (a) Understanding is in our interactions with the environment; (b) Cognitive conflict or

[4] See Appendix B, Nomenclature for further explanation of 'Constructivist Theory.'

puzzlement is the stimulus for learning and determines the organization and nature of what is learned; (c) Knowledge evolves through social negotiation and through the evaluation of the viability of individual understandings (Wilson, 1996).

As an extension of the constructivist philosophy Howard Gardner's *Theory of Multiple Intelligences*[5] addresses the role that intelligence plays in learning. As seen in Figure 2.1 (Sarah the Theater Ed, 2013), Multiple Intelligences theory states that there are eight types of intelligence; linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, intrapersonal, interpersonal, and naturalist. People learn best through the activities that address their innate abilities (Gardner, 1999).

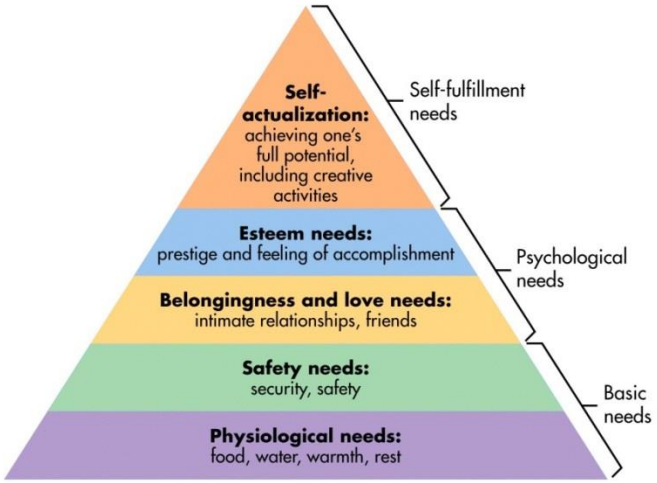
Humanism

Humanism is concerned with the whole person in the learning process, both intellect (cognition) and emotions (affective). There are five principles on which it focuses; (a) choice or control; (b) felt concern; (c) the whole person; (d) self-evaluation; (e) the teacher as facilitator.

Proponents in this field that applied these concepts to education include Abraham Maslow and Carl Rogers. In this approach to learning, psychologist, Carl Rodger's emphasized establishing good relationships between the teacher and the student. The goal is to allow students to become autonomous learners with the teacher as the facilitator (Ormrod, 1990).

Maslow proposed that motivation is based on a hierarchy of needs and the drive to learn is intrinsic. To move through the hierarchy of need and progress in learning the basic needs must be met before a person can progress to the next stage of development. Figure 2.2, (Atkinson, 1970) shows the progression of needs beginning with the most basic level and ending with self-actualization.

Figure 2.2 Maslow Hierarchy of Needs (Source: Atkinson, 1970)



[5] See Appendix B, Nomenclature for further explanation of 'Multiple Intelligences.'

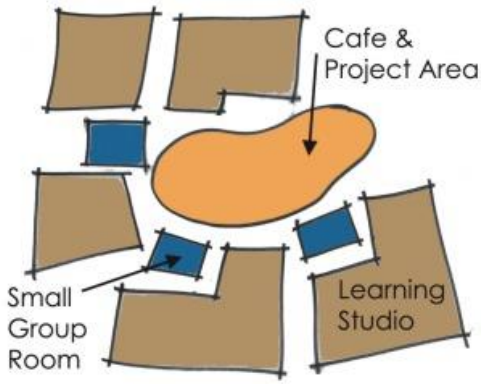
Contemporary Site Design Concepts

As teaching methodologies, educational philosophies and building technologies continue to advance so do the designs for contemporary schools. With increasing standards and expectations placed on students and teachers the role of the environment on the educational process must also be augmented. The design of school campuses must add to and enhance the learning process to allow those rising expectations to be met. Presently design is acknowledging the need for students to learn through direct rather than indirect means (Raffan, 2000). Three such design concepts that focus on students' exploration of their environmental both locally and globally as well as in group as well as independent exploration are; small learning communities (SLC), universal design, and nature play. Each offers a vital perspective on how to create school sites that support global citizen of the twenty-first century.

Small Learning Communities

Small learning communities (SLC) describe the practice of organizing large high schools into smaller units. This term encompasses smaller school structure, curricular specialization, focus on learners and learning, active and collaborative teacher and student work (Oxley, 2007). The practice of SLC'S has evolved over the last five decades from changes that focused on the physical form of the building to the interactions between students, teachers and the physical environment. Current design of SLC spaces modifies the finger plan and surrounds a center meeting space, as seen in Figure 2.3.

Figure 2.3 Small Learning Communities Classroom Plan
(Source: Nair & Fielding, 2007)



Five practices[6] that can be seen in successful SLC are; (a) self-determination; (b) identity; (c) personalization; (d) support for teaching; and (e) functional accountability. (Nair & Fielding, 2007).

[6] See Appendix B: Nomenclature, for a complete definition of "Small Learning Communities".

Universal Design

The goal of universal design is to create products and environments that are useable by all people to the greatest extent possible without adaptation or specialized design (Taylor, 2008). There are seven principles that encompass of universal design[7]; (a) equitable use; (b) flexibility in use; (c) simple and intuitive use; (d) perceptible information; (e) tolerance for error; (f) low physical effort; and (g) size and space for approach and use (Taylor, 2008). Universal design when applied to school and outdoor environment design allows for students, regardless of their abilities or disabilities, to access a variety of learning environments. In the article *Sensory Integration and Contact with Nature: Designing Outdoor Inclusive Environments* (Cosco & Moore, 2009), the principles of universal design applied to Montessori schools explain the impact of the environment on behavior. The key principle is one of *territorial development*; it maintains that children have a dynamic relationship with their environment, in which they repeatedly act at their territorial limits to expand their understanding of their world. By providing environments that allow them to expand their territories within a school site the benefits of this exploration can be seen through improvements in attention functioning and cognitive development (Tennessen & Cimprich, 1995). Diverse environments allow for exploration to be presented to students through a broad range of curricular options. To meet these expectations *Outdoor Settings for Play* (Moore, 1996), presents seventeen descriptors of guidelines for school sites; those of relevance to this study include; (a) entrance; (b) pathways; (c) fences, enclosures and pathways; and (d) gathering meeting and work settings[8]. These relevant guidelines provide structure and legibility to school sites regardless of population age for the school site. While the exact programing of the site can vary depending on the age and needs of the school campus being designed further understanding for the essentials of these designs can be understood through the concept of nature play.

[7] See Appendix B: Nomenclature, for a complete definition of “Universal Design”.

[8] See Appendix B: Nomenclature, for a complete list of “Outdoor Settings Guidelines”.

Nature Play

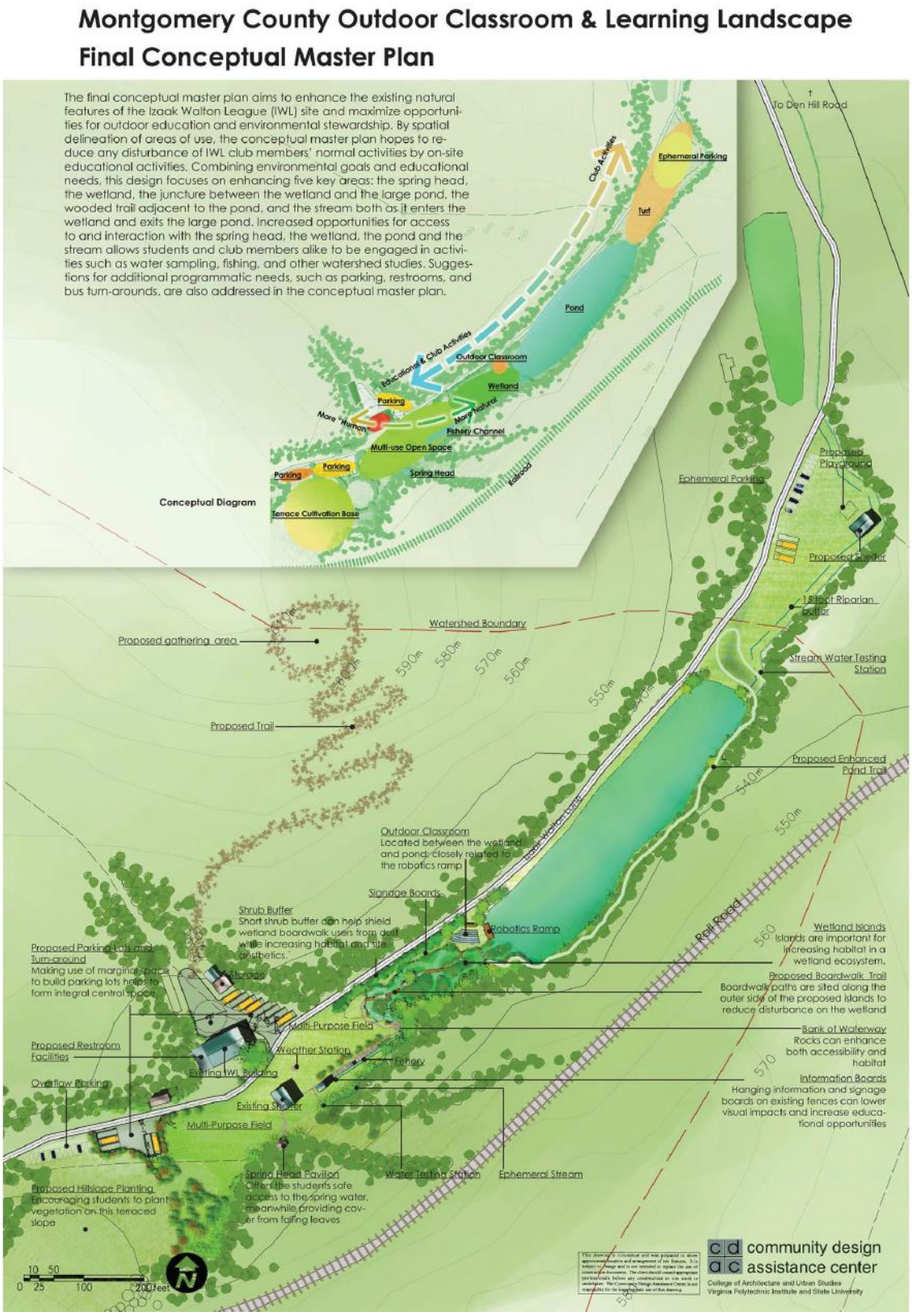
Nature Play can be described as a natural space that allows children to explore their immediate world through being together and playing together in a naturalized setting (Robin & Redmond, 2013). While nature play encompasses a broad range of experiences from 'wild' areas to local parks there are five components that are consistently present regardless of location; (a) exploratory materials; (b) unprogrammed space; (c) challenges; (d) varied activity types; and (e) interpersonal interaction (Oregon Parks and Recreation Department [OPRD], 2011). Proponents of natural play argue that nature play is a critical component in a child's development by forming connections with their imaginations as well as the natural world (Louv, 2008)

This design strategy can be identified in parks and elementary schools as an opportunity for children to interact with nature while still being in a safe environment. It is less often seen in design strategies for middle school and high school sites. The strategies of nature play are applicable regardless of the age group since the components of nature play can be modified to address any developmental stage. As students move from the lower grades into the upper grades some of the concepts of nature play can be seen in green school plans as 'teaching tools.' Each of the viewpoints presented by SLC's, Universal Design and Nature Play connect in enriching the learning environments present for students at any grade level. Even though high school students may not seem to be as physically active as they were in primary school they continue to test boundaries and look for connection with the world at large. Through Outdoor-Based Education environments designers can help educators meet these needs in an engaging way.

Precedents

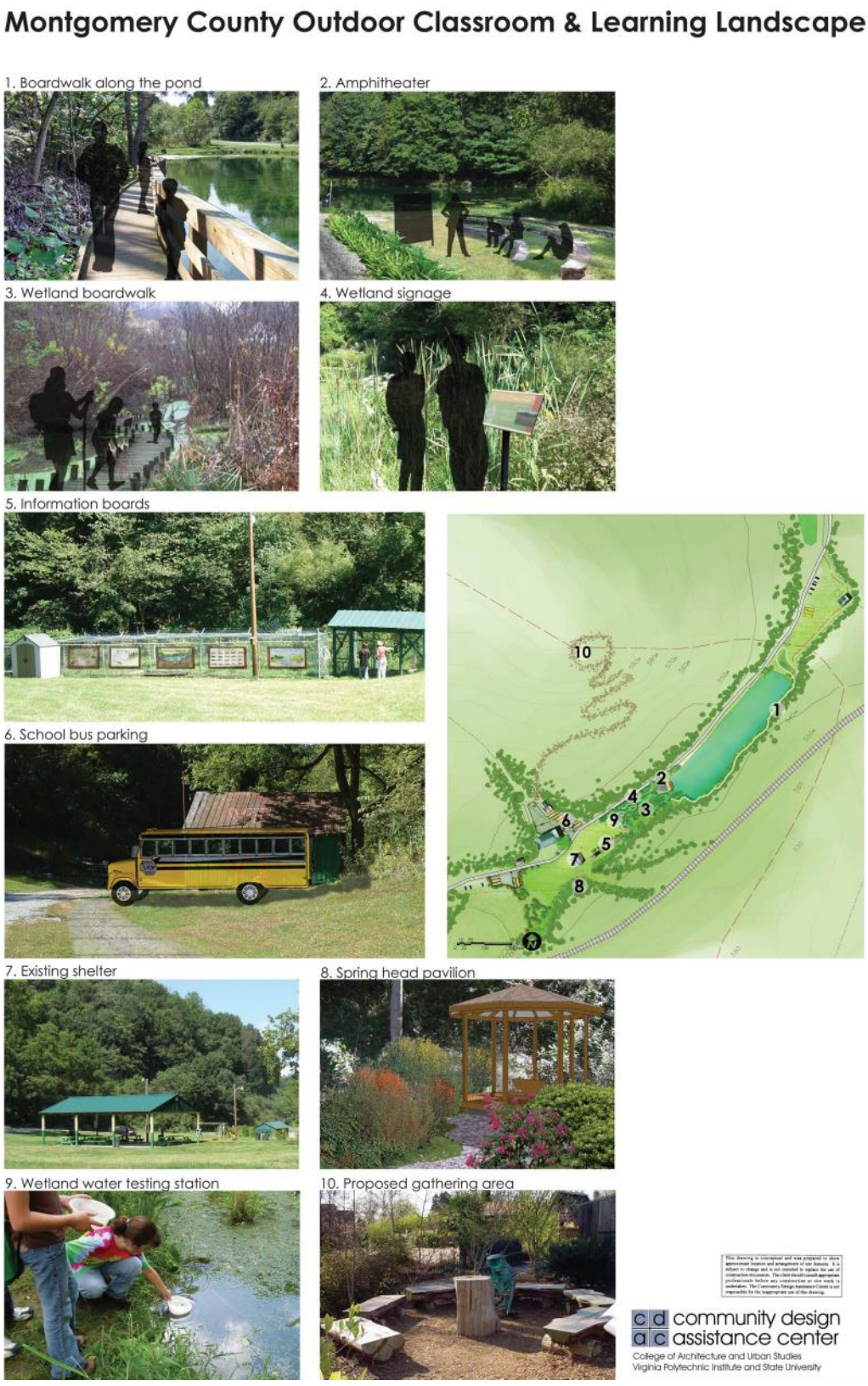
The three precedents used in this thesis include Montgomery County Outdoor Classroom (Virginia Tech, 2010), Hood River School Middle School (Mathis, 2012; Novak, 2010) and Sydnor Jennings Elementary School (Virginia Tech, 2010).

Figure 2.4 Montgomery County Precedent



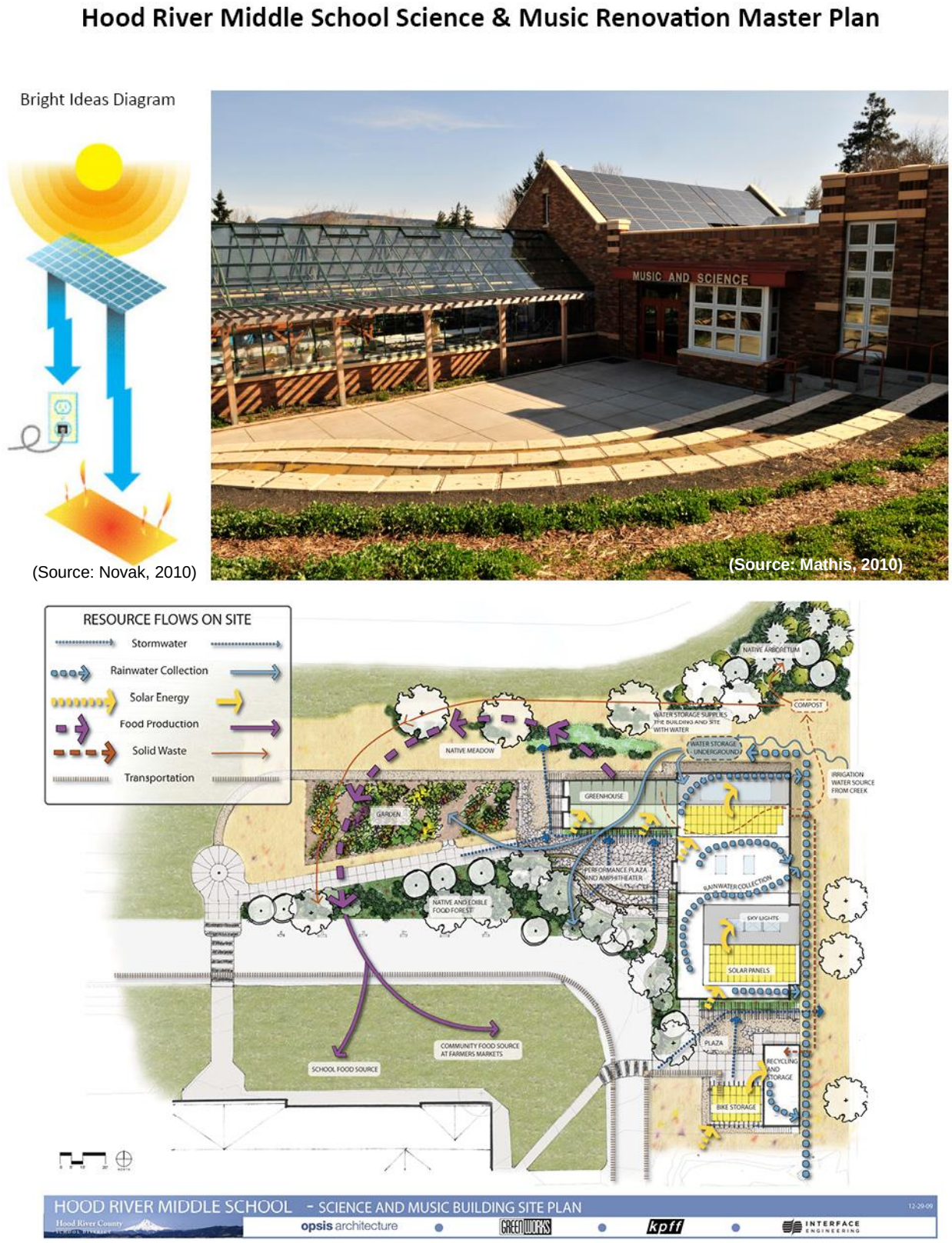
(Source: Virginia Tech, 2010)

Figure 2.5 Montgomery County Precedent



(Source: Virginia Tech, 2010)

Figure 2.6 Hood River Precedent



(Source: Novak, 2010)

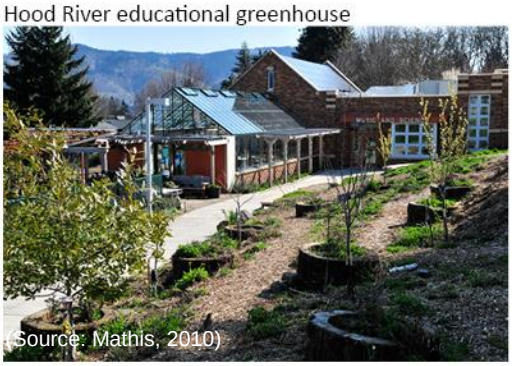
(Source: Mathis, 2010)

(Source: Mathis, 2010)

Figure 2.7 Hood River Precedent

Hood River Middle School Science and Music Renovation

Hood River educational greenhouse

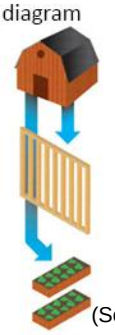


(Source: Mathis, 2010)

South side trellis

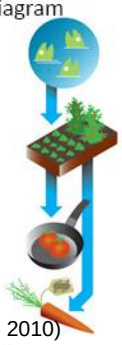
(Source: Mathis, 2010)

The New Old diagram



(Source: Novak, 2010)

Green Machines Diagram



(Source: Novak, 2010)

Outdoor classroom space

(Source: Mathis, 2010)

Raisedbed garden

(Source: Mathis, 2010)

Stormwater pathway

(Source: Mathis, 2010)

Stormwater features

(Source: Mathis, 2010)

Waterworks diagram

(Source: Novak, 2010)

Hood River Middle School's renovation adds a new music and science building, aiming for a LEED Platinum certification. Principal Brent Emmons, calls it an investment in the community's future. "This building is a teaching tool. We want to teach students early on about the importance of taking care of precious natural resources." Here's how it will work.

Bright Ideas-A 162-panel, 35-kilowatt solar power array on the roof generates all the electricity for the entire 6,300-square-foot complex. The grid powers the pumps for a radiant floor heating and cooling system. Extra-large windows and skylights reduce the need for artificial light in the new building.

Waterworks-Rainwater headed for storm drains is collected and redirected into a 14,000-gallon underground tank, which then feeds the school's toilets and garden irrigation system. The water skips the city's treatment plant, too, by draining into a bordering bioswale surrounded by native wetland plants.

Green Machines-The greenhouse's irrigation system transfers water from tilapia fish tanks to vegetable and fruit beds. The produce grown there supplies cooking classes and is sold at a farmers market held on school grounds.

The New Old-Salvaged trusses from a 1950's bus barn for the support beams of the new classrooms. Douglas firs were harvested from the original property for planter boxes amid the school's nearby fruit trees.

Figure 2.8 Sydnor Jennings Precedent

(Source: Virginia Tech, 2010)

Figure 2.9 Sydnor Jennings Precedent

(Source: Virginia Tech, 2010)

Sydnor Jennings Elementary School (SJES) serves 276 students and has 50 employees. An addition was built on the northwest side of SJES to accommodate the need for increased classroom space.

An undeveloped courtyard was retained in the center of the school complex. The courtyard is approximately 9,200 square feet. Initially designed as an 'exterior learning space', the courtyard quickly became a maintenance challenge. The grassed courtyard surface presents a maintenance challenge since it is fully enclosed within the building.

Recognizing the importance of outdoor experiential education to children's health, well-being, and academic achievement, the SJES faculty contacted CDAC to help them, "Turn the courtyard into a teaching garden for hands-on activities and experimentation." The expectation is that expanded environmental education opportunities will help boost academic achievement.

In addition, an improved courtyard would benefit the school aesthetically and instill a sense of pride and accomplishment in faculty and students.

Members of the community worked to develop a conceptual master plan for the school grounds. With the overarching goals of improving the site's aesthetics and usability through plantings that lead to improved playgrounds and exploration opportunities through walking trails.

Chapter 3 - Case Study Methodologies

Definition

Case studies are used when examining contemporary events when relevant behaviors cannot be manipulated (Yin, 1994). Case studies add direct observation and systematic interviewing to the historic evidence presented on the topic. An exploratory case study examines the relationship between site design and its use as an educational amenity.

Strategies

Yin proposes the use of case studies in research situations that look at the following; (a) policy, political science, and public administration enter; (b) community psychology and sociology; (c) city and regional planning research; and (d) to conduct of dissertations and theses in the social sciences (Yin, 1994).

A case study was chosen because it allows the investigation to retain the holistic and meaningful characteristics of real life – such as lifecycles, organizational and managerial processes, neighborhood change, international relations, and maturation of industries (Yin, 1994). Theories and questions were filtered through Yin's case study model to validate the appropriateness of a case study for this topic in a process similar to the diagram in Figure 3.1. Since the analysis was not a statistical one and involved the interaction of users and the physical context of the site, individual variables could not be detached from their context. To better understand the process of formulating the case study, explanation of the steps required to create a valid case study has been included. The creation of case study strategies and questions is a multi-step process that is discussed in the following section.

Figure 3.1 Case Study Model Validation

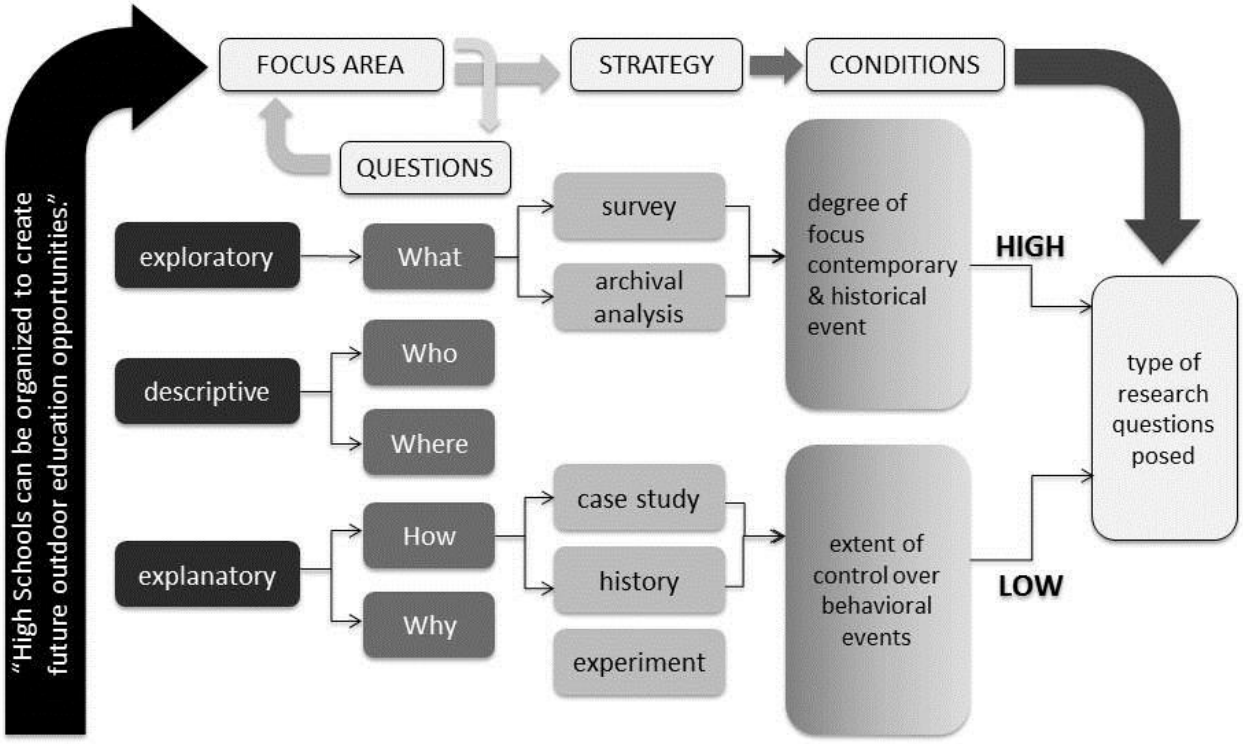
Case studies condense research into three different focus areas: exploratory, provisional, or explanatory. Case studies can look at each of these focus areas individually, or they can be investigated in combination. To understand which focus areas best address the research being conducted, they can be analyzed through the use of five research strategies: experiment, survey, archival analysis, history, and case study. All five strategies can be used; however, the extent to which each is utilized depends on three conditions; (a) on the type of research questions posed; (b) the extent of control the investigator has over actual behavioral events; (c) the degree of focus on contemporary and historical events (Yin, 1994).

Table 3.1 Research Strategy Situations

Strategy	***Form of research question***	***Requires control over behavioral events?***	***Focuses on contemporary events?***
Experiment	how, why	Yes	Yes
Survey	who, what, where, how many, how much	No	Yes
Archival Analysis	who, what, where, how many, how much	No	Yes/No
History	how, why	No	No
Case Study	how, why	No	Yes

Types of Research Questions. Categorization of the research question develops from the basic information gathering scheme of “who”, “what”, “where”, “how”, and “why”. The type of question guides how the inquiry will be organized and can be seen in Figure 3.2. The question posed: “How can future outdoor based education opportunities be anticipated by site designers of high school campus?” deals with operational links between school facilities and the design framework that has existed for these facilities. “How” questions are explanatory and lead to the use of case studies, histories, and experiments as preferred research strategies (Yin, 1994). Since this question is broad and requires further explanation, a follow-up question was posed. The secondary question, “What conditions are essential for high school campus designs to support outdoor based educational spaces?” provides clarity as it addresses the links between educational pedagogy and the school facilities. “What” questions tend to favor survey strategies or the analysis of archival records. These “what” questions look to describe the

Figure 3.2 Research Strategy Flow Chart



incidence or prevalence of a phenomena for the purpose of predicting certain outcomes rather than looking for frequencies or instances of an event (Yin, 1994). For this reason, the pairing of case study, survey, and archival analysis is best suited to the research questions posed.

Behavioral Events and Historical Events. To address the "how" questions, the relationship between histories and behavior need to be analyzed. Understanding historical events is a preferred strategy when there is no access or control over behavioral events in a research setting. Since the time frame of the history being studied is relative and can overlap with contemporary events, this research strategy intersects that of the case study.

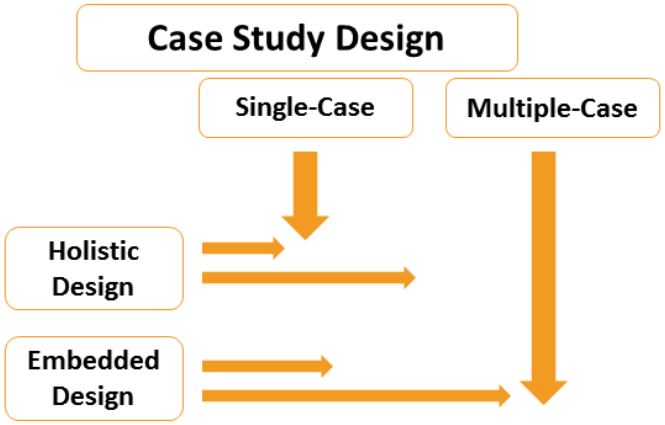
Defining Case Study as Inquiry. To understand the process required for case study, a definition must be in place. Case studies deal with; (a) the scope of the research; (b) the relationship between phenomena and the context; (c) how the resulting strategy will be defined and implemented (Stoecker, 1991). Identifying and defining the research that is being done ensures that the evidence addresses the initial research questions. The components that the research addresses include; (a) the study question; (b) its proposition; (c) the units of

analysis; (d) the link between the data and the propositions; and (e) the criteria for interpreting the findings. The following sections in this chapter will identify these components of the research design.

Methodology

Case study design is based on the relevant pair of interactions that take place within a study. The first pair of interactions, the single-case and the multiple-case studies, looks at the quantity of cases being analyzed. The next pair, holistic design and embedded design, is selected based on the units of analysis to be covered. These two pairs can be combined in a variety of ways to describe the case study being designed see Figure 3.3.

Figure 3.3 Case Study Design Diagram



Single-Case versus Multiple-Case Study Designs. The distinction between using a single-case study or multiple-case study to address the research questions should be made prior to any data collection. Single-case studies are appropriate to use in specific circumstances where rationale can be presented for its use. Most often multiple-case study design is used for comparative research (Yin, 1994). The research question established addresses multiple fields of study as well as the possibility of a variety of site conditions. Due to these conditions, it seems best that a multiple-case study be chosen so that incorrect assumptions regarding causality do not take place.

Holistic versus Embedded Case Studies Designs. Once a decision has been made between a single-case or multiple-case study, researchers must decide what the embedded units of analysis are for the study. If the research is only looking at one global unit of analysis, it is considered holistic. If the research contains several units or sub-units of analysis, it is considered embedded (Yin, 1994). This research study looks at multiple units of analysis including: how space is used; what environmental factors are important for space design; the variety of individuals using the space. The research is addressing a multiple unit of analysis due

to the links that are present between the site, the building, and the users. Each component of the analysis provides data on specific aspects of the site or its use. The topic of this research investigates the overlap between these units of analysis.

Establishing Validity

To ensure the replication logic is consistent across multiple studies, a framework was established to state the conditions under which the phenomenon are and are not likely to be found. In doing so, other researchers will be able to predict similar results or predict contrasting results for predictable reasons (Yin, 1994). Four aspects of the case study quality[9] that need to be considered include; (a) construct validity; (b) internal validity; (c) external validity; and (d) reliability (Kidder & Judd, 1991). In laymen's terms the design of one's research should deal with at least four problems: what questions to study, what data are relevant, what data to collect, and how to analyze the results (Philliber, Schwab, & Sloss, 1980). The steps completed to establish validity during this research study are listed in Table 3.2.

*Constructed validity***.** To meet the test of constructed validity, an investigator must be sure to cover two steps; (a) Select the specific types of change that are to be studied (In relation to the original objectives of the study) and (b) demonstrate that the selected measures of these changes do indeed reflect the specific type of change that has been selected (Yin, 1994). In this research study the change to be studied is how outdoor spaces can be shaped and located on the site to maximize their use for outdoor based education. The measures that will be used to reflect the change selected are the conditions that affect how a space can be used: environmental, space requirements, activity type, circulation, access and proximity.

Internal validity. Internal validity is a priority for explanatory case studies, in which the investigator is trying to determine whether event X led to event Y. Internal validity, for case study research, also establishes that correct inferences are being made since every event cannot be directly observed every time (Yin, 1994). To establish internal validity within this study, the variables that were used to analyze the site and its use as an educational setting

[9] See Appendix B: Nomenclature, for a complete definition of "Case Study Quality".

were defined and quantified. Each variable contained additional sub units to fully encompass all elements of the research design.

Table 3.2 Case Study Validity Tests

Tests	*Case Study Tactic*	*Research Phase of Tactic*	*Action Taken in this Research*
Constructed Validity	Use multiple sources of evidence	Data collection	Use of documentary evidence, physical artifacts, interviews, survey and site visit.
	Establish chain of evidence	Data collection	Interviews transcribed in real-time, survey data collected and compiled into a database, documentary evidence compiled into a database.
	Have key informants review draft case study report	Composition	Documentary evidence and survey reviewed by key informants before publication.
Internal Validity	Do pattern matching	Data analysis	Patterns identified across cases.
	Do explanation building	Data analysis	Some causal links identified.
	Do time series analysis	Data analysis	Not performed in this research.
	Do logic models	Data analysis	Not performed in this research.
External Validity	Use rival theories within single cases	Research design	Not used because of exploratory nature of research.
	Use replication logic in multiple-case studies	Research design	Multiple cases investigated using replication logic.
Reliability	Use case study protocol	Data collection	Same data collection procedure followed for each case. Consistent set of initial questions used in each interview.
	Develop case study database	Data collection	Surveys, interview transcripts, notes and other physical artifacts entered into database.

External validity. External validity allows other researchers to know whether the study's findings can be generalized beyond the immediate case study; this generalization is not automatic. The theory must be tested through applications of the findings in a second or even third location where the theory has specified that the same result should occur (Yin, 1994). To verify that the research being completed would be relevant to the design and educational

communities, historic research on design and educational pedagogy was completed. Precedent studies are also provided to show existing examples of implementation of related concepts. This research explains the correlations between the research and the community at large. In addition all schools studied are located in the same /county/region/state to reduce the number of independent variables.

Reliability. A future lead investigator should be able to follow exactly the same procedures as described by the initial investigator and the lead investigator should arrive at the same findings and conclusions. This requires the establishment of a case study protocol to minimize the errors and biases in a study (Yin, 1994). The case study protocol established for this research is discussed in further detail in the next section, Protocol Development. The number of case studies necessary is also a decision was related to the reliability of a study. This decision is based on the number of case replications that would substantiate the research and provide appropriate external validity. The optimal number of case studies used in the research was three as this allowed for analysis of sites with existing, retrofitted, and unmodified designs.

Protocol Development

A protocol is an instrument that contains the procedures and general rules that should be followed in using the instrument, in this case a survey of site users. A protocol should include the following; (a) overview of the case study project; (b) field procedures; (c) case study questions: and (d) a guide for the case study report (Yin, 1994).

Case Study Overview. The overview provides background information about the research conducted.

Substantive issues being investigated. Many aspects qualities of design and campus planning were considered for this research study. The scope of this investigation will be limited to the following topics; (a) building-to-site relationships; (b) usability variables; (c) space requirements for outdoor based education; and (d) activity type.

Relevant readings. Resources for this case study were gathered from many sources, and the connections are discussed in chapter two. A summary of the relevant readings can be found in Table 3.4.

Hypothesis being examined. Can a framework be established to provide for and increase the variety of suitable spaces for outdoor based education?

Rationale for site selection. The site for this case study was selected based on the following criteria:

- *Proximity. All school locations were within the same state and county, Sedgwick County, in Kansas. This allowed the populations sampled to have a higher degree of similarity in regard to educational standards and demographics.*
- *School Size. The Goddard School District and the Maize School District were chosen based on their similarity to other suburban schools in the state of Kansas. This allowed for generalization/inferences to be made that could apply to similar populations in the United States.*
- *Design Criteria. The three schools were chosen to represent a cross-section of school types and design phases present: retrofitted, the original building was designed with no or limited outdoor based education spaces; existing, the original building was designed with outdoor based education spaces in the plan; control, the building was not designed with outdoor based education spaces and have not be retrofitted.*

Broader relevance of the inquiry. The purpose of the inquiry is to analyze the components that allow a space in a campus to be considered suitable for use by teachers, students, and community members for outdoor based education. From a design perspective initial site analysis focused on its suitability for the building and other infrastructure components. How the site will work for the end user is considered after many important site decisions are finalized. The goal in creating a framework for site planning is to allow the end users' needs to be considered earlier in the planning process thus allowing for a greater impact to be made for the end users.

Project statement. The following information was provided to subjects of the study as an explanation of the research being conducted.

The benefits of engaging students with the natural environment have been found to be beneficial to both cognitive and physical development. An increasing number of architecture and landscape architecture firms are addressing the emerging field of environmental-based educational design. It has also been found that successful use of the site requires input and buy-in from stakeholders such as teachers, students, and community members. Such buy-in requires flexible site plans that allow for adaptable spaces for changing needs and requirements

of those stakeholders. To this end, site planning and design of exterior spaces should focus on creating opportunities for environmental-based education for end users rather than static design plans.

This research will address how current high school campus plans use exterior site space for environmental-based education opportunities. The research will evaluate the site plans of three schools to see how they perform within the established framework of variables that focuses on how the site performs as an outdoor education setting. To substantiate the site analysis research, surveys will also be submitted to existing site users (teachers) to better understand the priority of these variables to the end user.

Field Procedures. Since the research will take place in a real world situation, there is a lack of control over the data collection environment. This means the nature of the interviews is more open-ended and full cooperation may not be forthcoming. Observations also suffer from similar problems since the researcher is intruding into the subjects' world to make observations (Yin, 1994). The tasks necessary for preparation of field research are listed in Table 3.3.

Table 3.3 Field Procedures Table

Procedure	***Task***
Data Collections Tasks	Teacher surveys Site variables table
Access To Key Organizations	Goddard School District Maize School District
Schedule Of Data Collection Activities	Survey Creation-Dec 2012 Site Visit-Jan 9-11 2013 Follow Up Visit-Jan 29 2013 Survey Database Creation-Feb 2013 Survey Database Analysis- Feb 2013 Secondary Follow-up Survey- March 2013
Providing For Unanticipated Events	Contact information of building staff Incomplete Surveys Additional Site Information

Triangulation

Case study research takes advantage of the method of triangulation to establish validity in a qualitative study. The five types of triangulation; data, investigator, theory, methodological, and environmental triangulation are described in (Guion & Diehl, 2011). For this case study data triangulation and methodological triangulation are used, see Table 3.4.

Table 3.4 Triangulation Types

Triangulation Type	***Resource***	***Example***	***Validity***
Data source	During the analysis stage, feedback from the stakeholder groups would be compared to determine areas of agreement as well as areas of divergence.	researchers, community members, teachers, and school administrators	The use of different sources of information in order to increase the validity of a study.
Investigator	Using several different investigators in the analysis process then compare the findings from each evaluator to develop a broader understanding.	multiple investigators in the same field	Validity is established if investigators come to the same conclusions.
Theories	Use of multiple perspectives to interpret a single set of data using professionals outside of a particular field of study since Individuals from different disciplines bring different perspectives.	multiple investigators from different fields	Therefore if each evaluator interprets the information in the same way, then validity is established.
Methodological	The use of multiple qualitative and/or quantitative methods to study the program,	compare results from surveys, focus groups, and interviews	If the conclusions from each of the methods are the same, then validity is established.
Environmental	Uses different locations, settings, and other key factors related to the environment in which the study took place, such as the time, day, or season. Next identify environmental factors that influence the information.	varying locations or seasons when the surveying took place	If these factors can be changed but the findings remain the same across varying environmental conditions, then validity has been established.

Evidence

To make best use of the evidence collected, the three principles of data collection were applied to the evidence. The principles of data collection are; (a) multiple sources of evidence (triangulation); (b) case study database collections including evidentiary data-based reports, articles, books, and chain of evidence. Sources of evidence[10] included documentation, archival records, interviews, direct observation, participant-observation, and physical artifacts. By gathering evidence from multiple types of sources, the validity of the research is stronger. The sources of evidence used for the research included documentation, archival records, interviews, and direct observation.

Interpretation

Four dominant analytic techniques[11] exist to allow data to be prioritized and understood. These techniques are pattern-matching, explanation-building, time-series analysis, and program logic models. The analytic technique that is most appropriate for this research is explanation-building. Explanation-building analyzes case study data by building an explanation about the case & identifying a set of causal links (Yin, 1994). The explanation building process is a result of series of iterations to refine and revise the proposition until it clearly explains the case study findings. Because of this iterative process the final explanation provided by the case study may not have been expected at the beginning of the process, thus providing a new perspective on the proposition.

Case Studies

Case studies were completed for the following schools; Goddard High School, Eisenhower High School, and Maize High School. To ensure validity, the three schools' demographics are listed in Table 3.5 and Table 3.6 (Kansas State Department of Education [KSDE], 2011).

[10] See Appendix B: Nomenclature, for a complete definition of "Sources of Evidence".

[11] See Appendix B: Nomenclature, for a complete definition of "Analytic Techniques".

School Demographics Background. The data compiled in Table 3.6 provides a baseline by which to compare the three schools. The data used was the total building enrollment (proxy for sample size) and percent of students on free or reduced lunch (proxy for socio-economics of neighborhood). Map 3.1 provides free and reduced lunch demographic data for the state of Kansas as a comparison to the individual school data provided in Table 3.5. Data collected is from the 2011-2012 school year (Kansas State Department of Education [KSDE], 2011).

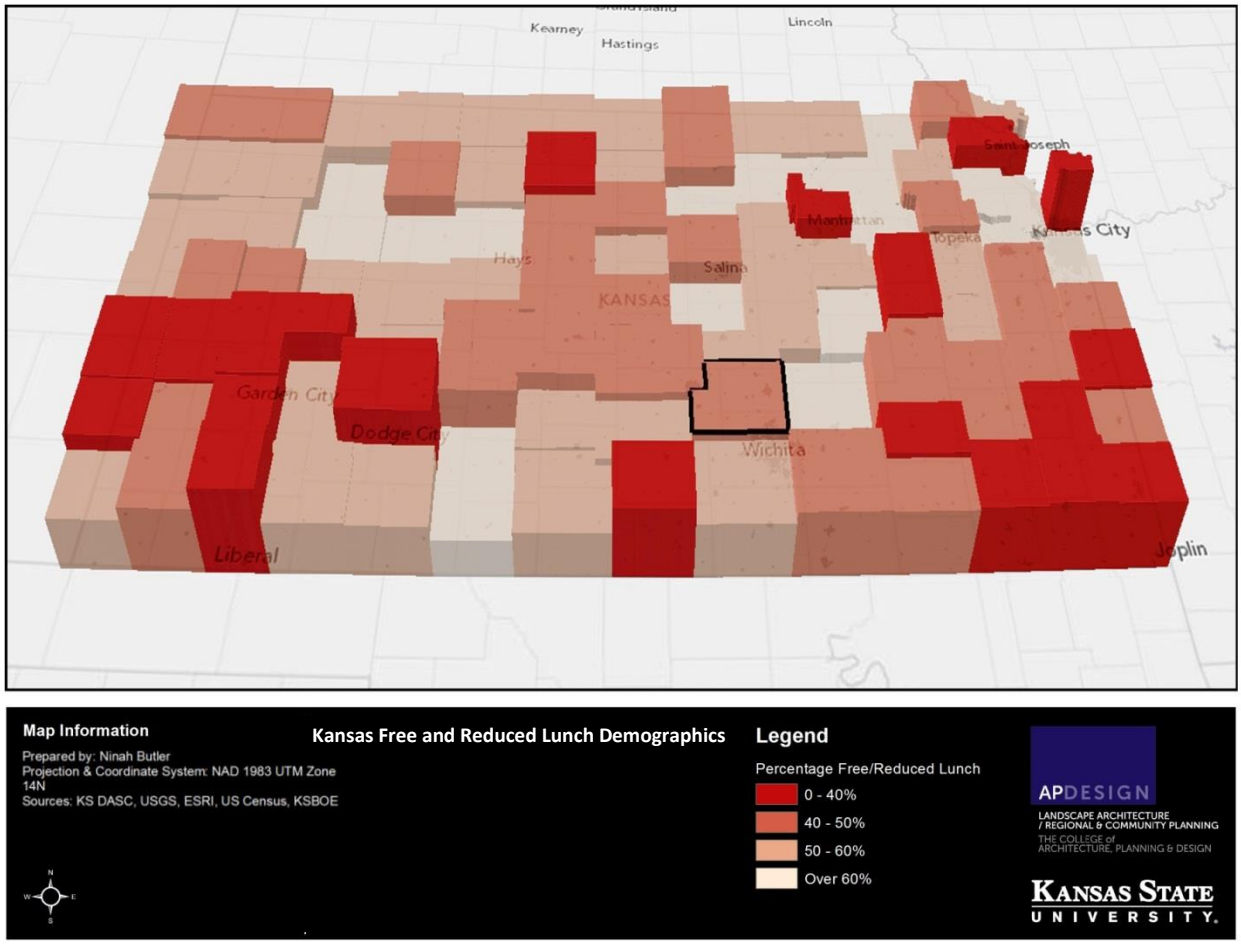
Table 3.5 Case Study District Demographics

Demographics	*Goddard School District*	*Maize School District*	*State of Kansas*
Total Enrollment 9-12	1,639	2,182	129,177 or 452/District
Total District Enrollment K-12	5,316	6,922	455,028 or 1,591/District
Percent of Student Population on Free or Reduced Lunch	25.75%	16.63%	48.68%
Pupils Transported over 2.5 mi.	3,458	4,544	134,614.5 or 470.7/District

Table 3.6 Case Study Building Demographics

Demographics	*Goddard High School*	*Eisenhower High School*	*Maize High School*
Total Building Enrollment	898	741	1,490
Total District Enrollment	5,316	5,316	6,922
Percent of Student Population on Free or Reduced Lunch	31.74%	18.76%	15.84%
Building Age	16 years	2 years	10 years

Map 3.1 Kansas Free and Reduced Lunch Demographics

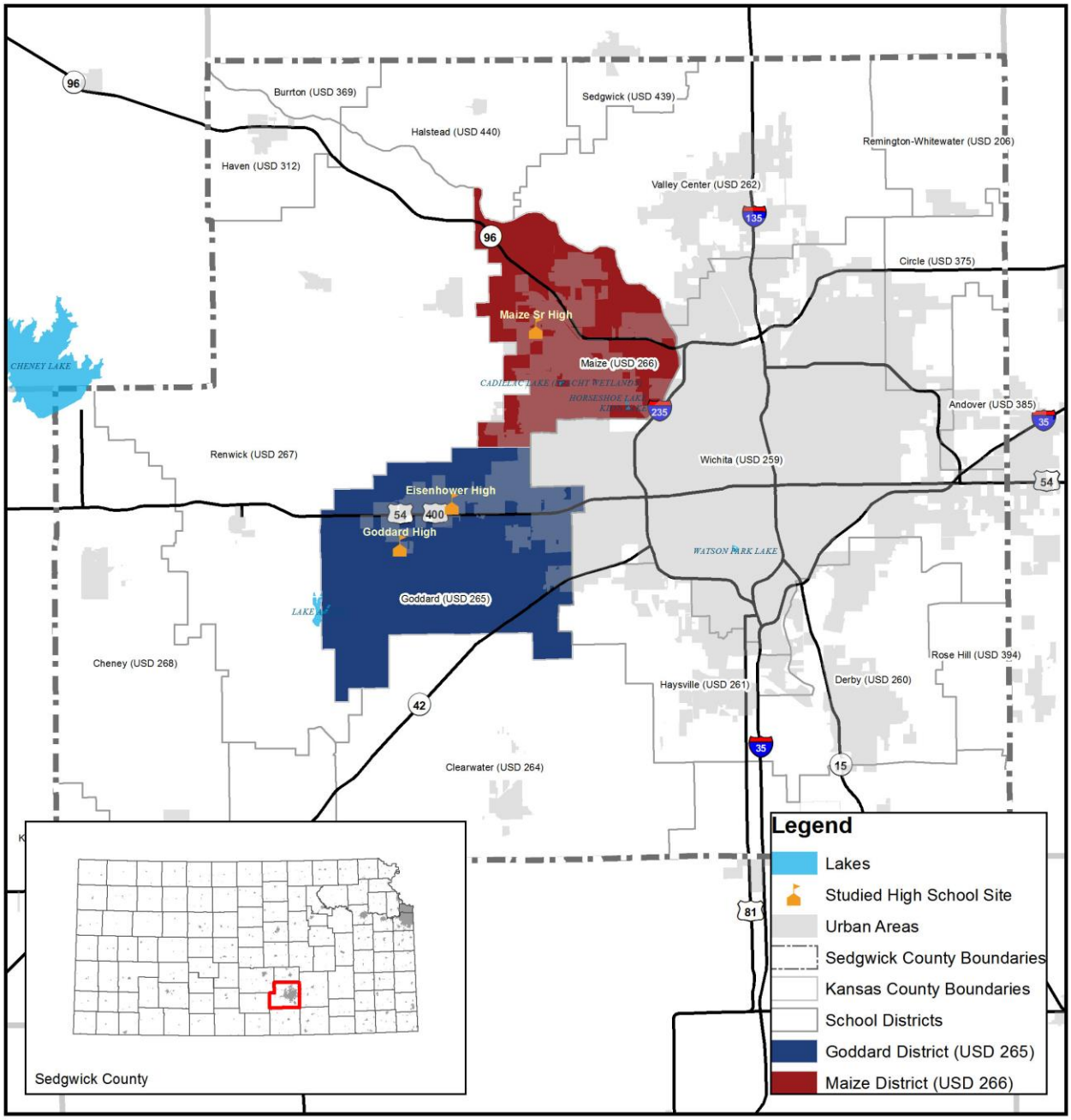


Site Reference Maps

District and School Maps

Map 3.2 is a reference map of the study areas within Sedgwick County. Map 3.3 and Map 3.6 show the district boundaries for the Goddard and Maize School Districts in Wichita, Kansas. Following each district map are Map 3.4 Map 3.5 and Map 3.7 identifying the existing site conditions as well as the sites within the campus that are used in the case studies.

Map 3.2 Case Study Reference Map



Map Information

Prepared by: Ninah Butler
Projection & Coordinate System: NAD 1983 UTM Zone 14N
Sources: KS DASC, USGS, ESRI, US Census, KSBOE

1 in = 5 miles
1 inch = 26,400 feet

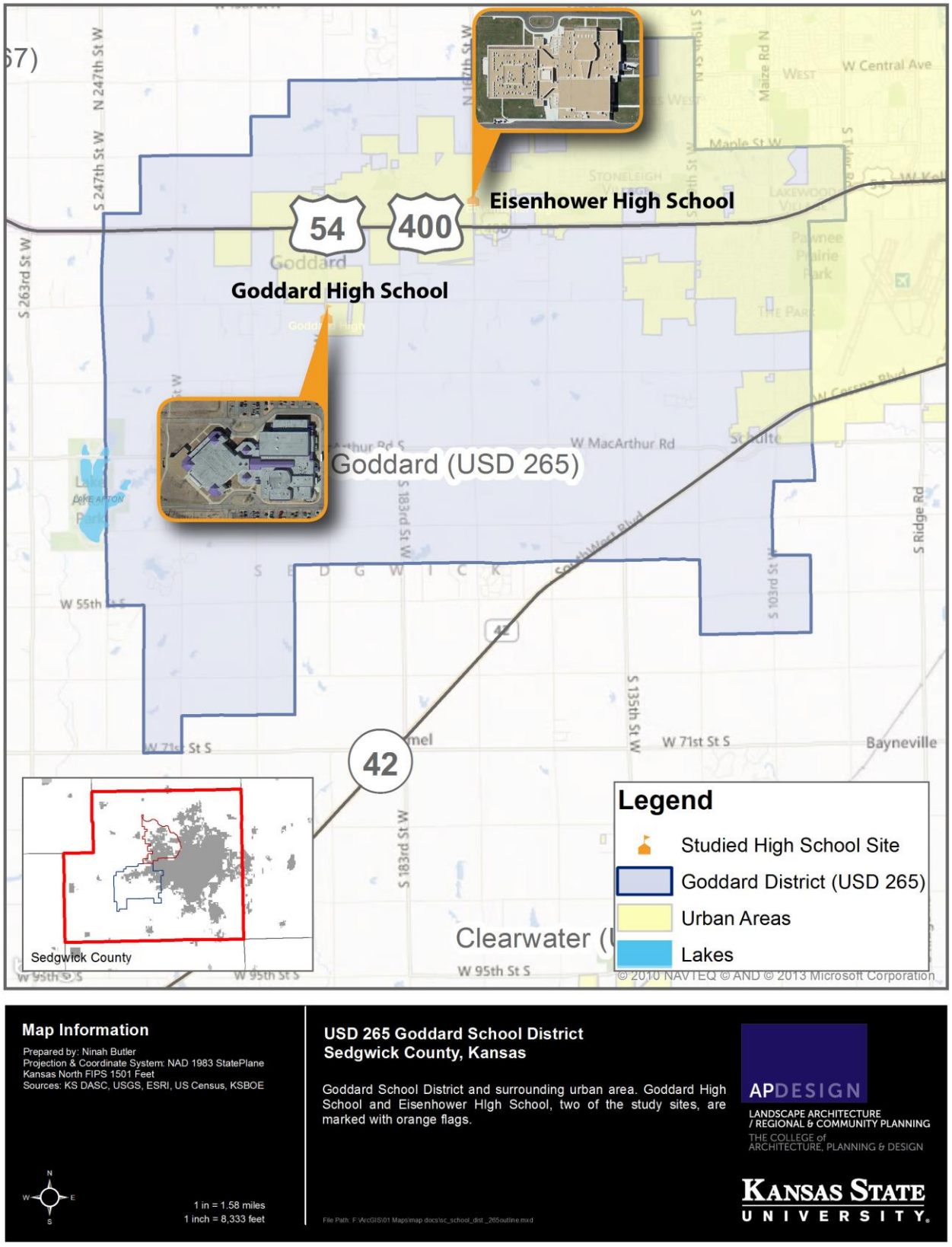
File Path: F:\ArcGIS\01 Maps\map docs\sc_school_dist _2.mxd

Sedgwick County, Kansas School Districts

The Goddard School District,USD 265 and the Maize School District, USD 266 are shown in the map above in their respective school colors. The populated area's of the district s are shown as a grey overlay. The three campus' visited are marked by an orange flag.

APDESIGN
LANDSCAPE ARCHITECTURE / REGIONAL & COMMUNITY PLANNING
THE COLLEGE of ARCHITECTURE, PLANNING & DESIGN
KANSAS STATE UNIVERSITY

Map 3.3 USD 265 Goddard School District



Map Information

Prepared by: Ninah Butler
Projection & Coordinate System: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Sources: KS DASC, USGS, ESRI, US Census, KSBOE

1 in = 1.58 miles
1 inch = 8,333 feet

File Path: F:\ArcGIS\01 Maps\map docs\sc_school_dist _265outline.mxd

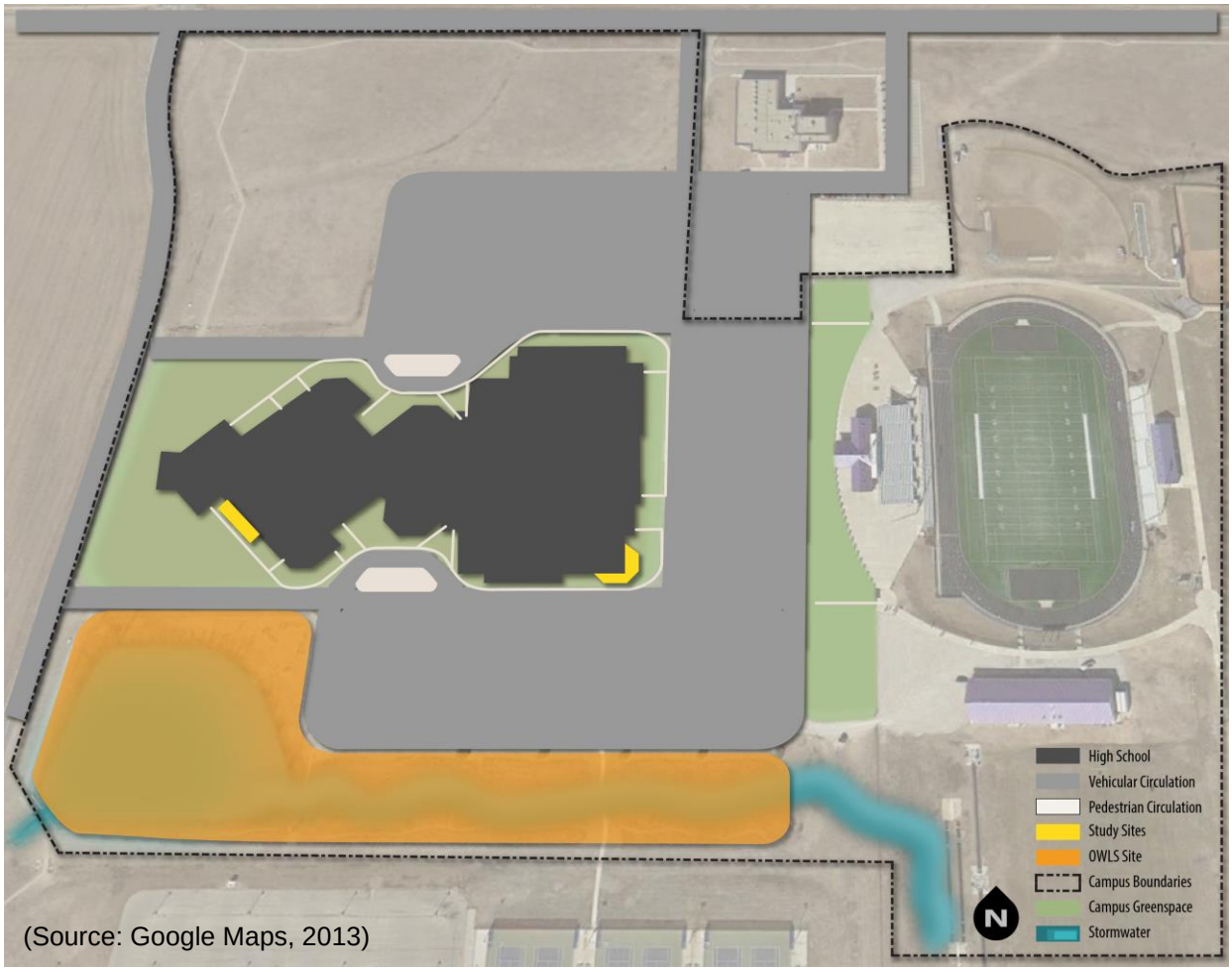
USD 265 Goddard School District
Sedgwick County, Kansas

Goddard School District and surrounding urban area. Goddard High School and Eisenhower HIgh School, two of the study sites, are marked with orange flags.

APDESIGN
LANDSCAPE ARCHITECTURE / REGIONAL & COMMUNITY PLANNING
THE COLLEGE of ARCHITECTURE, PLANNING & DESIGN

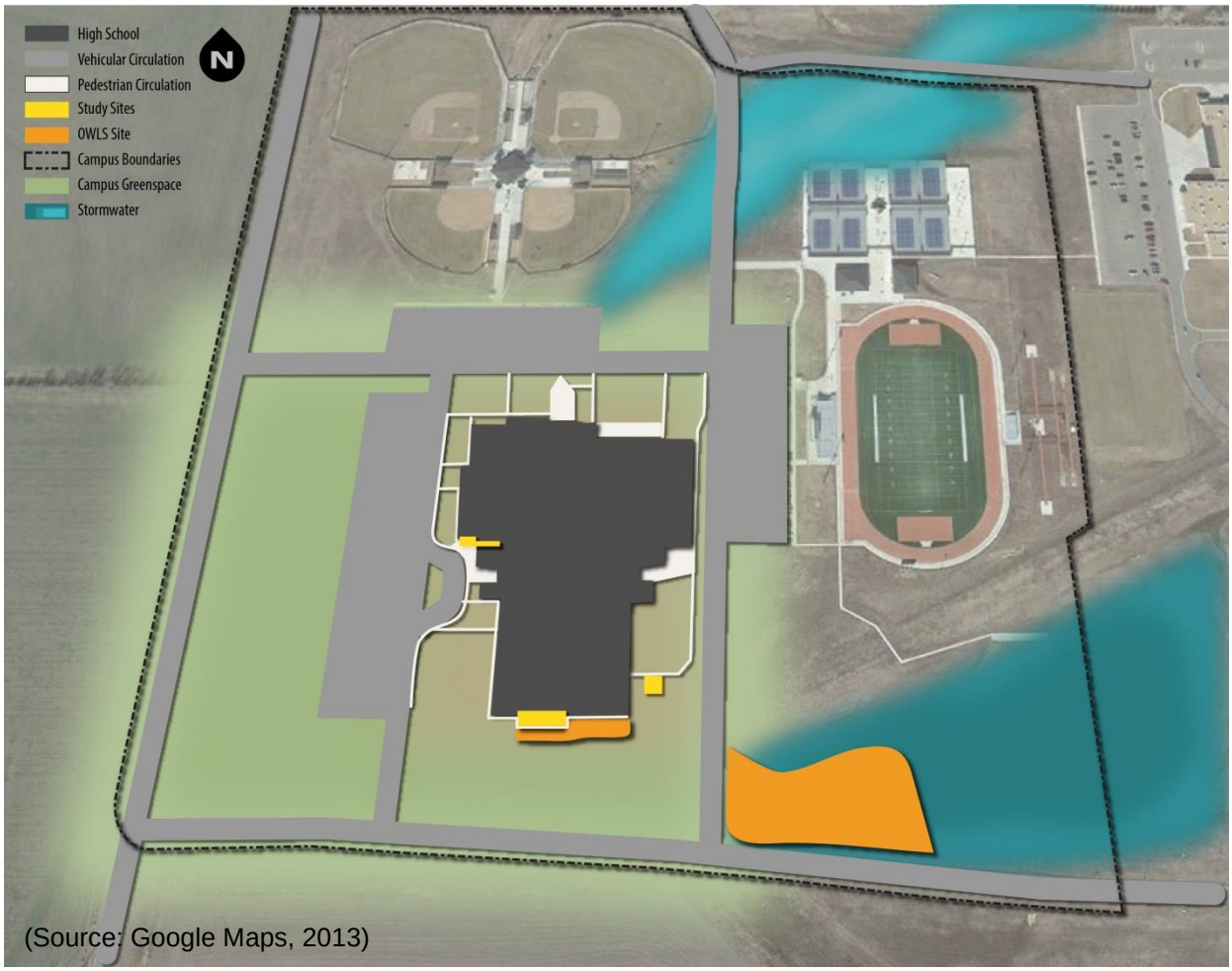
KANSAS STATE UNIVERSITY

Map 3.4 Goddard High School Site Inventory



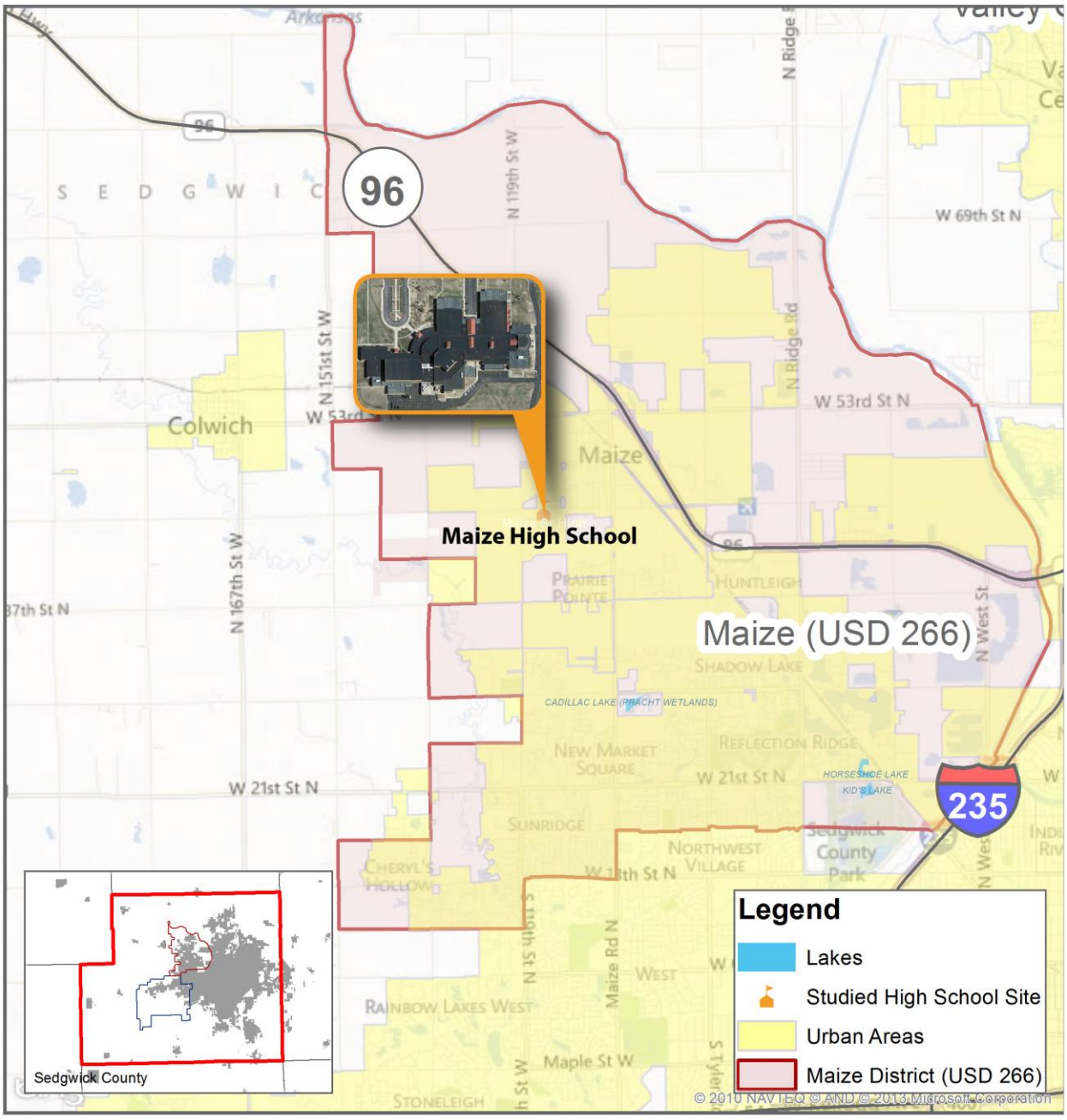
(Source: Google Maps, 2013)

Map 3.5 Eisenhower High School Site Inventory



(Source: Google Maps, 2013)

Map 3.6 USD 266 Maize School District



Map Information

Prepared by: Ninah Butler
Projection & Coordinate System: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Sources: KS DASC, USGS, ESRI, US Census, KSBOE

1 in = 1.42 miles
1 inch = 7,500 feet

File Path: F:\ArcGIS\01 Maps\map docs\sc_school_dist _266M.mxd

USD 266 Maize School District Map
Sedgwick County, Kansas

Maize School District and surrounding urban area. Maize High School, one of the case study sites, is marked with an orange flag.

APDESIGN
LANDSCAPE ARCHITECTURE / REGIONAL & COMMUNITY PLANNING
THE COLLEGE of ARCHITECTURE, PLANNING & DESIGN
KANSAS STATE UNIVERSITY

Map 3.7 Maize High School Site Inventory

(Source: Google Maps, 2013)

Chapter 4 - Research Findings

Site Checklist and Inventory

This section of research will present the observation made during the site visit of the three high schools. The observations of the sites are based on a checklist addressing fours areas of interest, which will be referred to as variables, include; (a) environmental factors, (b) space requirement, (c) activity type, and (d) building to site relationship. These variables were further sub divided to create measurable units for the checklist[12].The data from the checklists was used to create Figure 4.1 through Figure 4.10. The correlation between the variables and the research question can be seen in Table 4.1.

Table 4.1 Variables Table

Variables	***Research Question***
spaces on the site	outdoor based education of high school campus
space is being used	opportunities anticipated on school campus
access points	essential conditions to support outdoor based education
performs based on the variables	essential conditions to support outdoor based education

Each of variables contributes to understanding how to design sites for future use by teachers and students. In addition to the variables, the presence or absence of outdoor based education spaces on a campus provides information about the significance of outdoor based education to teachers when designing lesson plans and curriculum. Looking at the use of these existing spaces give examples of how the space is used and what variables are present. The regularity of access associates to utility and usability. This relationship is further substantiated how the variables perform on the checklists and on the survey showing the importance of variables to end users. The survey results were used to prioritize the variables and identify usefulness by end users. These results will be further discussed in the following section, Survey Data Collection.

[12] See Appendix E & F, Site Checklist and Revised Site Checklist for further information.

Variation/Error

Modifications were made to the site checklist after the initial visit to clarify and identify the parameters of the survey. Completed checklists were reviewed based on the updated checklist and adjustments were made as necessary to clarify the performance of the site. Changes to the checklist can be seen by comparing the two checklists in Appendix D.

Goddard High School

Goddard High School was designed with a greenhouse and an art patio. After occupancy teachers modified the site to include the Outdoor Wildlife Learning Site (OWLS). There are three outdoor based education spaces on the site; OWLS, the greenhouse, and the art patio. Their designated use is as follows; (a) OWLS, science education; (b) greenhouse, storage, plant starting, plant experiments; and (c) art patio, drawing, pottery, writing.

Figure 4.1 GHS OWLS Inventory

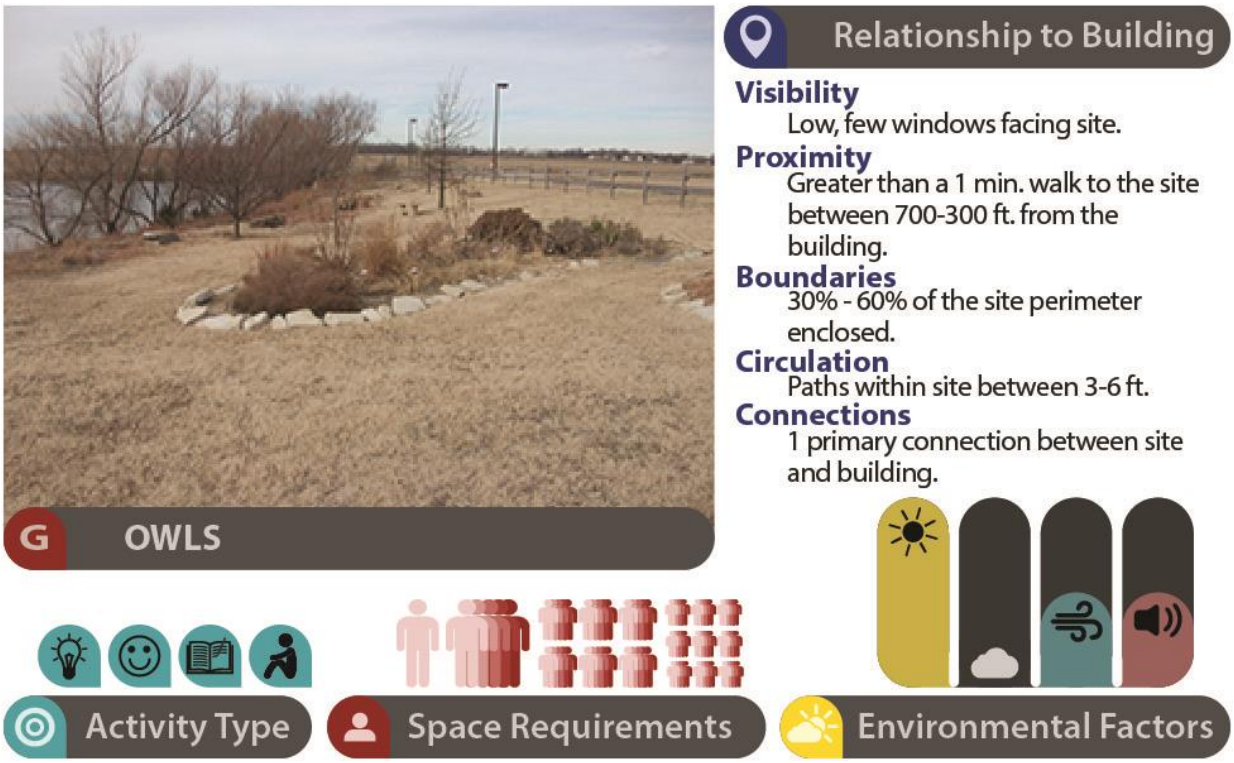


Figure 4.2 GHS Greenhouse Inventory

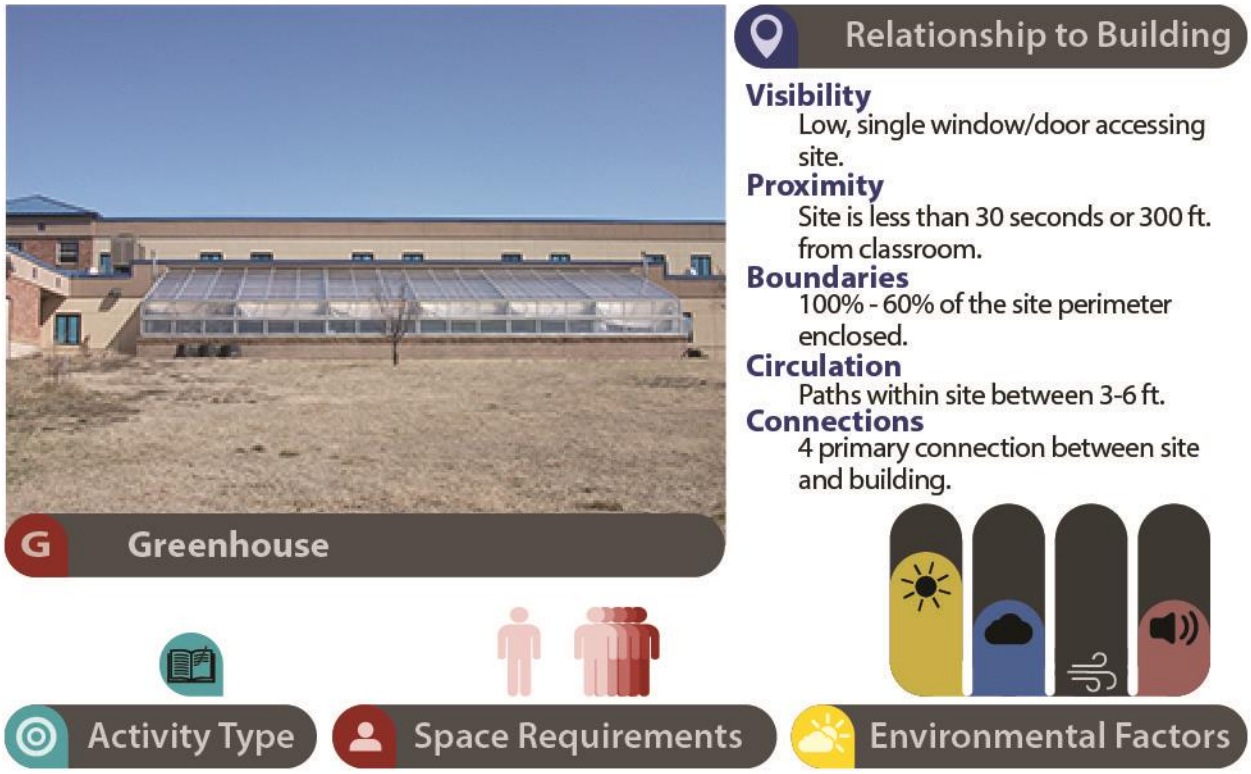
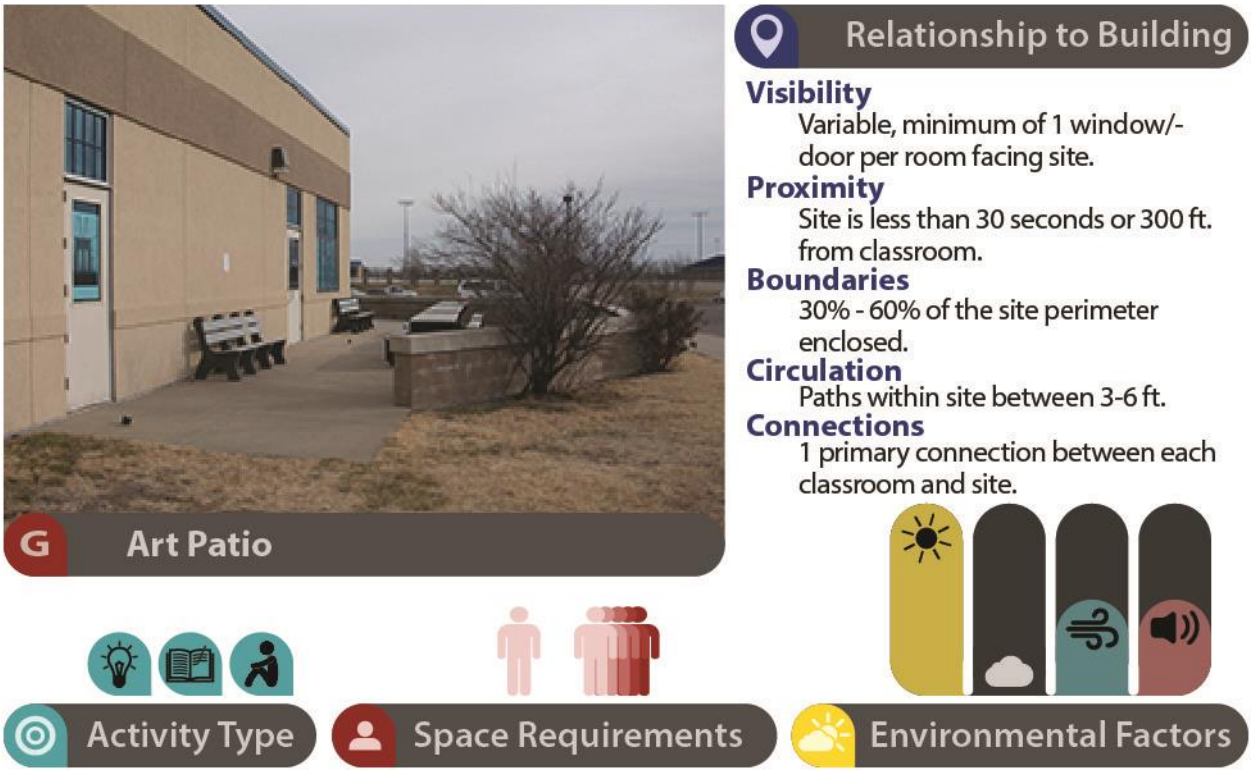


Figure 4.3 GHS Art Patio Inventory



Eisenhower High School

Eisenhower High School was designed with three outdoor education spaces in the campus plan with the identification of the future addition of the pergola and the OWLS space once occupancy began. There are four outdoor based education spaces on the site; OWLS, the greenhouse, the reading patio, and the pergola. The following tables summarize how each space performs based on the site checklist. Their designated use is as follows; (a) OWLS, science education; (b) greenhouse, storage, plant starting, plant experiments; (c) reading patio= reading, group discussion; and (d) pergola, writing assignments, observation, reading.

Figure 4.4 EHS OWLS Inventory

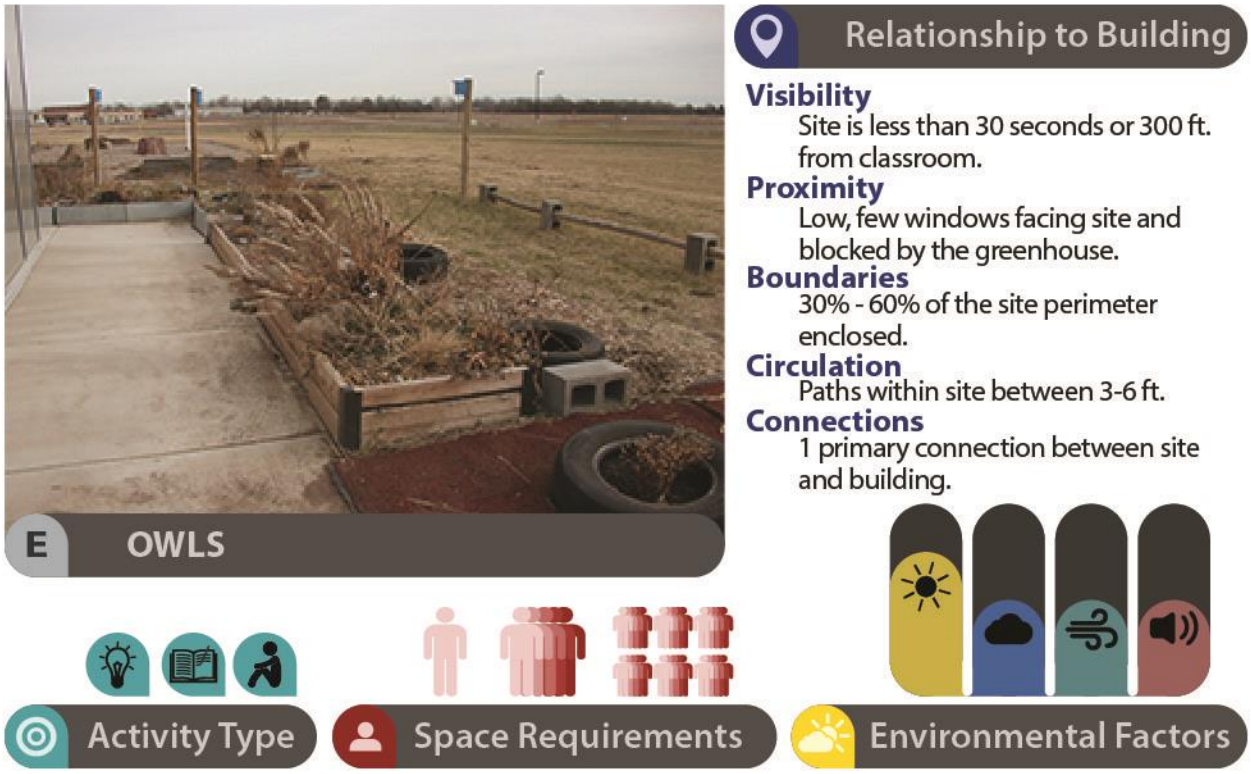


Figure 4.5 EHS Greenhouse Inventory

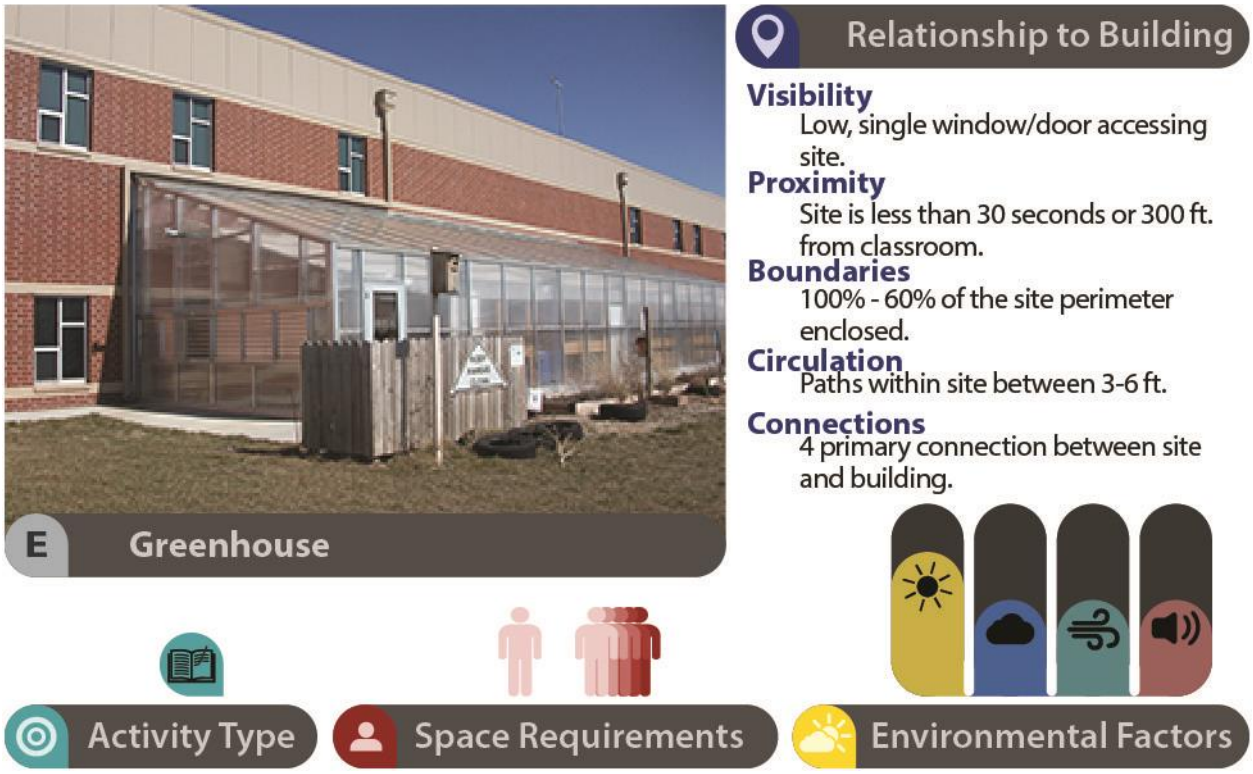


Figure 4.6 EHS Pergola Inventory

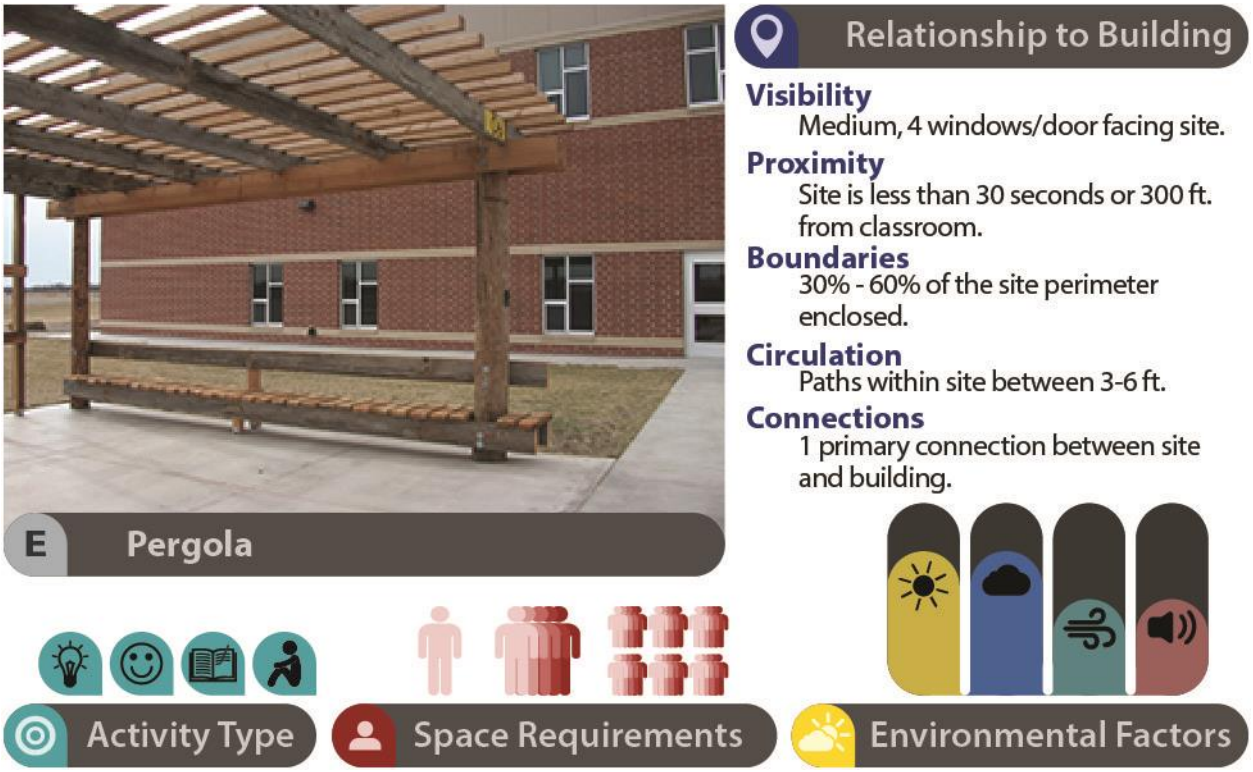
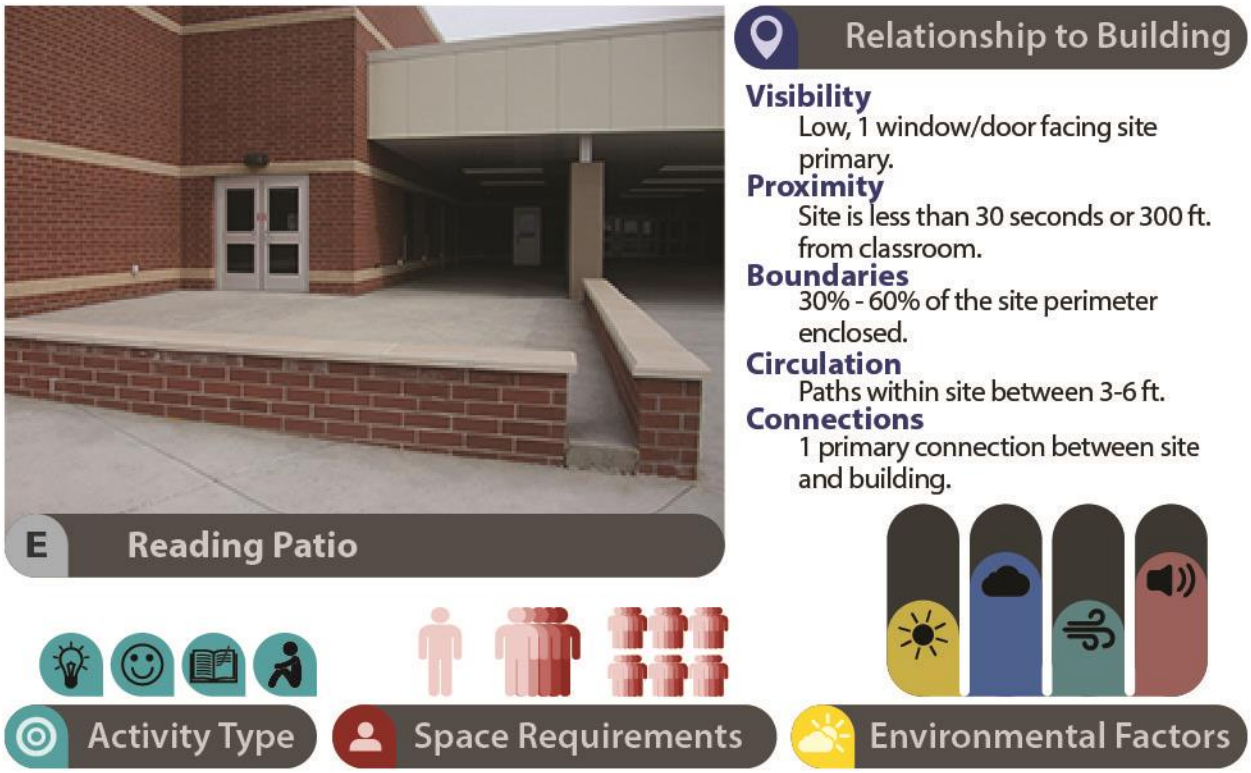


Figure 4.7 EHS Reading Patio Inventory



Maize High School

Maize High School was designed with an entry patio and an access patio near the art classrooms. After occupation teachers adapted the site to include the xeric garden. There are three outdoor based education spaces on the site; the entry, the art patio, and the xeric garden. The following tables summarize how each space performs based on the site checklist. Their designated use is as follows; (a) entry, general gathering space; (b) xeric garden, student observations, plant investigations; and (c) art patio, drawing, pottery.

Figure 4.8 MHS Entry Inventory

Figure 4.9 MHS Xeric Garden Inventory

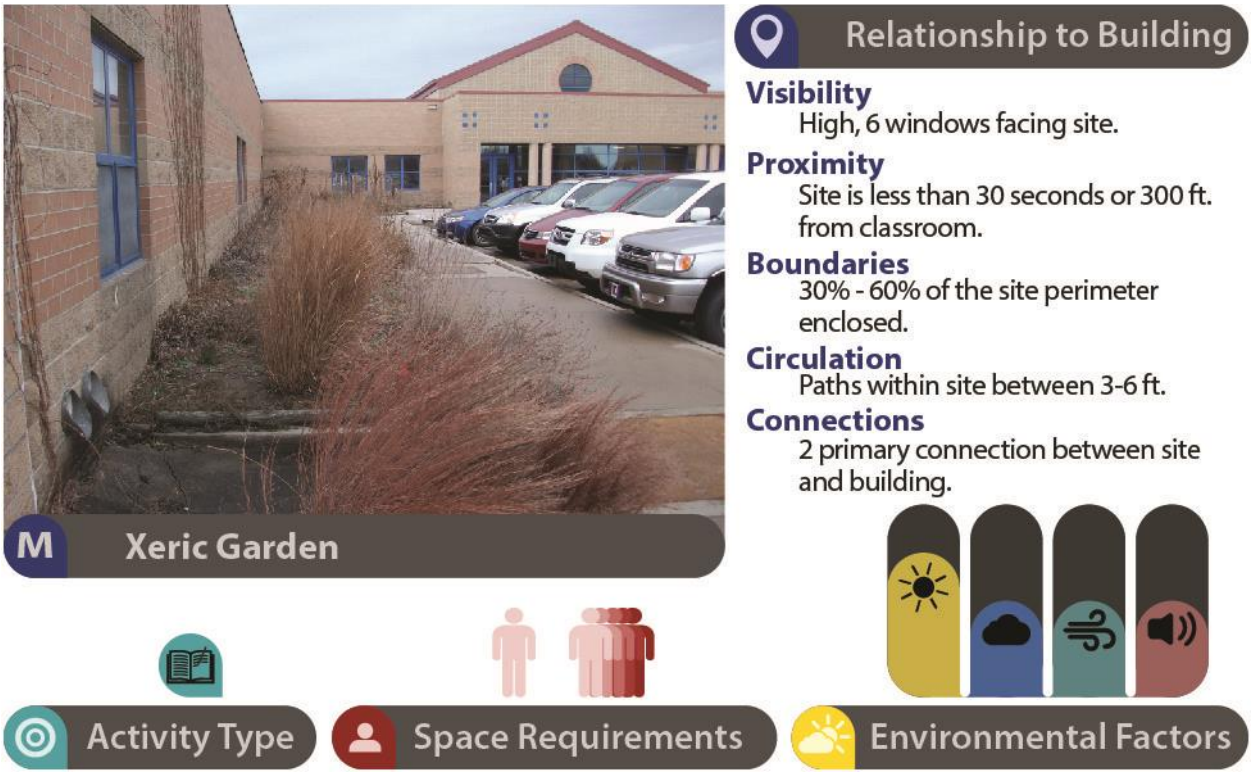
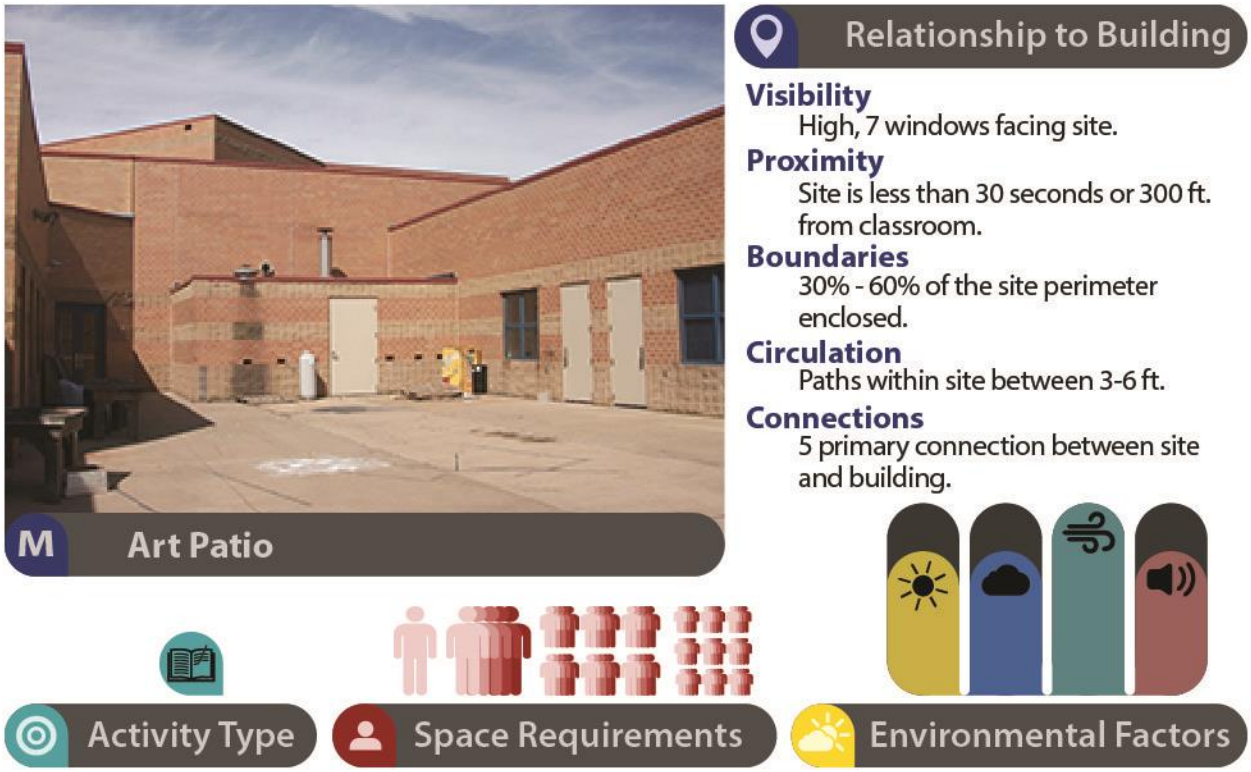


Figure 4.10 MHS Art Patio Inventory



Survey Data Collection

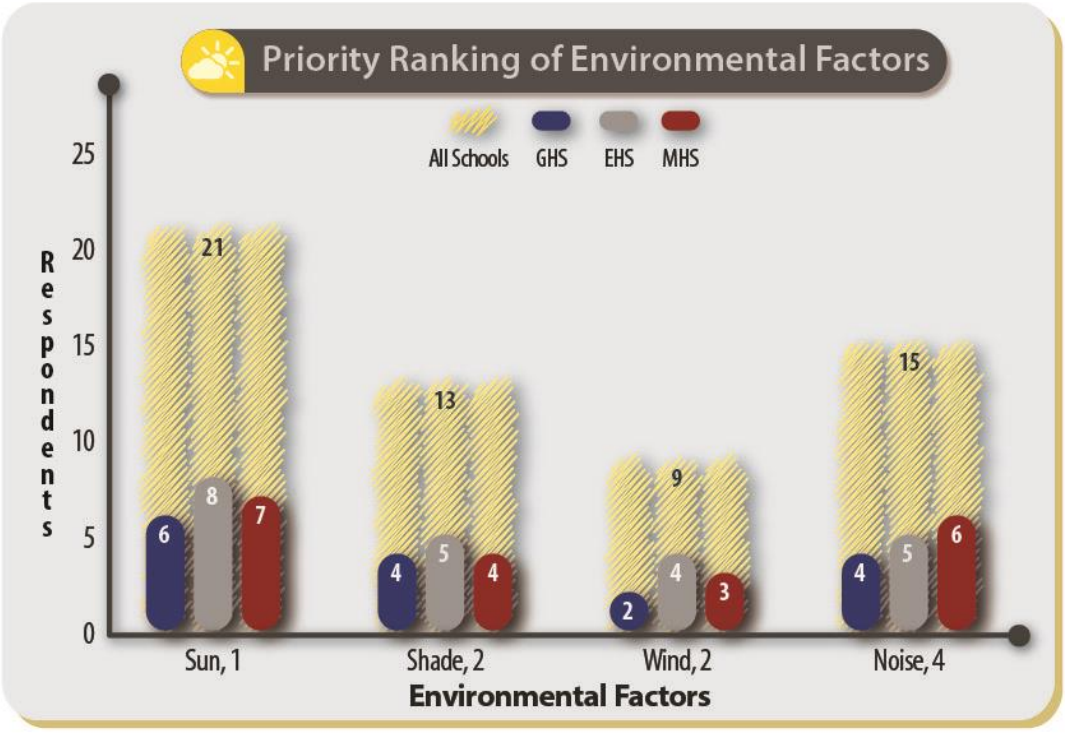
Key Preference Results by Category

Surveys were provided to teachers at each school site to gain data on the following topics; (a) how teachers used the outdoor education spaces present on their campus; (b) the availability of outdoor education spaces on the site; and (c) ranking of specific variables on their effect of use of outdoor education spaces.

Each school was provided with 15 surveys. The surveys were distributed to teachers and were returned at the teachers' discretion. The compiled results of the surveys can be seen in in Appendix I. The data from the surveys was compared both on an individual and collective case study basis to the variables identified. The results as well as a summary of the findings can be seen in Figure 4.11 through Figure 4.13.

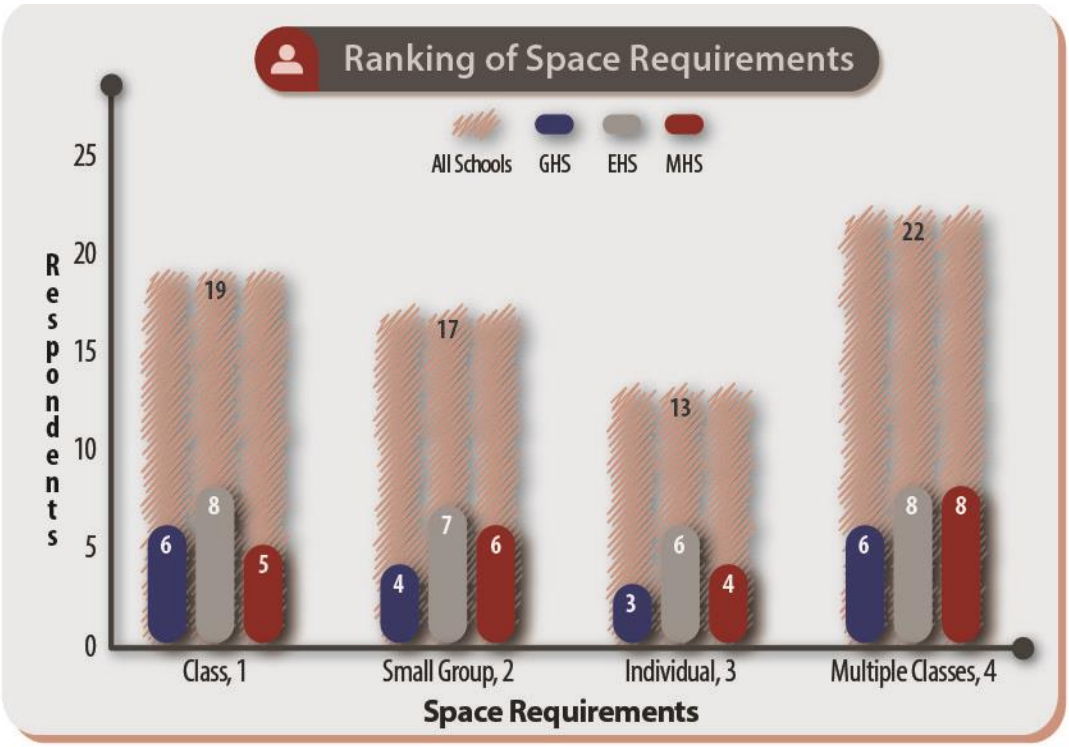
Environmental Factors. Trends in the environmental factors category were consistent across the three schools. The priority for teachers was to have sunlight available, shade and shelter from wind were both ranked high as a second consideration, though shade was more important than shelter from wind; and ambient noise was considered a low priority factor.

Figure 4.11 Environmental Factors Graph



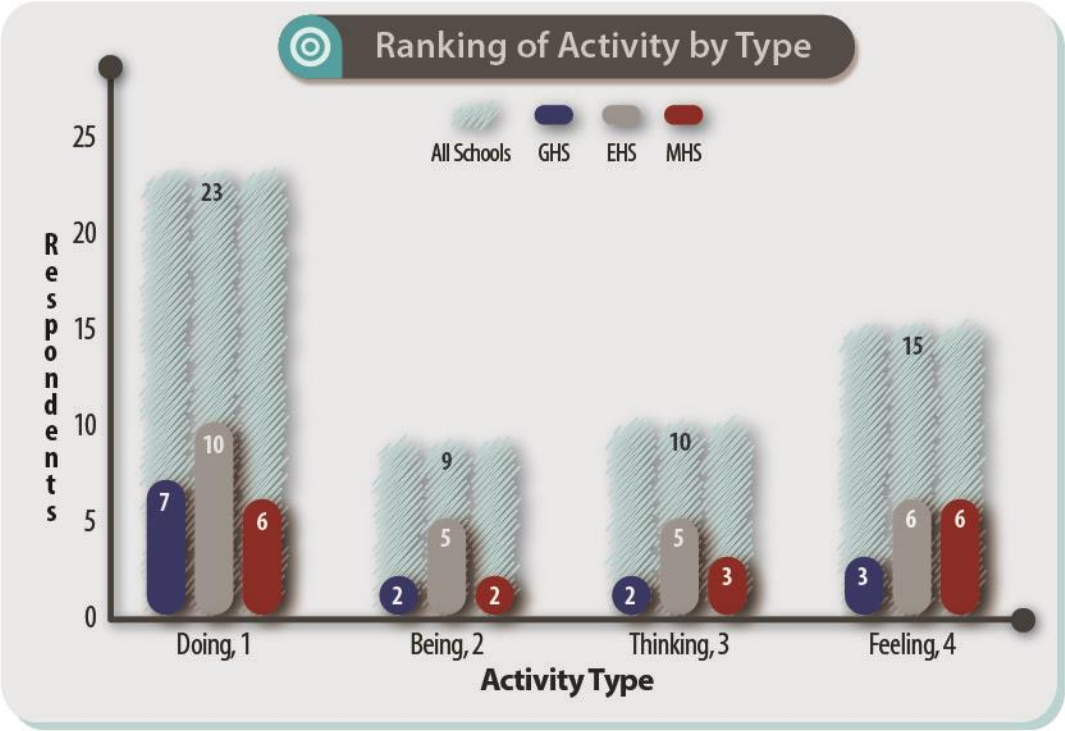
Space Requirement. Trends in the space requirements category were similar at Goddard High School and Eisenhower High School, but varied slightly at Maize High School. Teachers desired a space that could accommodate a single class at Goddard High School and Eisenhower High School as a priority whereas Maize High School ranked small group space as a priority. All schools ranked small group spaces over individual space and multiple group space ranked last for all schools.

Figure 4.12 Space Requirement Graph



Activity Type .Trends in activity typed category was consistent across all three schools. Surveys showed space for Doing as a priority across all three schools. Spaces for Being ranked second, Thinking ranked third and Feeling ranked fourth at all schools.

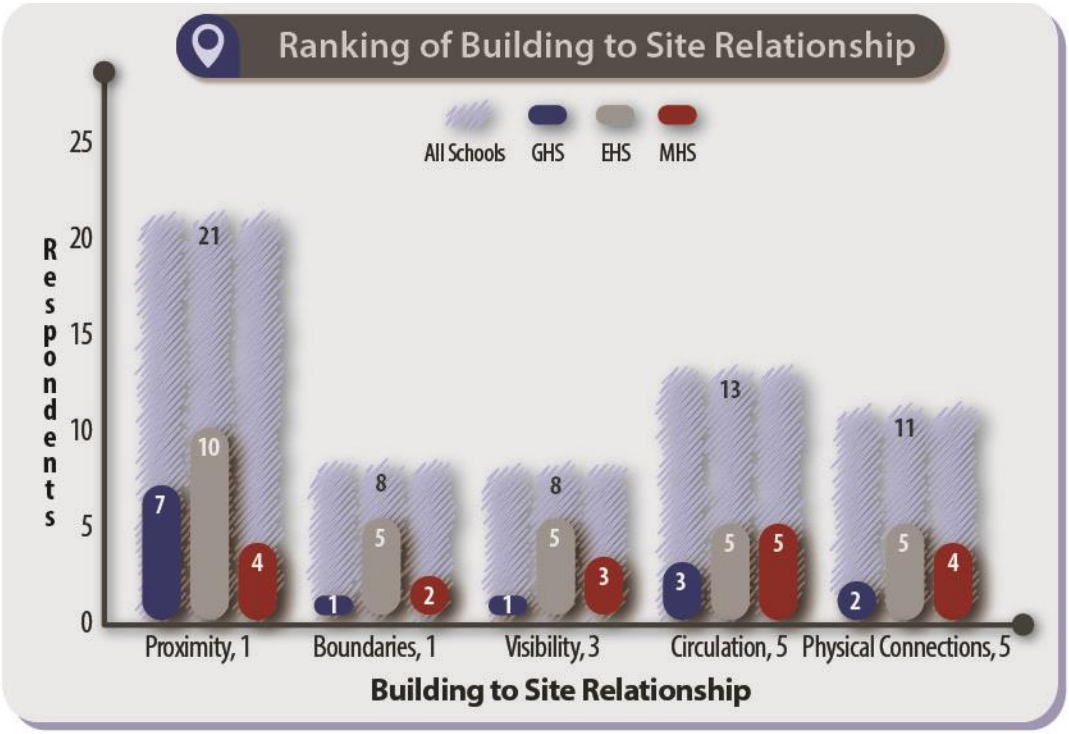
Figure 4.13 Activity Type Graph



Building to Site Relationship. Trends in building to site relationship category were not consistent across the three schools except in the category of proximity which was ranked as the highest priority for all three schools. The variation in responses in this category could be due to the difference in building footprints between the three schools.

Goddard High School and Eisenhower High School are similar with a consolidated central building layout and Maize High School has a finger building layout. Goddard High School had one respondent that felt boundaries was a high priority, one respondent felt visibility was of moderate importance, three respondents felt circulation was of low importance and two felt that physical connections was of low importance. Eisenhower High School was equally split across the remaining four categories. Two Maize High School respondents ranked boundaries as a high priority, three respondents ranked visibility as moderately important five respondents felt circulation was of low importance and four felt physical connections were of low importance.

Figure 4.14 Building to Site Relationship Variable Graph



Variation/Error

Initial responses were inconsistent and incomplete from all schools except Eisenhower High School. To increase the respondent pool and to clarify data provided teachers were contacted and given the opportunity to complete an online version of the survey. This increased the pool of responses to a quantity that substantiate the validity of the responses.

Error in this portion of the survey may have been introduced for multiple reasons; (a) Incomplete responses were provided by respondents; (b) misunderstanding due to instructions; (c) incomplete responses due to online survey format. Errors in the survey were found and overall did not affect the validity of the survey data enough to discount the results for this survey. If further research is proposed refinement of the survey would prove necessary.

Chapter 5 - Discussion and Conclusions

Summation of Findings

Site Variables and Planning. The key to a well-designed site is to integrate the needs of the users, local resources and a cultural context to make it inviting and useful to a variety of users (Danks, 2010). A factor in campus planning that receives limited attention in the early phases is the integration of the site users in the planning process. *Decisions and Decisions-Makers in Planning Educational Facilities: Communication Channels* is an article where the topic is only addressed in one section, and limits interaction to face time with district Superintendents and impersonal surveys for teachers (Earthman, 2011). Despite this it is often one of the first comments seen in regard to design of outdoor based educational spaces (Knight et al., 2006). The research focus of this thesis was to bridge the gap between these two positions to allow designers to prepare the site for more detailed planning by end users.

The results of this research are intended for both site planners and teachers, since one may not be acquainted with the perspective of the other, the relevant findings will be described from both perspectives. For planners the goal of the research is to better prepare the school campus for occupancy by the end users with our without additional outdoor based education spaces. For teachers the goal of the research is to assist them in the selection and planning of their desired outdoor based education space.

Table 5.1 Site Variables Results

Priority	***Variable***	***Teacher Planning Questions***
Environmental Factors	Sun	Is the weather favorable for having students outside?
Space Rank	Class	Is the space large enough for my needs?
Activity Type	Doing	Does the space provide for the activity I have in mind?
Building to Site Relationship	Proximity	How long/ how far is the space from my classroom?

When planning outdoor spaces designers analyze the site to understand the opportunities and limitations, identify the site users, and design spaces with varying degrees of enclosure. Despite this when school sites are analyzed the planning tends to ignore the human scale and to focus on building placement, parking and vehicular circulation. From this research

designers can allow for the human scale of use while also allowing the end users to have buy in and input for its long term use. Since the variables in Table 5.1 were ranked by teachers as the most influential on usability their relationship to design and site analysis also needs to be taken into account.

When planning lessons teachers consider a variety of factors and how the impact the learning process. Some of these factors include content, learner type, time frame, and resource requirements (Eglin & Barnes, 2013). The use of outdoor education spaces is contingent on its ability to fit within the parameters that are created by the teacher. From the result of the survey data a high preference toward one variable in each category was seen as a priority; those categories can be seen in Table 5.1. These four variables show the factors that teachers use to decide how useful an outdoor space is when planning lessons for students. The presence or absence of these variables correlates to the degree to which outdoor based education spaces are used on a school campus. When these variables are used to assess existing sites patterns can be identified. Questions that teachers may ask when considering the use of outdoor based education spaces may sound something like the ones seen in Table 5.1.

These same four variables when viewed from the planning perspective can lead to different questions and insights. The terms sunlight, class space, activity and site proximity to building address spatial concerns. Together these two perspectives provide a complete view of how the site will be used and how best to accommodate those uses, Table 5.2 offers a comparison of how these two groups view the identified priority variables.

Table 5.2 Teacher and Designer Variable Comparison

Teacher Perspective	***Variable***	***Design Perspective***
Students will be able to work outside for a 20-40 min period of time.	Sunlight	Solar access. What parts of the campus will receive sun throughout the day?
Space for 20-30 students to work without interfering with each other or other groups of students.	Class Space	Square footage and dimensions.
Specific planned activities that can be led, monitored, or observed by one adult.	'Doing' Activities	Active, multi-use space large enough to accommodate amenities and people.
Within a 30 - 60 sec walk from the classroom.	Building Proximity	Locations on-site and grouped by distance from building envelope.

Site Assessments from Checklist

A summation of findings for each site visited at the three schools can be seen in Figures 5.1 through 5.10, along with detailed results from review of the site checklist observations showing any patterns found. The goal of these assessments is to better understand the relationships between the physical aspects of the sites, the users' actions as well as their perceptions of their use. The source of these results comes from the site checklist, teacher survey and interviews conducted at the time of the visit[13]. Table 5.3 provides a key for the variables listed in the assessments.

Table 5.3 Key for Site Assessments

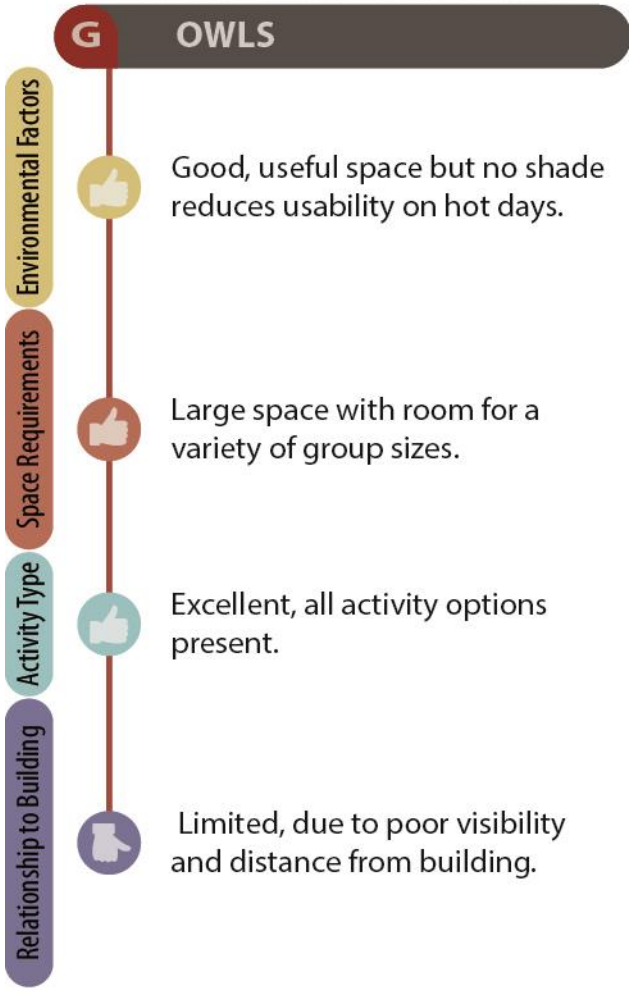
Variable Categories	Relationship to Building	Activity Type	Space Requirements	Environmental Factors
	4 or 5 of 5 variable categories ranking high	4 of 4 variable categories ranking high	4 of 4 variable categories ranking high	4 of 4 variable categories ranking high
	3 of 5 variable categories ranking high	2-3 of 4 variable categories ranking high	2-3 of 4 variable categories ranking high	2-3 of 4 variable categories ranking high
	Only 1-2 variable categories ranking high	Only 1 of 4 variable categories ranking high	Only 1 of 4 variable categories ranking high	Only 1 of 4 variable categories ranking high

[13] Examples can be found in Appendices' G & H.

Goddard High School

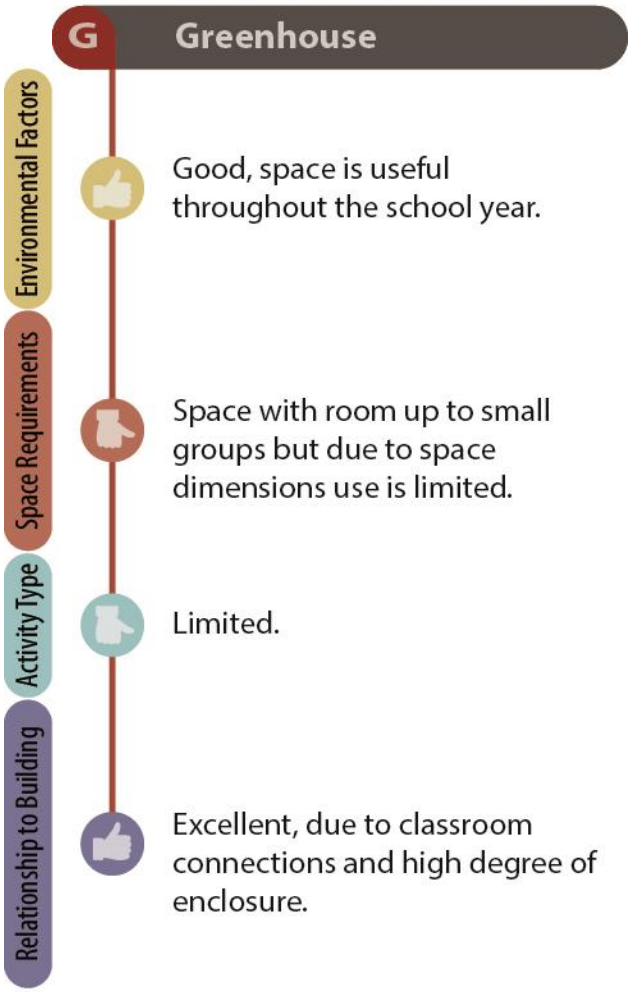
OWLS. The OWLS site ranks highly in three of the four variable categories, except in the area of connectivity to the building. It is well organized to provide space for any size group or any of the four activity types. Teachers noted that it is used as an educational space as well as a community space during non-school hours. With plantings dispersed around the space and site elements such as benches, paths, and a dock any extreme environmental changes can be mitigated to allow for a comfortable experience. The only area of concern noted is the sites location. With the OWLS site situated on the west side of the campus and across a driveway it does not provide efficient access or visibility with the building. It is worth noting that despite teachers ranking proximity as a priority for use this space receives a high volume of use despite its distance from the building and science classrooms.

Figure 5.1 GHS OWLS Assessment



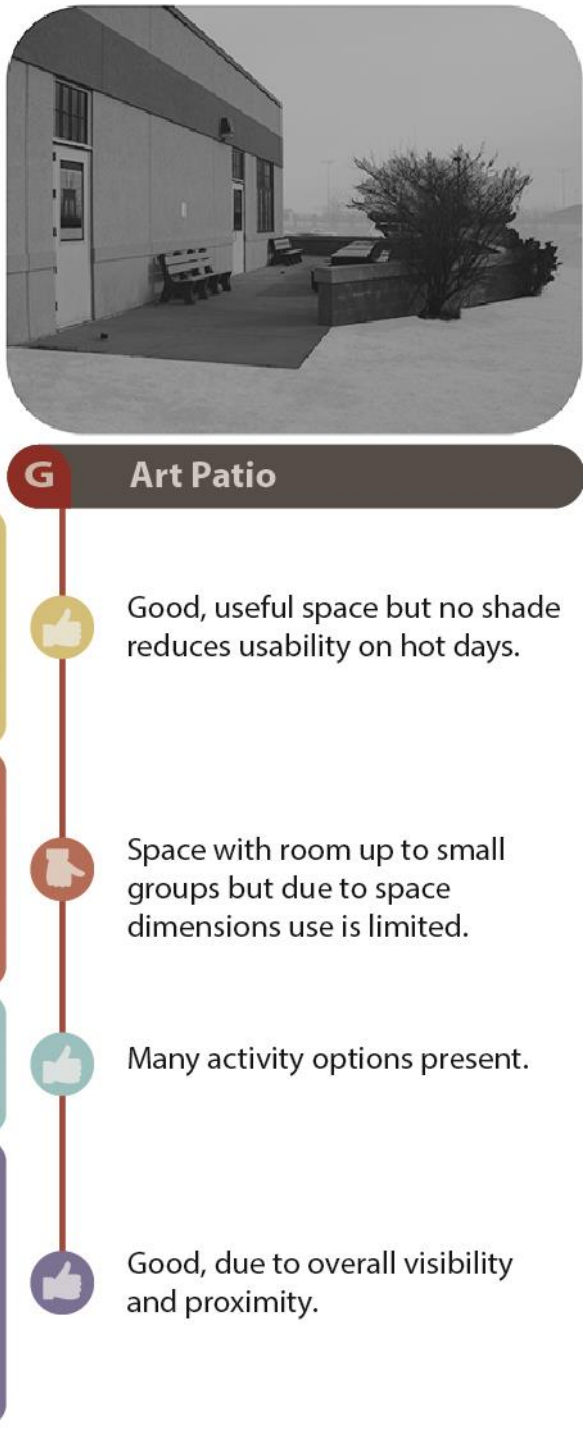
Greenhouse. The greenhouse had mixed results in the variable categories. In the relationship to building category the space provides excellent access and connections with a door in each adjoining classroom and provides enclosure to mitigate all environmental extremes the space. However the space does offer limited use when space and activity type are considered. This is due to a layout of site elements and dimensions that are geared towards a production greenhouse rather than as a gather space or learning environment. At the time of the visit the space was not being used for education purposes due to maintenance issues.

Figure 5.2 GHS Greenhouse Assessment



Art Patio. The art patio ranked highly in three of the four variable categories, except in the area of space required. With direct access to the art classrooms building relationship variables were ranked highly. This direct connection also allows for increased activity possibilities since moving supplies is not an impediment as well as mitigating extreme environmental factors. The limitations of this space are due to; a) the size of the space since two classes can access it but would not be able to occupy it at the same time and b) the aesthetic value of the space for art is reduced since the programming adjacent to it is a parking lot with no screening provided. While the aesthetic value was not a variable for this study it is of interest as this was designed specifically for use by art teachers.

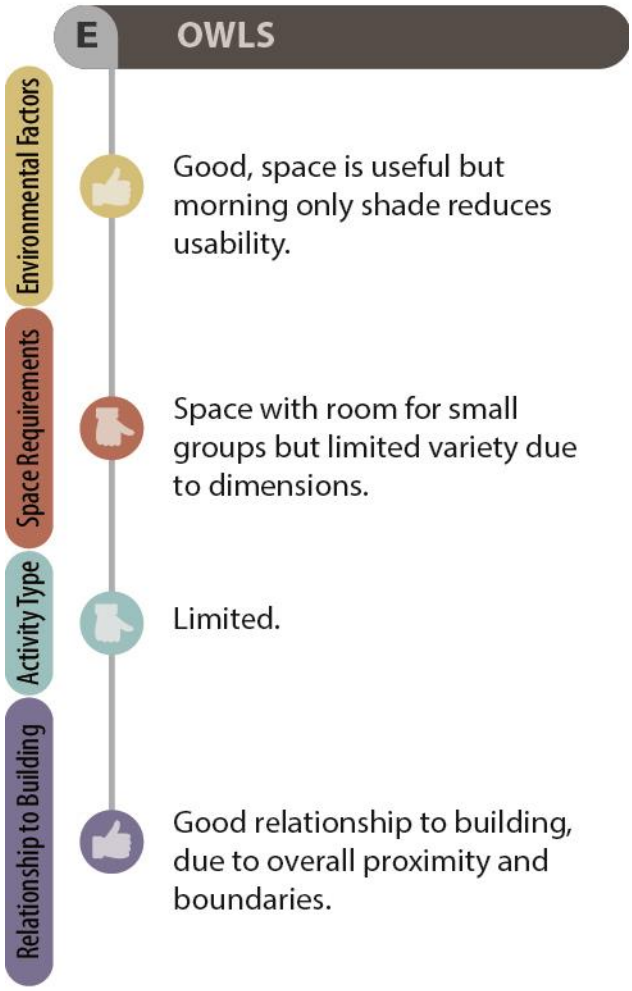
Figure 5.3 GHS Art Patio Assessment



Eisenhower High School

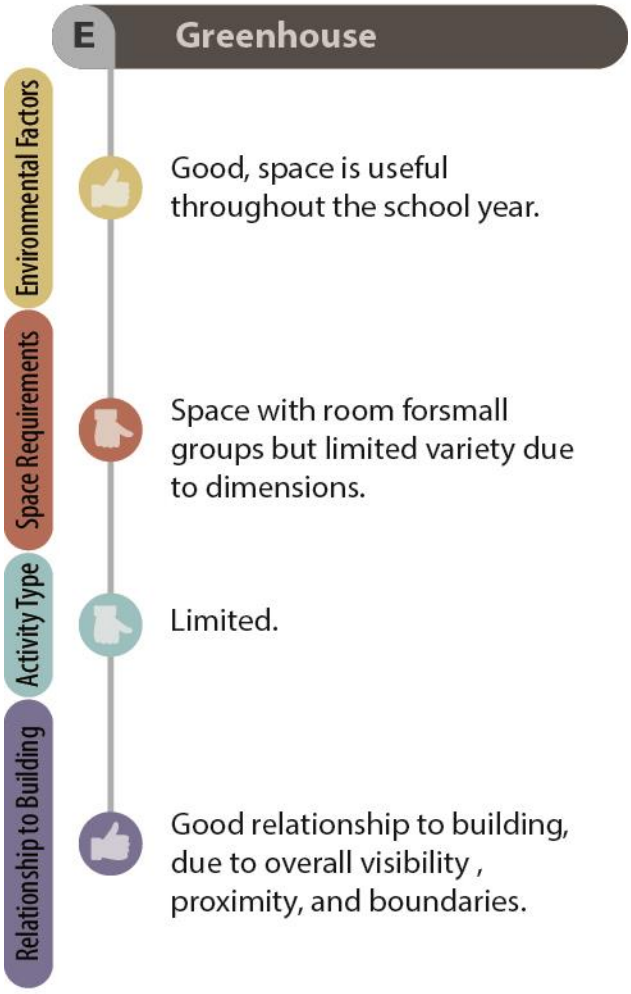
OWLS. The OWLS site had mixed results due to limitations in the space and activity categories. These low rankings may be due in part to the age of the site as it is only two years old however the space is divided between multi-purpose beds surrounding the greenhouse and a wetland area directly off site but still on the campus. With a portion of the OWLS site situated directly outside the greenhouse it does provide good relationships with the building as well as providing mitigation for extreme environmental factors such as high winds or low temperatures.

Figure 5.4 EHS OWLS Assessment



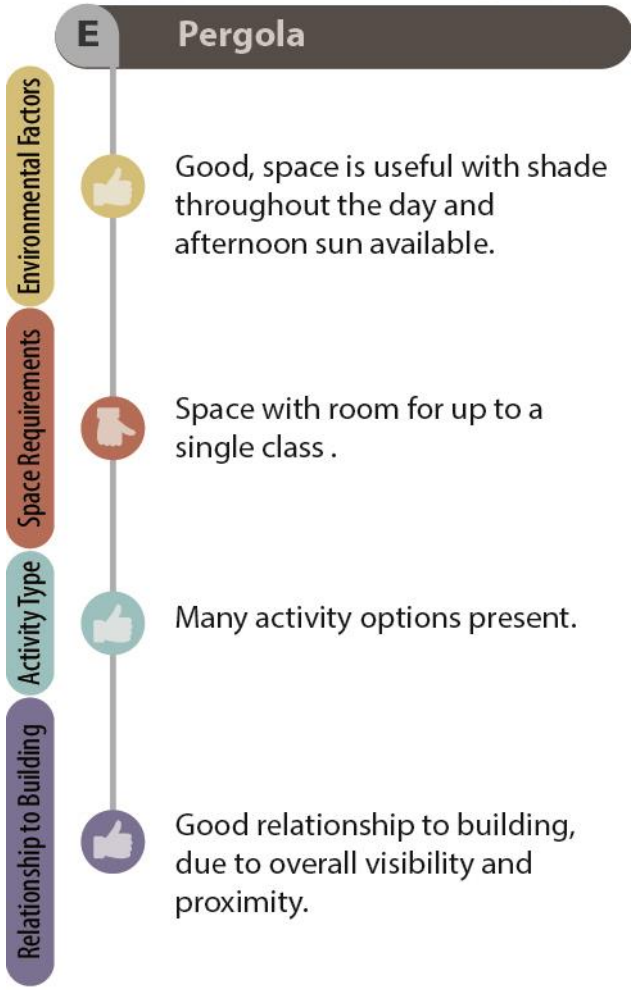
Greenhouse. The greenhouse had mixed results in the variable categories. In the relationship to building category the space provides excellent access and connections with a door in each adjoining classroom and provides enclosure to mitigate all environmental extremes in the space. However the space does offer limited use when space and activity type are considered. This is due to a layout of site elements and dimensions that are geared towards a production greenhouse rather than as a gather space or learning environment. It does provide the benefit of additional access to the OWLS site which is directly outside. At the time of the visit the space was being used for storage of supplies for the spring semester.

Figure 5.5 EHS Greenhouse Assessment



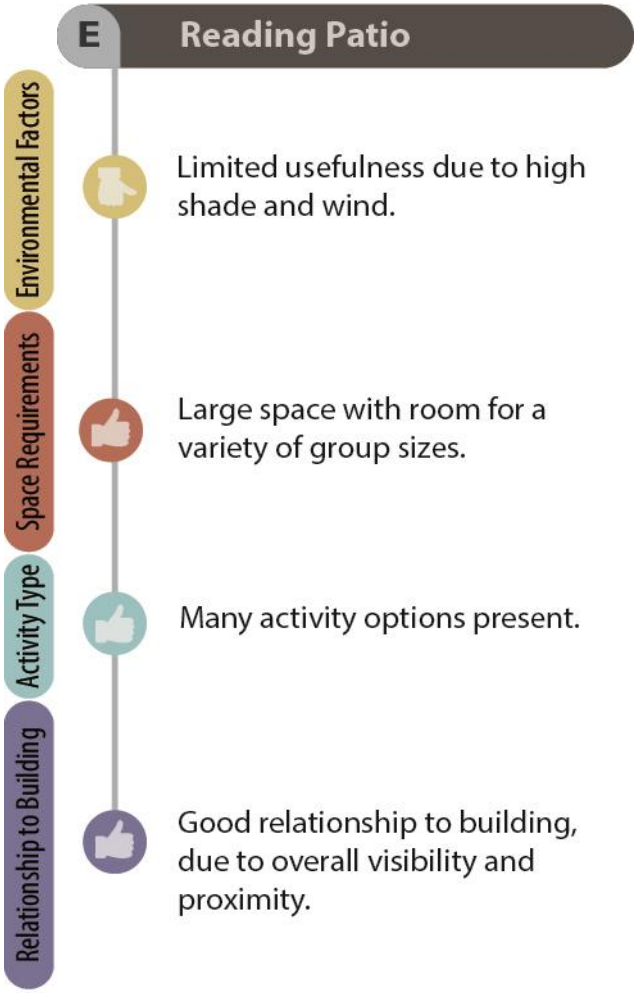
Pergola. The pergola ranks highly in three of the four variable categories. In all areas of its relationship with the building the space did well, however to maintain building security the closest access point is locked and requires a key or to be opened from the inside, otherwise people have to return to the main entrance to allow people back into the building. The location of the pergola allows for the space to be used in several ways and is large enough for multiple classes if the surrounding space is factored in. While the space allows for a mixture of sun and shade there are no barriers to reduce wind or noise other than the main building.

Figure 5.6 EHS Pergola Assessment



Reading Patio. The reading patio ranked highly in three of the four variable categories, except in the area of environmental factors. With direct access to the library the building relationship variables were ranked high, however it is worth noting that the librarians said that the space was not being used during school hours since it was too cold to read outside. Though this site is designed for all activity type and provides appropriate space for them, a lack of site elements or sense of enclosure make those activities unlikely.

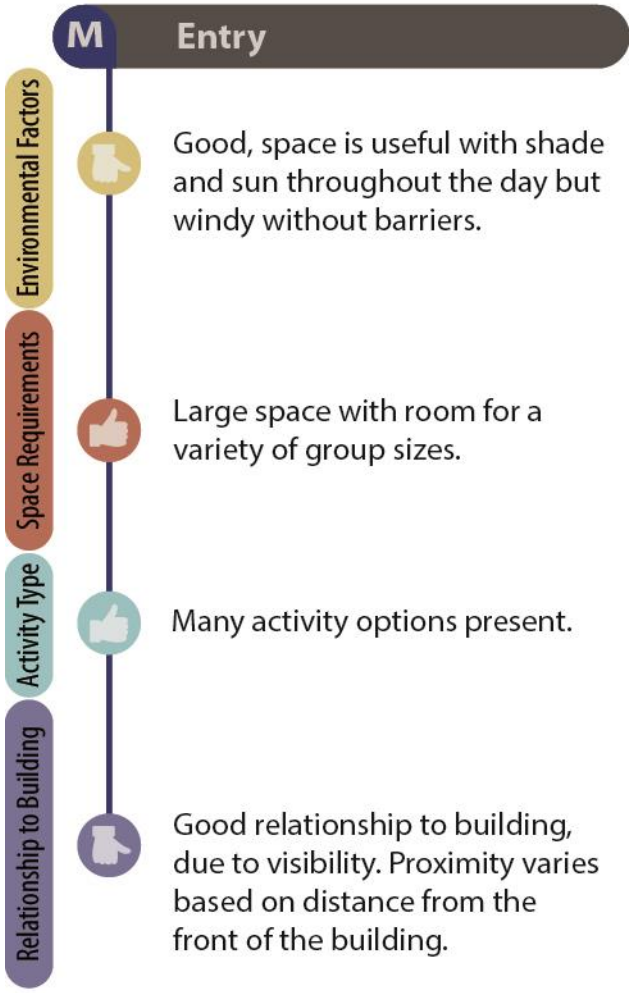
Figure 5.7 EHS Reading Patio Assessment



Maize High School

Entry. The entry site had mixed results ranking highly in the categories of space requirements and activity type. The amount of space provided could accommodate any size group. With benches, tables and open spaces there is space and considerations made for multiple activity types. The space also provides both areas of sun and shade for users but with the materiality of the space and no barriers provided the area becomes very windy and noisy. The space has a good relationship with the building with a high level of visibility, enclosure and circulation within the space, but the challenge its location provides, at the main entrance to the building, tends to outweigh these other variables. By being far away from many classes' teachers that would use it may not find it worth their time.

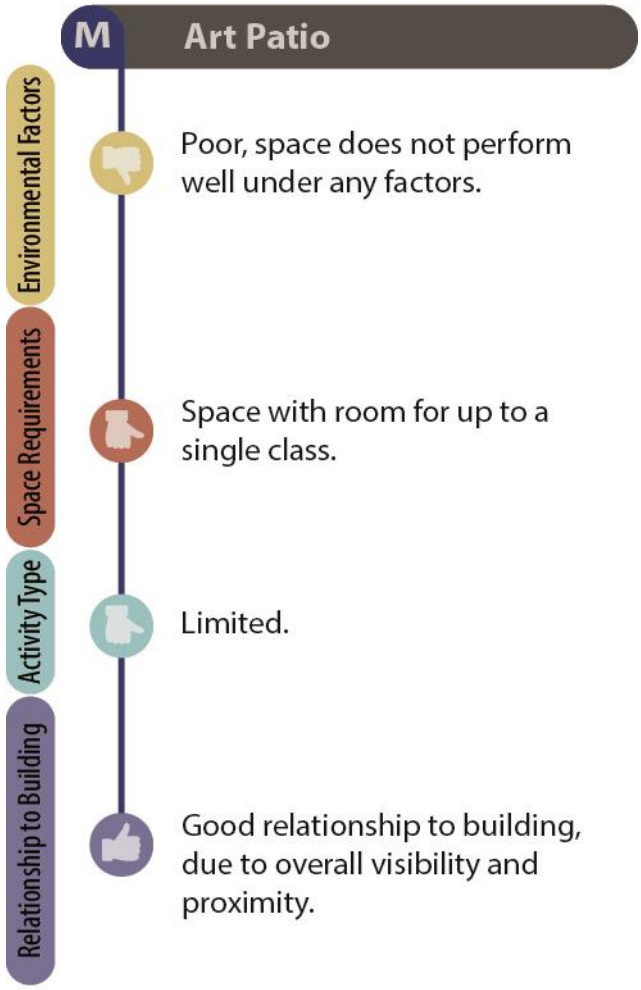
Figure 5.8 MHS Entry Assessment



Maize High School

Art Patio. The art patio had poor results in three of the four variable categories. The space does not provide any relief from environmental extremes and with its tunnel like shape increase the occurrence of wind and noise. The space does provide enough space for multiple students to work the layout of the space, lack of site elements and wind make group work difficult. This also leads to a limitation of the types of activities possibly in the space. The one variable that the space ranked highly in was its relationship to the building as it provides access and visibility from each classroom as well as from an entry point in the hall. Unfortunately due to the placement of the door it is difficult to open or close against the wind.

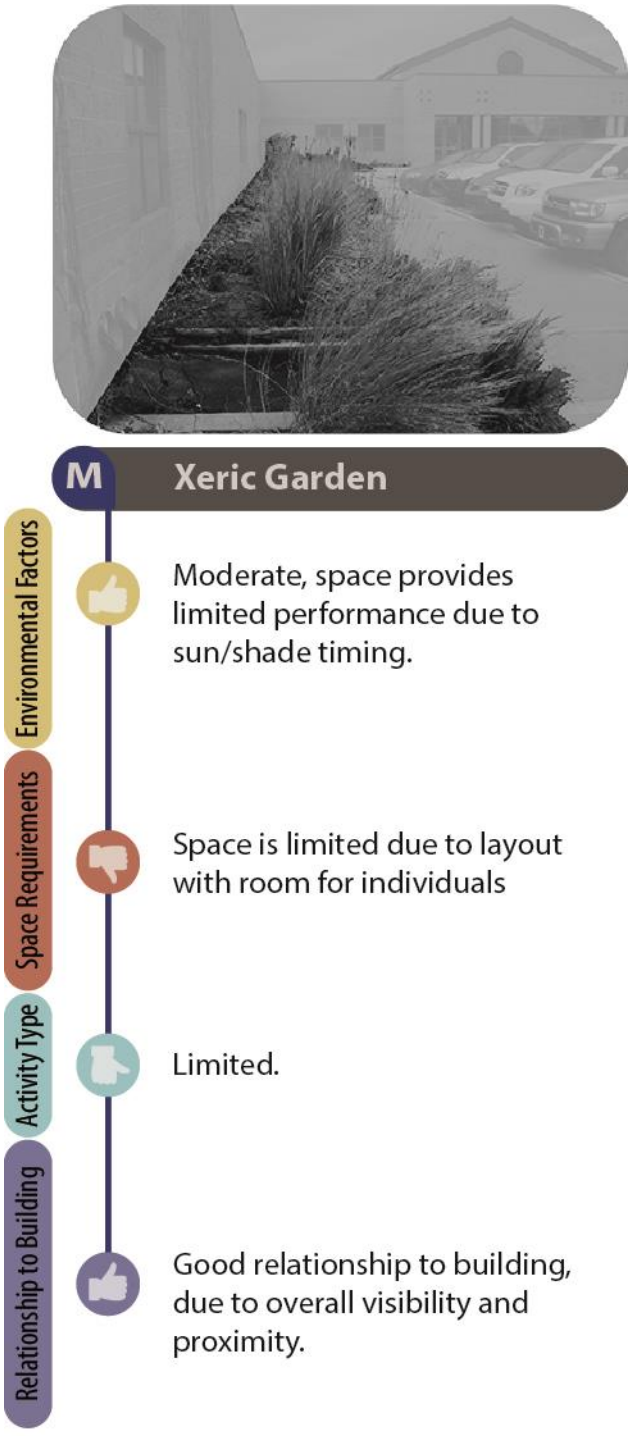
Figure 5.9 MHS Art Patio Assessment



Maize High School Xeric

Xeric Garden. The xeric garden had mixed results in the variable categories, ranking highest with its relationship to the building and lowest in the area of space requirements. The location of the space is between two wings of the building plan and adjacent to the library. This provides many entry points and a high degree of visual access for many users. However the potential of the space is lost due to poor rankings in the rest of the categories. While space is abundant the poor dimensions mean that it is not useable. Due to the reduced usability the types of activities for this space are limited to basic observation purposes. Building orientation creates extremes in many environmental categories.

Figure 5.10 MHS Xeric Garden Assessment



Conclusions

The goal of this thesis was to identify and measure dimensions of performance for Outdoor Based Educational settings for designers of high school campuses. These performance dimensions would allow designers to systematically identify opportunities for OBE that allow the end users to program the space to meet their specific needs. In addition case studies were analyzed using the guidelines to test the efficacy of the model. In this chapter the contribution of the thesis will be reviewed and opportunities for future research will be discussed.

Interpretations and Implications

When considering the impact of site planning on outdoor based education spaces designers can feel overwhelmed by the number of variables that a high school campus presents. To clarify and focus the impact of their work on future outdoor based education plans designers should remember to address the following; (a) proximity; (b) open space dimensions and square footage; (c) interaction opportunities; and (d) solar impact.

Proximity. In standard campus plans open space is grouped into two main locations; the primary entrance and athletic fields. This leaves unplanned open space as marginal borders along buildings, walking paths and parking islands. These unplanned open spaces are often the ones that become the future gardens, ecological observation areas, and demonstration spaces. Survey results showed that teachers were more inclined to use locations that were quick and easy to access. An ideal space should be with in a 30-60 second walk for the average class from their primary meeting space. Care should be taken in consideration of this. Often a site is only 10-20 seconds away from the primary meeting space but due to access points and circulation routs actual proximity could be much higher. While visual connections via windows are appropriate for observations they limit opportunities for interaction and exploration.

Open Space Dimensions and Square Footage. During this study no differentiation was made between dimensions and square footage. However through the study it became apparent that they were not proportional measures of space requirements. A prime example of this can be seen at Maize High School and the Xeric Garden. Square footage measurements of the whole space, including planted areas and hardscape, is approximately 720 sq. ft. This is acceptable for up to a single class (700 sq. ft. - 1000 sq. ft.). But the north side of the garden's

dimension of hardscape is approximately 45 ft. x 9 ft. or 405 sq. ft. This limits use to small groups (250 sq. ft. – 450 sq. ft.) or individuals (35 sq. ft.). The results of the surveys show that teachers preferred outdoor based education spaces for single classes, 700 sq. ft. -1000 sq. ft.

Doing Activities. Since the case study and resulting survey focused on outdoor based education or learning spaces it is not surprising that preference was given to Doing Activity spaces. These are spaces with opportunities for physical activity and which recognizes the need for students to extend themselves, develop new skills, and to find challenges. This corresponds to structured activities that guide students to explore, interact and engage the environment (Freeman & Tranter, 2011). Another reason for this preference could be the population being sampled would be classified as a stratified representative sample[14]. Respondents where recommend by building principals based on the stipulation that they use any outdoor space in their lessons. Thus respondents being surveyed were predisposed to this activity type. An additional possible factor predisposition to this activity type would be related to discipline concerns. As a general rule a teacher prefers to structure class time whether inside or outside so as to reduce the probability for off task behavior. The other activity types; thinking, being, and feeling; have a higher degree of variation in their level of structure.

Even though the reason behind this preference is not known design considerations can still be formed from these results. To meet the needs of future users outdoor based education spaces should be positioned in or near diverse spaces to allow for varying levels of interaction by students.

Solar Impact. Of the four environmental variables presented in the survey; sun; shade; wind; and noise; teachers identified sun as the priority to using outdoor based education space. Possible reasons for this preference could be due to the following; (a) site location, all schools are located in areas that are currently rural transitioning into suburban; (b) time frame, Goddard High School and Eisenhower High School have 45 minute class periods while Maize High School has 90 minute class periods. This means that students will spend at a maximum of 30 minutes at GHS and EHS or 75 minutes at MHS in the outdoor based education space after

[14] See Appendix B: Nomenclature, for a complete explanation of "Sample Population Types".

instruction and travel time are factored in. This is not long enough for the other environmental factors to impede learning or activities; (c) correlation and dependence; whether true or false the presence of the sun can correlated to more favorable weather conditions. Designers should continue to address all the general categories; thermal, visual, auditory, olfactory, and hygienic and the standards of human comfort (Fincher & Boduch, 2010). But do so with the awareness of the impact of the building and surrounding infrastructure on outdoor based education space. Solar aspect, day length and light intensity should be understood and considered in context of outdoor based education spaces.

Limitations

The survey portion of the research focused on the high school campus demographic of public schools. Within this demographic the subset, teachers how use outdoor based education, were identified and surveyed. Research was done using probability sampling or representative sampling techniques[15]. Probability samples are selected in such a way as to be representative of the population. They provide the most valid or credible results because they reflect the characteristics of the population from which they are selected. Within the representative sample a population can be chosen through the use of random sampling or stratified sampling. **Random sampling** determines that a population (high school teachers) has been chosen and any individual within that population has an equal likelihood of selection. **Stratified sampling** is a mini-reproduction of the population. Before sampling, the population is divided into characteristics of importance for the research and then the randomly sampled within each category or stratum (Sommer, 2006). Within the probability sampling technique the research was conducted with the stratified sampling model rather than the random sampling model. While within this stratum the population was selected by the principal. Because of this responses to the survey were from individuals that were predisposed to using outdoor based education sites. If a random sampling technique had been applied to the population both teachers that were and were not already using outdoor based education spaces would have been sampled. Input from teachers who do not already use outdoor based

[15] See Appendix D - for further explanation of "Probability Sampling Techniques".

education spaces would have provided additional insight into the degrees of usability necessary to prompt their interaction.

Significance

Application for Designers

The site planning process for outdoor based education sites is revisited often in the life of a school. During these staggered planning phases the individuals/users/concepts do not remain constant and the intent of the design can be lost from stage to stage. Even though intent of a space may change an imprint of the original is always left behind. A strong and understandable imprint is left behind through the application of a framework of useable space for later phases of a campus' life. Opportunities that might initially be lost during the site planning process can be brought to the surface by layering the effect of proximity, open space dimensions and square footage, interaction opportunities, and solar impact on a site.

Another concern during the site planning phase is striking a balance between understanding a site and its users with the necessity to move the project forward. Site analysis addresses many variables including environmental, cultural, and interpersonal factors. Providing each variable with its 'due diligence' can be time consuming for a design professional and even more so to stakeholders that are unfamiliar with the process. By applying the outdoor based education guidelines to this phase of collaboration the level of 'frustration' for all can be reduced. The guidelines provide designers with the following tools they can share with these stakeholders; (a) Awareness, the concept of human comfort is intrinsic and once understood can be identified by both designers and stakeholders; (b) Unification, by providing focus to stakeholders in this phase time spent getting 'everyone on the same page' decreases; and (c) Justification, many stakeholders want to know why. Why is this way better? Why is this worth more money? Worth the time? By allowing stakeholders to apply the guidelines and to identify opportunities they are empowered to answer their own questions.

Application for Schools

"The only thing constant is change."

Heraclitus

Change is ever present in schools, from the daily ebb and flow of students to the shifts in pedagogy over time. The ability of a high school faculty and staff to identify and address the changes that effect students make all the difference in the quality of education provided. The guidelines defined through this research support users to efficiently implement their ideas for outdoor based education sites. Existing resources for teachers wanting to design outdoor based education sites focus on typology, materials and pedagogy. Unfortunately the planning resources are often limited to a few paragraphs advising caution and limiting interference (Grant & Littlejohn, 2001). The guidelines presented here fill the gap left by the current resources. The guidelines could be used by teachers doing analysis independently or in a team setting. Once completed stakeholders will be left with opportunities available on the sire that have been organized and ranked using variables related to their needs.

Initiators of outdoor based education spaces are often teachers who are big on motivation but are short on time. With efficient implementation retrofitting an existing spaces does not have to be an ad-hoc process, rather stakeholders have the ability to make informed decisions regarding assessment of existing spaces as well as providing rationalization for improvements and modifications. By making subjective assessments of space the improvements are not limited to one group/time/etc. and can be seen in the broader context of the educational process. This in turn allows educators to leverage support of the changes into grant opportunities as well as addressing state educational standards.

Future Research

The guidelines presented in this research are applicable to further research opportunities. Since the research completed in this thesis is at an initial stage, not an application of existing guidelines, the investigation was on a topical level. Further research completed would be able to move to deeper levels of understanding, possibilities include exploration of the variables proposed in these guidelines; environmental factors, space requirements, activity type and relationship to building. Each of these units is divided into

specific subunits for clarity. Due to this subdivision each variable unit could become an independent topic of study. Research of the environmental factors and their relationship to human comfort has been studied extensively (Fincher & Boduch, 2010). Despite the relationship between these factors their impact on educational design seems to be limited to the built environment as opposed to the whole site. The comparison of use patterns and desirability rankings could provide insight into the use of outdoor based educational spaces.

Another subject of future research presented by the guidelines are the design requirements for spaces, they are often described in overall square foot measurements rather than dimensions. This no doubt is due to the limitations that dimension present while square foot measurements allow for a higher degree of flexibility. Unfortunately due outdoor based educational spaces not being a priority in the design process they are often short changed for other site amenities. Further study of the relationships between dimensions, group size and activity type for outdoor based education spaces would provide insight into this topic.

Finally, all spaces studied for this research were in suburban settings. This provided consistent sampling opportunities and limited the number of independent variables being compared. While necessary for this study a subset of the high school population, schools in urban settings were overlooked. Many examples and opportunities of outdoor based education can be seen in urban schools regardless of the differences in the settings. Comparison of these two settings could provide further insight into what minimum requirements exist for outdoor based education space.

Bibliography

American Clearinghouse on Educational Facilities [ACEF]. (2013). Sustainable Schools and Campuses. *American Clearinghouse on Educational Facilities*. Education. Retrieved June 18, 2013, from http://www.acefacilities.org/

Art & Architecture Thesaurus. (2013). *Art & Architecture Thesaurus® Online*. Los Angeles, CA: J. Paul Getty Trust. Retrieved from http://www.getty.edu/research/tools/vocabularies/aat/index.html

Atherton, J. S. (2011, February 10). Gestalt and learning. *Learning and Teaching*. Education. Retrieved from http://www.learningandteaching.info/learning/gestalt.htm

Atkinson, M. (1970). *maslows-hierarchy-of-needs*. Retrieved from http://erickson.edu/igniting-passion-from-within/maslows-hierarchy-of-needs/

Broda, H. W. (2007). *Schoolyard-Enhanced Learning: Using the Outdoors as an Instructional Tool, K-8*. Portland, ME: Stenhouse Publishers.

Burke, C., & Grosvenor, I. (2008). *School*. UK: Reaktion Books.

Cosco, N., & Moore, R. C. (2009). Sensory Integration and Contact with Nature: Designing Outdoor Inclusive Environments. *The NAMTA Journal*, *34*(2), 158–177.

CU Denver. (2012). Learning Landscapes. *CU College of Architecture and Planning, Learning Landscapes*. Education. Retrieved March 11, 2012, from http://learninglandscapes.org/

Danks, S. G. (2010). *Asphalt to Ecosystems: Design Ideas for Schoolyard Transformation*. Oakland, CA: New Village Press. Retrieved from http://www.asphalt2ecosystems.org/home

Di Silvestro, R. (2012). Education: Not the Same Old Schoolyard. *National Wildlife Federation*, (April/May), 14–15.

Dudek, M. (2000). *Architecture of Schools: The New Learning Environments*. Woodburn, MA: Architectural Press.

Earthman, G. I. (2011). Decisions and Decisions-Makers in Planning Educational Facilities. *The ACEF Journal*, *2*(1), 5–15.

Eglin, K., & Barnes, L. (2013). Teaching Guide: Writing Lesson Plans. *Writing@CSU*. Education. Retrieved June 18, 2013, from http://writing.colostate.edu/guides/teaching/lesson_plans/

Fincher, W., & Boduch, M. (2010). Standards of Human Comfort: Relative and Absolute. *University of Texas Libraries: Digital Repository*. Education. Retrieved June 18, 2013, from http://repositories.lib.utexas.edu/handle/2152/13980

Fogle, D. P., & Klein, M. W. (1986). *Clues to American Architecture* (2nd ed.). USA: Starrhill Press.

Frampton, K. (1983). Towards a Critical Regionalism: Six Points for an Architecture of Resistance. In H. Foster (Ed.), *The Anti-Aesthetic. Essays on Postmodern Culture* (pp. 16–30). Seattle, WA: Bay Press. Retrieved from http://www.colorado.edu/envd/courses/envd4114-001/Spring%2006/Theory/Frampton.pdf

Freeman, C., & Tranter, P. (2011). *Children and Their Urban Environment: Changing Worlds*. London: Earthscan / James & James.

Gardner, H. (1999). *Intelligence Reframed: Multiple Intelligences for the Twenty-first Century* (1st ed.). New York: Basic Books. Retrieved from http://books.google.com/books/about/Intelligence_Reframed.html?id=nOHsjJZB0J8C

Google Maps. (2013). *Aerial Photo*. Retrieved from https://maps.google.com/

Grant, T., & Littlejohn, G. (2001). *Greening School Grounds: Creating Habitats for Learning*. Gabriola Island, BC: New Society Pub.

Grippin, P., & Peters, S. (1984). *Learning Theory and Learning Outcomes: The Connection*. Lanham, MD: University Press of America.

Guion, L. A., & Diehl, D. C. (2011). *Triangulation: Establishing the Validity of Qualitative Studies* (Education No. FCS6014) (p. 3). Florida: Inoversity of Florida. Retrieved from https://edis.ifas.ufl.edu/fy394

Harris, C. (2005). *Dictionary of Architecture and Construction* (4th ed.). New York: McGraw-Hill Professional.

Heraclitus. (2013). Heraclitus Quotes. *goodreads*. General. Retrieved July 8, 2013, from http://www.goodreads.com/author/quotes/77989.Heraclitus

Hertzberger, H. (2008). *Space and Learning: Lessons in Architecture 3*. Rotterdam: 010 Publisher.

Hille, R. T. (2011). *Modern Schools: A Century of Design for Education*. New York: Wiley.

Hood River Middle School. (2010). Retrieved from http://thelearninglandscape.blogspot.com/2010/10/hood-river-school-district-school.html

Illeris, K. (2004). *The Three Dimensions of Learning: Contemporary Learning Theory in the Tension Field between the Cognitive, the Emotional, and the Social.* Malabar, FL: Krieger Publishing Company.

Jencks, C. (1987). *Modern Movements in Architecture* (2nd ed.). UK: Penguin Books.

Kansas State Department of Education [KSDE]. (2011). *Education Organizations in This County (Information and Statistics)*. Kansas: Kansas State Department of Education. Retrieved from http://www.ksde.org/Default.aspx?tabid=1870

Karliner, J. (2013). What Is A Green School? *Green Schools Initiative*. Education. Retrieved June 28, 2013, from http://greenschools.net/section.php?id=11

Kidder, L., & Judd, C. M. (1991). *Research Methods in Social Relations* (6th ed.). St. Louis, MO: Holt Rinehart & Winston.

Knight, E., McLellan, G., Haque, M., & Tai, L. (2006). *Designing Outdoor Environments for Children: Landscaping School Yards, Gardens and Playgrounds*. New York: McGraw-Hill Book Co.

LearningTheories. (2013). Behaviorism. *Learning-Theories.com*. Retrieved from http://www.learning-theories.com/

Louv, R. (2008). *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Chapel Hill, NC: Algonquin Books.

Lynch, K., & Hack, G. (1984). *Site Planning* (3rd ed.). Cambridge, MA: The MIT Press.

Mathis, M. (2012). Hood River School District - School Upgrades. *The Learning Landscape*. Business. Retrieved from http://thelearninglandscape.blogspot.com/2010/10/hood-river-school-district-school.html

Merriam, S. B., Caffarella, R. S., & Baumgartner, L. (2007). *Learning in Adulthood a Comprehensive Guide* (3rd ed.). San Francisco, CA: Jossey-Bass. Retrieved from http://www.credoreference.com.er.lib.k-state.edu/book/wileyla

Moore, R. C. (1996). Outdoor Settings for Playing and Learning: Designing School Grounds to Meet the Needs of the Whole Child and Whole Curriculum. *The NAMTA Journal*, *21*(2), 97–121.

Nair, P., & Fielding, R. (2007). *The Language of School Design: Design Patterns for 21st Century Schools*. Minneapolis, MN: Designshare, Inc.

Nielsen, J. (2012). Usability 101: Introduction to Usability. *NN/g Nielsen Norman Group*. Retrieved June 5, 2013, from http://www.nngroup.com/articles/usability-101-introduction-to-usability/

Novak, M. (2010). *Hood River LEED Diagram*. Retrieved from http://www.portlandmonthlymag.com/home-and-garden/articles/leed-school-0910

Oregon Parks and Recreation Department [OPRD]. (2011). Natural Play | Resources. *Oregon Natural Play Initiative*. Government. Retrieved June 26, 2013, from http://naturalplay.wordpress.com/resources/

Ormrod, J. E. (1990). *Human Learning: Principles, Theories, and Educational Applications*. Princeton, NC: Merrill Publishing Company.

Oxley, D. (2007). *Small Learning Communities: Implementing and Deepening Practice*. Portland, OR: Northwest Regional Education Laboratory. Retrieved from http://smallschoolscoalition.com/?page_id=263

Parliament. (2013). The 1870 Education Act. *www.parliament.uk*. Government. Retrieved January 28, 2013, from http://www.parliament.uk/about/living-heritage/transformingsociety/livinglearning/school/overview/1870educationact/

Perkins Eastman Architects, Perkins, B., & Bordwell, R. (2010). *Building Type Basics for Elementary and Secondary Schools*. Hoboken, NJ: Wiley.

Philliber, S. G., Schwab, M. R., & Sloss, G. S. (1980). *Social Research*. USA: Peacock Publishers.

Pugin, A. W. N., & Weale, J. (1841). *The True Principles of Pointed or Christian Architecture : Set Forth in Two Lectures Delivered at St. Marie's, Oscott.* London: W. Hughes.

Raffan, J. (2000). *Nature Nurtures: Investigating the Potential of School Grounds*. Toronto: Evergreen Canada. Retrieved from http://www.evergreen.ca/docs/res/Nature-Nurtures-Summary.pdf

Robin, A., & Redmond, G. (2013). Natural Play Spaces. *green: landscapes / gardens / playgrounds / plants*. Business. Retrieved June 26, 2013, from http://www.leavesofgreen.co.uk/landscape-design/natural-play-spaces.htm

Robson, E. R. (1877). *School architecture: Being practical remarks on the planning, designing, building, and furnishing of school-houses*. London: J. Murray.

Rogers, J. (2011). Wichita, KS Context Map. Context Map, Wichita, KS: Sedgwick County Geographic Information Services (SCGIS). Retrieved from https://gismaps.sedgwickcounty.org/portal/

Sarah the Theater Ed. (2013). *Theory of Multiple Intilligences*. Retrieved from http://theatereducation.tumblr.com/post/36031456890/a-theory-that-my-class-spends-a-great-deal-of-time

Scribner, D. (2012). *Greening Goddard High School and newly opened Eisenhower High School-USD 265*. PowerPoint Slides presented at the Implementing Energy Efficiency and Sustainability Using Employee Green Teams, Wichita, KS. Retrieved from http://www.greenwichita.org/

Sommer, B. (2006). Sampling: Types of Samples. *Psychology 41, Research Methods*. Education. Retrieved June 18, 2013, from http://psychology.ucdavis.edu/sommerb/sommerdemo/sampling/types.htm

Stine, S. (1996). *Landscapes for Learning: Creating Outdoor Environments for Children and Youth* (1st ed.). New York: Wiley.

Stoecker, R. R. (1991). Evaluating and Rethinking the Case Study. *The Sociological Review*, *39*, 88 – 112.

Sullivan, C., & Boults, E. (2010). *Illustrated History of Landscape Design*. New York: Wiley.

Taylor, A. (2008). *Linking Architecture and Education: Sustainable Design of Learning Environments*. New Mexico: University of New Mexico Press.

Tennessen, C. M., & Cimprich, B. (1995). Views to Nature: Effects on Attention. *Journal of Environmental Psychology*, *15*(1), 77–85.

Titman, W. (1994). *Special Places; Special People: The Hidden Curriculum of School Grounds.* (No. ISBN-0-947613-48-X). Toronto: Green Brick Road. Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED430384

U.S. Department of Education [USDE]. (2013). U.S. Department of Education Green Ribbon Schools. *ED.gov*. Government. Retrieved July 1, 2013, from http://www2.ed.gov/programs/green-ribbon-schools/index.html

U.S. Green Building Council [USGBC]. (2013). What Makes a School Green? *The Center for Green Schools*. Business. Retrieved July 1, 2013, from http://www.centerforgreenschools.org/main-nav/k-12/what.aspx

Virginia Tech. (2010). CDAC Projects Archives. *Community Design Assistance Center*. Education. Retrieved October 25, 2013, from http://cdac.arch.vt.edu/ppoutdoorlearn.html

Wilson, B. G. (1996). *Constructivist Learning Environments: Case Studies in Instructional Design*. Englewood Cliffs, NJ: Educational Technology Publications.

Yin, R. K. (1994). *Case Study Research: Design and Methods* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Appendix A - List of Abbreviations

List of Abbreviations

ACEF: American Clearinghouse on Educational Facilities

OBE: Outdoor Based Education

LEED: Leadership in Energy & Environmental Design

GBCI: Green Building Certification Institute

SLC: Small Learning Communities

KSDE: Kansas Department of Education

GHS: Goddard High School

EHS: Eisenhower High School

MHS: Maize High School

USD: Unified School District

OWLS: Outdoor Wildlife Learning Site

Appendix B - Nomenclature

General Terms

High School. Educational institutions for the third level of (usually compulsory) education for children, entered after elementary school and middle or junior high school. The grades or forms included in high schools vary by location, but often include grades 9 to 12. If the school district has no middle or junior high school, high school may include grades 7 to 12 (“Art & Architecture Thesaurus,” 2013; Harris, 2005).

Site Planning. The uncomplicated definition of site planning is the organization of the external physical environment to accommodate human behavior. On a more complex level site planning is the art of arranging structures on the land and shaping the spaces in between. It is an “art” that links architecture, engineering, landscape architecture, and city planning by using technical skills to address moral and esthetic issues and purposes is to enhance everyday life (Lynch & Hack, 1984).

Site Plan. Locating objects and activities in space and time (Lynch & Hack, 1984). A more thorough definition would be: Drawings or works in another medium laying out the precise arrangement of a structure on a plot of land. It may also refer to plans for gardens, groups of buildings, or developments, where the layout of buildings, roadways, utilities, landscape elements, topography, water features, and vegetation may be depicted. For drawings or other representations on a horizontal surface of cities or larger areas, particularly when such representations are not part of a design process, use "plans (maps)" (“Art & Architecture Thesaurus,” 2013).

Utility. Refers to the design's functionality: Does it do what users need? (Nielsen, 2012)

Usability. A quality attribute that assesses how easy user interfaces are to use (Nielsen, 2012). Table A.1 defines the five components of usability.

Table A.1 Five Components of Usability

Five Quality Components of Usability	
Learnability	How easy is it for users to accomplish basic tasks the first time they encounter the design?
Efficiency	Once users have learned the design, how quickly can they perform tasks?
Memorability	When users return to the design after a period of not using it, how easily can they reestablish proficiency?
Errors	How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
Satisfaction	How pleasant is it to use the design?

Representative Samples. Representative samples are selected in such a way as to be representative of the population. They provide the most valid or credible results because they reflect the characteristics of the population from which they are selected. There are two types of probability samples: random and stratified (Sommer, 2006).

- *Random sample. The term random has a very precise meaning. Each individual in the population of interest has an equal likelihood of selection.*
- *Stratified sample. A stratified sample is a mini-reproduction of the population. Before sampling, the population is divided into characteristics of importance for the research. Then the population is randomly sampled within each category. Stratified samples are as good as or better than random samples, but they require fairly detailed advance knowledge of the population characteristics, and therefore are 5.6 to list*

Architectural Design Paradigms

Beaux Arts. An academic, neoclassical architectural design style taught at the *École des Beaux-Arts* in Paris beginning in the 1600's. The focus of the architecture was on the harmonious composition and order of sculptural decorations through the use of hierarchy and symmetry (Fogle & Klein, 1986).

Arts and Crafts. An aesthetic and social movement of the late nineteenth century that originated in England and spread to the United States, Germany, and Northern Europe. A reaction against industrialization and the quality of manufactured goods, the movement is marked by a desire to revive the craftsmanship associated with traditional arts, a form follows function philosophy, and an idealized view of the medieval craft guilds ("Art & Architecture Thesaurus," 2013).

Modernism (International Style). Refers to the style of architecture that emerged in Holland, France, and Germany after World War I and spread throughout the world, becoming the dominant architectural style until the nineteen-seventies. The style is characterized by an emphasis on volume over mass, the use of lightweight, mass-produced, industrial materials, rejection of all ornament and color, repetitive modular forms, and the use of flat surfaces, typically alternating with areas of glass ("Art & Architecture Thesaurus," 2013).

Functionalism. Doctrine or practice that emphasizes practical utility or functional relations in the design and construction of structures, objects, and systems. Use also when referring to the contemporary design philosophy, relating chiefly to architecture and furnishings, holding that form should be adapted to use, material, and structure ("Art & Architecture Thesaurus," 2013).

An architectural principle that believed building design should be based upon the building purpose rather than its form. The roots of functionalism can be traced back to the Vitruvian triad, 'utilitas', 'venustas', and 'firmitas', as one of the three classical goals of architecture (Pugin & Weale, 1841).

Postmodernism. Refers to the style and period of art and architecture that developed in the nineteen-sixties and after, when there was a clear challenge to the dominance of Modernism. Generally speaking, it advocated a pluralistic approach to the arts and it stated that Modernism had failed because of a lack of a coded language of meaning to the viewer ("Art & Architecture Thesaurus," 2013).

Critical Regionalism. Theory or method that seeks to humanize modern architecture by moving away from global uniformity and unquestioning reliance on technology, favoring instead solutions drawing on regional traditions and materials, while at the same time maintaining awareness of the universal nature of contemporary culture ("Art & Architecture Thesaurus," 2013; Jencks, 1987).

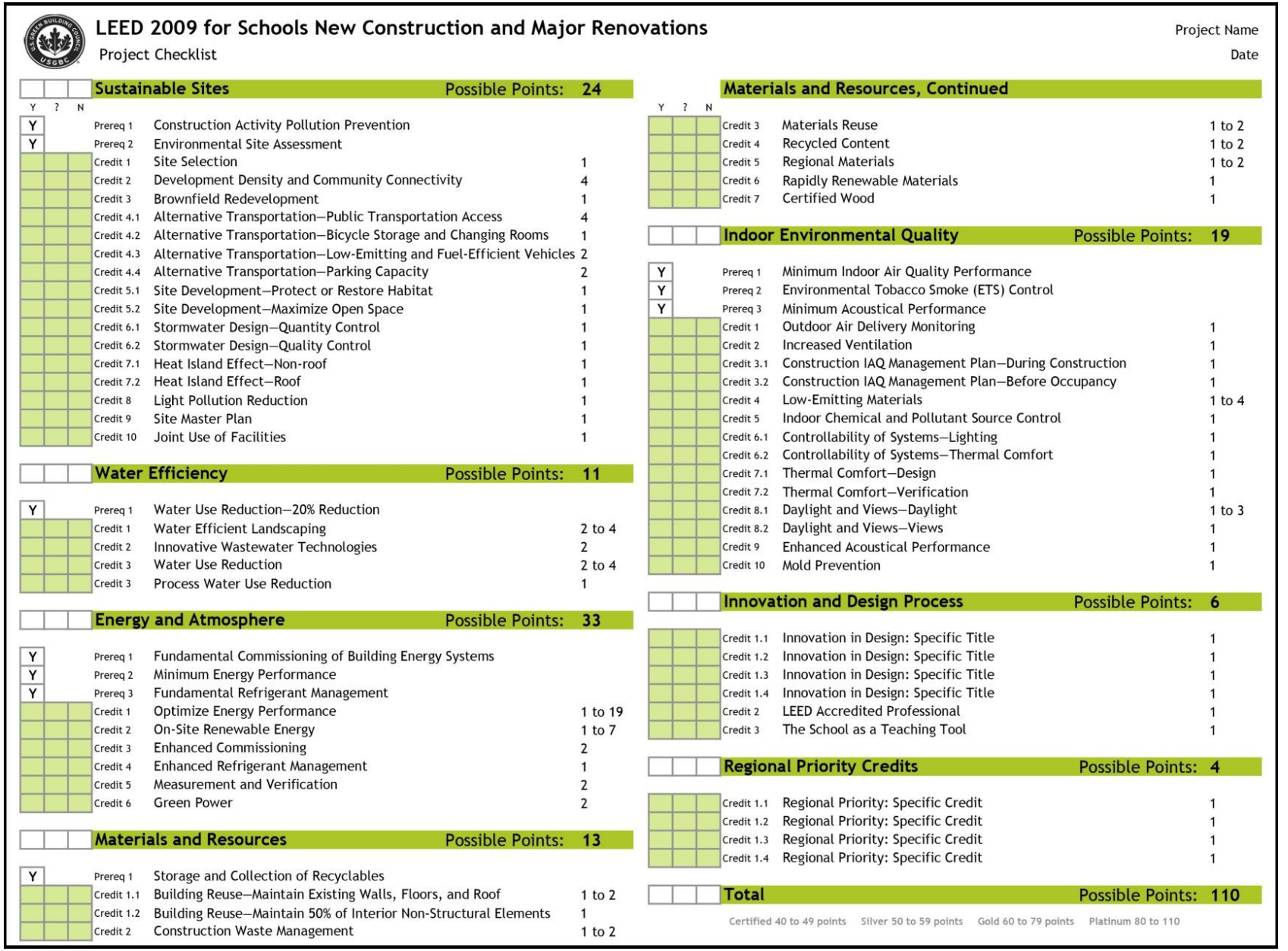
Contextualism. Refers to the concept that a work of art must be experienced in its context or setting and that this knowledge of the work of art leads to a richer appreciation and understanding of it ("Art & Architecture Thesaurus," 2013).

The Green Building Certification Institute (GBCI) administers project certification for commercial and institutional buildings and tenant spaces (U.S. Green Building Council [USGBC], 2013). under USGBC's LEED rating systems (U.S. Green Building Council [USGBC], 2013).

LEED Green Building Standards. Leadership in Energy & Environmental Design (LEED) is a green building tool that addresses the entire building lifecycle for high performance schools that are healthy for students, comfortable for teachers, and cost-effective. LEED is an internationally recognized certification system that measures a building using several metrics, including; (a) energy savings; (b) water efficiency; (c) sustainable land use; (e) improved air quality and; (f) stewardship of natural resources.

Based on established sustainable building practices and emerging concepts, the LEED rating systems are performance-based and comprehensive in scope. Points are awarded on a 100-point scale, and credits are weighted to reflect their potential environmental impacts. Different levels of certification are granted based on the total number of earned points. The four progressive levels of certification are: Certified, Silver, Gold and Platinum (U.S. Green Building Council [USGBC], 2013).

The Green Ribbon Schools program was established in 2011 by the U.S. Department of Education. Recipients demonstrate best practices to reduce environmental impact, promote health, and ensure a high-quality environmental and outdoor education program. Honored schools exercise a comprehensive approach to creating "green" environments through reducing environmental impact, promoting health, and ensuring a high-quality environmental and outdoor education to prepare students with the 21st century skills and sustainability concepts needed in the growing global economy (U.S. Department of Education [USDE], 2013).



LEED 2009 for Schools New Construction and Major Renovations

Project Checklist

Project Name

Date

Y	?	N				
Sustainable Sites					Possible Points:	24
Y			Prereq 1	Construction Activity Pollution Prevention		
Y			Prereq 2	Environmental Site Assessment		
			Credit 1	Site Selection	1	
			Credit 2	Development Density and Community Connectivity	4	
			Credit 3	Brownfield Redevelopment	1	
			Credit 4.1	Alternative Transportation—Public Transportation Access	4	
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1	
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2	
			Credit 4.4	Alternative Transportation—Parking Capacity	2	
			Credit 5.1	Site Development—Protect or Restore Habitat	1	
			Credit 5.2	Site Development—Maximize Open Space	1	
			Credit 6.1	Stormwater Design—Quantity Control	1	
			Credit 6.2	Stormwater Design—Quality Control	1	
			Credit 7.1	Heat Island Effect—Non-roof	1	
			Credit 7.2	Heat Island Effect—Roof	1	
			Credit 8	Light Pollution Reduction	1	
			Credit 9	Site Master Plan	1	
			Credit 10	Joint Use of Facilities	1	
Water Efficiency					Possible Points:	11
Y			Prereq 1	Water Use Reduction—20% Reduction		
			Credit 1	Water Efficient Landscaping	2 to 4	
			Credit 2	Innovative Wastewater Technologies	2	
			Credit 3	Water Use Reduction	2 to 4	
			Credit 3	Process Water Use Reduction	1	
Energy and Atmosphere					Possible Points:	33
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems		
Y			Prereq 2	Minimum Energy Performance		
Y			Prereq 3	Fundamental Refrigerant Management		
			Credit 1	Optimize Energy Performance	1 to 19	
			Credit 2	On-Site Renewable Energy	1 to 7	
			Credit 3	Enhanced Commissioning	2	
			Credit 4	Enhanced Refrigerant Management	1	
			Credit 5	Measurement and Verification	2	
			Credit 6	Green Power	2	
Materials and Resources					Possible Points:	13
Y			Prereq 1	Storage and Collection of Recyclables		
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 2	
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1	
			Credit 2	Construction Waste Management	1 to 2	

Y	?	N			
Materials and Resources, Continued					
			Credit 3	Materials Reuse	1 to 2
			Credit 4	Recycled Content	1 to 2
			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1
Indoor Environmental Quality				Possible Points:	19
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Y			Prereq 3	Minimum Acoustical Performance	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan—During Construction	1
			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
			Credit 4	Low-Emitting Materials	1 to 4
			Credit 5	Indoor Chemical and Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
			Credit 8.1	Daylight and Views—Daylight	1 to 3
			Credit 8.2	Daylight and Views—Views	1
			Credit 9	Enhanced Acoustical Performance	1
			Credit 10	Mold Prevention	1
Innovation and Design Process				Possible Points:	6
			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
			Credit 1.4	Innovation in Design: Specific Title	1
			Credit 2	LEED Accredited Professional	1
			Credit 3	The School as a Teaching Tool	1
Regional Priority Credits				Possible Points:	4
			Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1
Total				Possible Points:	110

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

Figure A.1 LEED Site Checklist (Source: USGBC, 2013)

Learning Theories

Learning Theories. Conceptual frameworks that describe how information is absorbed, processed, and retained during learning. Learning brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views (Illeris, 2004).

Behaviorism. Behaviorism states that the learner is passive and is responding to environmental stimuli. As these responses are repeated they become a learned behavior (LearningTheories, 2013).

Cognitivism. Cognitivism places emphasis on processing stimuli from the environment rather than the stimuli and the overt behaviors that arise. The mental processes that are of interest include recognition, recall, analysis, reflection, application, creating, understanding, and evaluation (Merriam et al., 2007).

Gestalt Theory. In learning it concentrates on the way in which the mind insists on finding patterns in things, and how this contributes to learning, especially the development of 'insight' (Atherton, 2011).

Constructivism. A learning process which allows a student to experience and act upon an environment first-hand, to both acquire and test new knowledge, thereby giving the student reliable, trust-worthy knowledge (Wilson, 1996). Constructivist learning theory proposed the following views;

- *"Understanding is in our interactions with the environment."*
  The concept that what we learn and how we learn are linked is the key to the constructivist model of learning. Constructivism states that we all understand things differently because we gained the knowledge through different sets of experiences. Once the knowledge is gained, we work to see if our individual understanding of those concepts is compatible with others.
- *"Cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned."*
  A second key for constructivist learning is that the goal of the learner is central to what is learned. This goal influences the learner's purpose for learning, what they focus on while learning, and what understandings they construct while learning. Constructivists call this "puzzlement" as it suggests influence from both intellectual and pragmatic goals.

- *"Knowledge evolves through social negotiation and through the evaluation of the viability of individual understandings."*

  Finally, constructivism looks at knowledge growing from social interactions. This is based on the idea that our knowledge is not valuable simple because it is a learned fact but because it is tested and examined in a social setting where we find that it is either accepted or challenged by a larger body of individuals. Through this testing we can adapt and modify out knowledge. As a result, 'facts' come from widespread agreement on a topic not simply personal interpretation.

Multiple Intelligence Theory. Howard Gardner's theory on how people perceive and understand the world (Gardner, 1999). Currently nine types are proposed, but the following eight will be addressed in this research;

- **Linguistic Intelligence.** The capacity to use language to express what's on your mind and to understand other people.
- **Logical/Mathematical Intelligence.** The capacity to understand the underlying principles of some kind of causal system; or to manipulate numbers, quantities, and operations.
- **Musical Rhythmic Intelligence.** The capacity to think in music; to be able to hear patterns, recognize them, and perhaps manipulate them.
- **Bodily/Kinesthetic Intelligence.** The capacity to use your whole body or parts of your body (your hands, your fingers, your arms) to solve a problem, make something, or put on some kind of production.
- **Spatial Intelligence.** The ability to represent the spatial world internally in your mind, or a more circumscribed spatial world. Spatial intelligence can be used in the arts or in the sciences.
- **Naturalist Intelligence.** The ability to discriminate among living things (plants, animals) and sensitivity to other features of the natural world (clouds, rock configurations).
- **Intrapersonal Intelligence.** Having an understanding of yourself; knowing who you are, what you can do, what you want to do, how you react to things, which things to avoid, and which things to gravitate toward.
- **Interpersonal Intelligence.** The ability to understand other people.

Humanism. Emphasizes that perceptions are centered in experience, and it also emphasizes the freedom and responsibility to become what one is capable of becoming (Ormrod, 1990).

Activity Types. Elements that students look for in school grounds are listed below (Freeman & Tranter, 2011, p. 65; Titman, 1994).

- **A place for thinking.** Provides intellectual stimulation, things to discover and study and learn about, by themselves and with friends, and which allow them to explore, discover and understand more about the world they live in.
    - Examples: Journaling, unstructured, independent activities
- **A place for feeling.** Present color, beauty and interest, which engender a sense of ownership, pride and belonging, in which they don't feel vulnerable.
    - Examples: Process and reflect.
- **A place for being.** Allow students to be themselves, which recognizes their individuality, their need to have a private persona in a public place, for privacy, for being alone with friends, and for being quiet outside a noisy classroom.
    - Examples: Interact and engage with peers.
- **A place for doing.** Offers opportunities for physical activity, for doing all kinds of things, and which recognizes their need to extend themselves, develop new skills, and to find challenges and take risks.
    - Examples: Structured activities that allow for exploration, interaction and engagement with the environment.

Contemporary Design Concepts

Table A.2 Small Learning Communities Best Practices

Five Domains of Small Learning Communities Best Practices	
Self-Determination	Autonomy in decision making, physical separateness, self-selection of teachers and students, and flexible scheduling must all be present to allow small learning community members to create and realize their own vision.
Identity	Small learning communities profit from developing a distinctive program of study that originates in the vision, interests, and unique characteristics of their members.
Personalization	Small learning community members know each other well. Teachers are able to identify and respond to students' particular strengths and needs.
Support for Teaching	SLC teachers assume authority as well as responsibility in educating their students. School leadership does not reside only in the administrative staff; administrators teach, and teachers lead.
Functional Accountability	SLC teams use performance assessment systems that require students to demonstrate their learning and the SLC to demonstrate its success.

Small Learning Communities. An interdisciplinary team of teachers who share a few hundred or fewer students in common for instruction, assumes responsibility for their educational progress across years of school, and exercises maximum flexibility to act on knowledge of students' needs (Oxley, 2007).

Universal Design Site Guidelines. The article *Outdoor Settings for Playing* presents seventeen school site design guidelines for planning purposes. The complete list is as follows; (a) Entrances; (b) Pathways; (c) Signs & Displays; (d) Fences, Enclosures, & Barriers; (e) Manufactured Equipment & Play Structures; (f) Multi-Purpose Game Settings; (g) Groundcovers & Safety Surfaces; (h) Landforms & Topography; (i) Trees & Vegetation; (j) Garden Settings; (k) Animal Habitats; (l) Aquatic Settings; (m) Sand & Dirt Settings; (n) Play Props; (o) Gathering, Meeting, & Work Settings; (p) Performance Settings; and (q) Field Stations & Storage Settings (Moore, 1996).

Appendix C - Universal Design Principles

(Source: Taylor, 2008)

Appendix D - Constructing Probability Samples Model

Steps for selecting a RANDOM sample.

1. Specify the population
2. Decide on the desired sample size.
3. List all the cases.
4. Make a decision rule (i.e., to select the cases with either the lowest or highest set of random numbers.)
5. Assign a random number to each case.
6. Sort cases (names) by a random number.
7. Follow the decision rule and select the sample.

Steps for selecting a STRATIFIED sample.

1. Specify the population.
2. Specify variable levels (strata) of the population that might affect the research outcome (e.g., gender, religion, etc.).
3. Decide on the desired sample size.
4. List all the cases within each stratum (levels of critical variables).
5. Make a decision rule (i.e., to select the cases with either the lowest or highest set of random numbers.)
6. Within each stratum.
    a. Assign a random number to each case.
    b. Sort cases (names) by a random number.
7. Follow the decision rule and select the sample so that the proportions in the sample reflect the proportions in the population.

(Sommer, 2006)

Appendix E - Site Variables Checklist

Site Checklist

Variable	Sub-Units	Options	Present
Environmental Factors	Sunlight	Early Morning	
		Mid-Morning	
		Afternoon	
	Shade	Early Morning	
		Mid-Morning	
		Afternoon	
	Wind	None	
		Intermittent	
		Constant	
	Noise	Low (0-40dB)	
		Med (40-70dB)	
		High (70-95 dB)	
Design Type	Existing		
	Retrofit		
	Control		
Space Requirements	Amphitheater		
	Single Class		
	Small Group		
	Individuals		
Activity Type	Thinking		
	Feeling		
	Doing		
	Being		

		High	Medium	Low
Relationship to Building	Visibility			
	Proximity			
	Boundaries			
	Circulation			
	Connections			

Updated Site Checklist

Variable	Sub-Units		Present
Design Type			
	Existing		
	Retrofit		
	Control		
Environmental Factors			
	Sunlight	8AM-10AM	
		10AM-12PM	
		12PM-3PM	
	Shade	8AM-10AM	
		10AM-12PM	
		12PM-3PM	
	Wind	0-6 mph	
		6-8 mph	
		8-16 mph	
	Noise	(0-40dB)	
		(40-70dB)	
		(70-95 dB)	
Space Requirements			
	Amphitheater	1540-2500 sq. ft.	
	Single Class	770-1000 sq. ft.	
	Small Group	250-450 sq.ft.	
	Individuals	35 sq. ft.	
Activity Type			
	Thinking		
	Feeling		
	Doing		
	Being		

Variable	Sub-Units		Present
Relationship to Building			
	Visibility	number of windows/wall facing designated space	
		1 window/ 15 ft.	
		1 window/ 25 ft.	
		1 window/ 35 ft.+	
	Proximity	Distance between building and site	
		1 min, 300ft -0 ft	
		2.5-1 min, 700ft -300 ft	
		2.5 min, 700+ ft	
	Boundaries	Percent of space's perimeter enclosed	
		100%-60%	
		60%-30%	
		30%-0%	
	Circulation	Width of paths within space	
		6 ft. +	
		6-3 ft.	
		3-0 ft.	
	Connections	Number of paths between space and building	
		2+	
		1	
		0	

Site User Questionnaire

Please answer the following questions by placing an (X) in the relevant block or writing your answer in the space provided.

General Information
This section of the questionnaire refers to background or biographical information. Although we are aware of the sensitivity of the questions in this section, the information will allow us to compare groups of respondents. Once again, we assure you that your response will remain anonymous. Your co-operation is appreciated.

General Facility Information

School Address Placed Here

1. Is the above school information correct
   a.

YES	
NO	

   b. If not please complete the following information.

School Name	
Address	
City, State, Zip	
Phone Number	

General Personal Information

2. Please identify the person responsible for the questionnaire responses, and please provide the appropriate title and contact information.
   a.

Name	
Title	
Employer	
Phone Number	
Email	
Best Contact Time	

3. What content area do you teach? (Please list all for the 2012-2013 school year.)

4. What grade level? (Please list all for the 2012-2013 school year.)

Site Use
This section of the questionnaire refers to the design and use of outdoor spaces on your campus.

Site User Questionnaire

5. Does your school have designated outdoor educational spaces on the campus?
   a.

YES	
NO	

   b. Please list these areas.

   c. Do you use these outdoor educational spaces at your school?

YES	
NO	

   d. If so how often?

Often	
Sometimes	
Seldom	
Never	

   e. What type of teaching/activities do you do when you are outside?

6. Are there non-designated outdoor areas that are used for teaching on your campus?
   a.

YES	
NO	

   b. Please list these areas.

   c. Do you use these outdoor educational spaces at your school?

YES	
NO	

   d. If so how often?

Often	
Sometimes	
Seldom	
Never	

   e. What type of teaching/activities do you do when you are outside?

7. What areas on campus do you use most often?

a. Are these Designated or Non-Designated spaces?

Designated	
Non-Designated	

8. Please list the top 5 spaces that you use.

a.

1.	
2.	
3.	
4.	
5.	

b. How often do you use each of these areas?

	Often	Sometimes	Seldom	Never
1.				
2.				
3.				
4.				
5.				

c. Why do you use these spaces?

1.	
2.	
3.	
4.	
5.	

d. How much time does it take to travel to these outdoor spaces? (*Give best approximation in minutes)*

1.	

2.	
3.	
4.	
5.	

Preference

This section of the questionnaire refers to the factors that affect the desirability of the space to be utilized as an outdoor educational space.

9. Please numerically (1,2,3,4,...) rank in order of importance the following variables.

a. Environmental Factors

(Definition: Please answer the question in regard to the importance of the factors availability during the time that you are present.)

Sunlight	
Shade	
Wind	
Noise	

b. Space Requirements

(Definition: Please answer the question based on your average need for space.)

Amphitheater	
Single Class	
Small Group	
Individuals	

c. Activity Type

*(Definition: Please answer the question based on the type of activities that you regularly engage. **Thinking;** spaces for, journaling, and other unstructured, independent activities, **Feeling**; spaces that allow students to process and reflect, **Doing**; spaces for structured activities that allow for exploration, interaction and engagement with the environment, and **Being;** spaces that allow students to interact and engage with peers.)*

Thinking	
Feeling	
Doing	
Being	

d. Relationship to Building

(Definition: Please answer the question based on the need for association of these elements with the building structure.)

Visibility	
Proximity	
Physical Boundaries	
Circulation	
Physical Connection	

Maintenance

Site Survey Continued

Site User Questionnaire

This section of the questionnaire refers to teacher's degree of involvement in maintenance of the outdoor educational spaces on their campus.

10. Are you involved in the maintenance and upkeep of any outdoor educational spaces?
    a.

YES	
NO	

    b. If YES please list them.
        i. What activities do you consider maintenance?

        ii. How much time do you spend on maintenance per week?

    c. If NO;
        iii. Who is in charge of the maintenance of these areas?

        iv. What activities are considered maintenance?

Follow Up

11. Are you available for future contact on this subject?
    a.

YES	
NO	

Appendix H - Raw Combined School Survey Data

Table A.3 Combined School Survey Data

Combined Schools Survey Results

General Information

Respondents Per School

Goddard High School	7	Eisenhower High School	15	Maize High School	8

Site Use

ODE On-Site		Designated ODE Site Use		Non-Designated ODE Site Use		Non-Designated VS. Designated ODE Site Use	
Yes	24/29	Yes	22/29	Yes	20/29	Non-Designated	11
		O, ST	18/29	O, ST	17/29	Designated	18

Preference

Environmental Ranking		Space Ranking		Activity Type		Building to Site Relationship	
Sun (1)	21/29	Class (1)	19/29	Doing (1)	23/29	Proximity (1)	21/29
Shade(2)	13/29	Sm. Group (2)	17/29	Being (2)	9/29	Boundaries (1)	8/29
Wind (2)	9/29	Individuals (3)	13/29	Thinking (3)	10/29	Visibility (3)	8/29
Noise (4)	15/29	Multi-Class (4)	22/29	Feeling (4)	15/29	Circulation (5)	13/29
						Physical Connection (5)	11/29

Involved in Maintenance		***Available for Follow Up***	
Yes	6/29	Yes	26/29
No	22/29	No	2/29

Appendix I - District Bell Schedules

Table A.4 USD 265 Bell Schedule

Class Schedule Mon., Tues., Thurs., Fri.		*P.R.I.D.E Schedule Wed.*	
1st Hour	7:35 – 8:29 a.m.	1st Hour	7:35 – 8:25 a.m.
2nd Hour	8:34 – 9:28 a.m.	2nd Hour	8:30 – 9:20 a.m.
3rd Hour	9:33 – 10:27 a.m.	3rd Hour	9:25 – 10:15 a.m.
4th Hour	10:32 – 11:26 a.m.	P.R.I.D.E	10:20 – 10:45 a.m.
5th Hour & Lunch	11:31 a.m. – 12:53 p.m.	4th Hour	10:50– 11:40 a.m.
Lunch 1	11:31 - 11:58 a.m.	5th Hour & Lunch	11:45 a.m. – 1:01 p.m.
Lunch 2	11:58 a.m. - 12:26 p.m.	Lunch 1	11:45 a.m. - 12:10 p.m.
Lunch 3	12:26 - 12:53 p.m.	Lunch 2	12:10 - 12:35 p.m.
6th Hour	12:58 – 1:52 p.m.	Lunch 3	12:35 - 1:01 p.m.
7th Hour	1:57 – 2:51 p.m.	6th Hour	1:06 – 1:56 p.m.
After School Detention	3:00 – 3:55 p.m.	7th Hour	2:01 – 2:51 p.m.
		After School Detention	3:00 – 3:55 p.m.

Table A.5 USD 266 Bell Schedule

Class Schedule Mon., Tues., Thurs., Fri.		*Early Release* Schedule Wed.*	
Block 1	7:40-9:04	Block 1	7:40-8:55
Block 2	9:13-10:37	Block 2	9:04-10:19
Encore	10:43-11:15	Encore	10:26-10:56
Block 3	11:21-1:15	Block 3	11:02-12:49
Block 4	1:21-2:45	Block 4	12:55-2:10

***Note: The district dismisses students 30 minutes early every Wednesday to accommodate the Professional Learning Communities (PLCs) the teachers participate in.**