I, Emily A Krieger, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture (Master of).

It is entitled:
Future Forms for Healthy Development: Eliminating the Gap Between Nature and the Built Environment

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This work and its defense approved by:

Committee chair: Aarati Kanekar, PhD

Committee chair: Michael McInturf, MARCH
Future Forms for Healthy Development:
Bridging the Gap Between Nature and the Built Environment

A thesis submitted to the Graduate School
of the University of Cincinnati
in partial fulfillment of the
requirements for the degree of

Master of Architecture
In the school of Architecture and Interior Design
of the College of Design Architecture Art and Planning

By Emily Krieger
Bachelor of Science in Architecture, University of Cincinnati, June 2009

Committee Chair: Michael McInturf, First Chair
Committee Chair: Aarati Kanekar, Second Chair
Abstract

Today children are spending less and less time outdoors interacting with nature and more and more time indoors leading sedentary lifestyles in front televisions and computers. Consequently, two-thirds of American children cannot pass a basic physical fitness test, which includes running and doing sit-ups and push-ups, among other things. Along with physical health issues, such as obesity, children are also suffering from mental health disorders, such as Attention Deficit Disorder and depression, more than any other generation ever has. Though not believed to be the sole factor, a growing body of research exists directly linking the amount of time children spend outdoors interacting with nature to their mental, physical, and emotional health and development.

Happening simultaneously as this growing body of research is more and more people moving to urban areas. By the year 2030, 60 percent of the entire world’s population is predicted to live in urban areas. According to the 2000 census, over 79 percent of the people in the United States already do. This migration to urban areas is problematic because most of these spaces do not currently have the amounts and types of nature necessary to promote healthy development.

This thesis will investigate the importance of nature on human development and methods of integrating nature into cities in order to create a design methodology that seamlessly integrates nature into built form, which, when implemented, will reduce the negative effects that living in cities, and therefore devoid of nature, has on humans. This design methodology will then be demonstrated through the design of an urban educational school located in Cincinnati, Ohio.
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INTRODUCTION

As humans, we are shaped by the environment in which we exist. The surroundings we interact with mold our behaviors, patterns of life, and habits. This concept is often referred to as architectural determinism or environmentalism. This theory believes that the built environment is the chief, or even sole, determinant of social behavior. Therefore, if the built environment is not conducive to healthy human lifestyles than the consequence will be unhealthy development and behavior. But what makes a built environment healthy? Research is showing a healthy environment is one where a person can surround themselves and interact with nature on a daily basis. However, most urban areas do not currently provide this type of built environment.

For the majority of human evolution we gathered in small groups and lived off the land. It was not until the Industrial Revolution, which led to the creation of large cities, that humans began to shift away from a reliance on, and daily interaction with, the environment and other species. Before too long the majority of the world’s population will live in cities. It is predicted that by 2030 over 60% of the world’s population will live in urban areas. According to the 2000 census, over 79% of people in the United States already live in urban areas.

1 Charles Mercer, Living in Cities: Psychology and the Urban Environment
2 William C. Sullivan, “Forest, Savanna, City: Evolutionary Landscapes and Human Functioning,” in Urban Place: Reconnecting with the Natural World,
3 M. Jenks and Nicola Dempsey, Future Forms and Design for Sustainable Cities
Living in urban areas often means living without daily contact with nature. In most cities, the only contact people have with nature is with the few trees planted along the sidewalks and the few pocket parks that exist within the city limits. Nevertheless, research has shown that nature has a positive effect on mental, physical, spiritual, and emotional health. Studies suggest that people are drawn to natural areas, which is known as Biophilia, and that living devoid of daily interaction with nature is detrimental to all aspects of human health and development.

Unfortunately, due to an increasing reliance on technology - such as cars, televisions, and the Internet - people spend little time outdoors and are rarely in direct contact with nature, especially not on a daily basis. Nature is no longer a reality humans experience but instead is an abstraction we experience through technology such as advertising and virtual media.

This separation from nature is most detrimental to those still in their developmental stages, such as children. Therefore, children - who, for the most part, have no control over the environments they inhabit - are suffering the most serious consequences of living in urban areas. This is evident by the deteriorating health of today’s youth. For example, today’s generation is the first generation since World War II predicted to die before their parents.

This thesis will research both the importance of nature on human development and sustainable design strategies in order to develop a set of strategies that, when applied, will reverse the negative effects living in cities currently have on human development. These strategies will be demonstrated through the design of an urban educational facility located in downtown Cincinnati, Ohio.

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4 M. Jenks and Nicola Dempsey, *Future Forms and Design for Sustainable Cities*
Architecture and built form in urban spaces have become divorced from the natural environment. This is a result of the speed by which people live their lives, the lack of green space in cities for people to interact with, and our dependence on the technologies that entertain us and make our lives comfortable. This divorce of nature from built form has been shown to increase the chance of stress, irritability, and depression - among other things - in urban dwellers.¹

In order to minimize or reduce these negative effects, it is crucial to create a methodology of design that creates spaces which facilitate and encourage interaction between people and nature. This interaction is especially important for children because they are still in their primary developmental stages. In order to design spaces that achieve this integration of nature and built form, it is imperative to know how humans - especially children - develop, interact with, and value nature.

HUMAN DEVELOPMENT AND NATURE

Humans started evolution as hunters and gatherers. They lived off the land and moved from place to place as the resources were depleted. Humans lived and evolved like this for thousands of years, for almost all of our modern existence. As hunters and gatherers we chose our habitats much like other species chose their’s, based on their ability to support a specific aspect of our

¹ Lisa Benton-Short and John R. Short, *Cities and Nature*
Today the majority of people choose to live in cities, which goes against our evolutionary need to connect with nature. As humans, we evolved in a world where our environments were constantly changing and noticing this change was essential to survival. Our genes developed this way for thousands of years and still do today. Therefore, as humans, we do not function well in unvarying environments and though most humans today no longer live off the land, it is still in our genes to connect with the land on a daily basis. However, living in cities makes it almost impossible to do this. Many researchers believe that because of this lack of interaction, cities are unfit environments for healthy lifestyles and development. Studies have shown that living in unfit environments leads to unhealthy patterns of behavior and functioning such as depression and obesity. It is possible for humans to survive in urban environments, but it is unlikely that, without daily contact with nature, humans will continue to thrive.

In order for humans to be happy and develop perceptual processes properly, a variety of different experiences are required. Some of these processes are fundamental in order for humans to function and deal with the stress of daily life in a healthy manner. One of these fundamental processes is the ability to differentiate oneself from one’s environment. This process is a skill learned during the developmental stages of childhood and is essential for emotional and mental health both as a child and later, as an adult. Nature is one of the few environments that stimulate all of the senses and create multiple different experiences and emotions at the same time. Early experiences in nature help facilitate this process by creating a variety of experiences that stimulate the senses and provide a surrounding through which a person can experiment, test, and explore. Without these natural experiences, developmental issues can often be seen later in life.

Experiencing nature is a natural form of physical exercise and mental recovery. Studies have found that people who participate in outdoor activities on a daily basis are less likely to experience stress or irritability or suffer from obesity. However, most humans today spend almost 90 percent of their time indoors. On top of that, most of this time spent indoors is spent sitting in front of computers, watching television, surfing the Internet, or playing video games. Living a sedentary lifestyle has been linked to many different mental health problems such as focusing issues and depression. Figure 2.1 graphically represents a study showing where humans, on average, spend their time.

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2 Christopher Day and Anita Midbjer, Environment and Children: Passive Lessons from the Everyday Environment
3 Jules Pretty, “Concluding Remarks: Nature and Health in the Urban Environment,” in Urban Place: Reconnecting with the Natural World
4 William C. Sullivan, “Forest, Savanna, City: Evolutionary Landscapes and Human Functioning,” in Urban Place: Reconnecting with the Natural World,
5 Charles Mercer, Living in Cities: Psychology and the Urban Environment
6 Richard Louv, Last Child in the Woods: Saving Our Children from Nature-deficit Disorder
order to reduce the likelihood that a person will lead a sedentary lifestyle, it is important to create spaces that encourage both movement and interaction with nature.

**CHILD DEVELOPMENT AND NATURE**

It is evident that nature is imperative to human health and well-being. It is especially important for humans still in their developmental stages, such as children. The first five years are the most important years for the development of a healthy human personality. Then, between the ages of six and thirteen, children go through some of the most important skills development stages, further developing their healthy personality. Consequently, if children do not properly develop these skills as children, there is a likelihood they will suffer from mental, physical, and emotional health issues later in life.

A 30-year index that ranks different aspects of children’s health shows that today’s children have sunk to the lowest level of health in history. This is evident when one looks at the current physical state children are in, the amount of mental health disorders, and the amount of medicines prescribed to children each year. In 2004, 18 percent of children ages 6-11 were considered obese. This number has risen from the 3.8 percent recorded in 1974. Interestingly, this childhood obesity epidemic has coincided with the largest increase in

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7 Charles Mercer, *Living in Cities: Psychology and the Urban Environment*
8 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
the history of organized sports. This suggests that physical health can be attributed to more than just organized outdoor activities. On top of this, nearly 8 million children in the United States suffer from mental disorders. The journal Psychiatric Services published a study in 2003 that states that the amount of antidepressants described to children has doubled in the last five years.

Today, children spend more and more time indoors. The importance of school and academic success is stressed at a higher level than ever before in history. Many schools have gotten rid of all recess or free play and have minimized electives such as music and art in order to add more core academic time to curriculums. Therefore, more and more children sit all day at school, then go home and sit all evening doing homework and watching television. It should be no surprise then that children are not developing proper motor skills and are suffering from obesity at greater levels than ever before.

Research shows that learning and developing are best done through hands-on and interactive activities. This is because the mind learns in an integrated and holistic way by making connections with experiences and the surrounding environment. One of the ways children develop is by pushing and expanding their known habitat. This requires exploration and developing the ability to adapt based on their direct environment. Activities that facilitate this development require exploration, construction, organization, and interaction with multiple different and changing environments. Nature is one of the few environments that provides the opportunity to do all these things at once. It allows children to develop based on their experiences, perceptions of, and interaction with all the different surroundings it provides. From environmental experiences the brain learns how it needs to "develop." It is therefore important for children to spend time outdoors interacting with nature in order for them to complete these activities and stages of development successfully.

Outdoor play is more beneficial for children than indoor play. This is because of the physical exercise and emotionally relaxing experience nature creates. Unstructured play outdoors is even more beneficial than organized outdoor activities because outdoor play varies more and is less time-bound. It therefore encourages exploratory play and creativity. Along with fostering

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9 Richard Louv, Last Child in the Woods: Saving Our Children from Nature-deficit Disorder
10 Richard Louv, Last Child in the Woods: Saving Our Children from Nature-deficit Disorder
11 Anne P. Taylor and Katherine Enggass, Linking Architecture and Education: Sustainable Design for Learning Environments
14 Christopher Day and Anita Midbjer, Environment and Children: Passive Lessons from the Everyday Environment
15 Richard Louv, Last Child in the Woods: Saving Our Children from Nature-deficit Disorder
creativity, outdoor play in nature helps children develop problem-solving skills through exploration and interaction. Children need to learn to identify risks and problems and then create and test solutions. Nature best facilitates the development of these skills because of the limitless opportunities to create, alter, and construct that nature provides. More and more, time spent outdoors is being recognized as essential to healthy child development.

An important set of skills that children need to develop at an early age in order to function later in life are motor skills. There are two types of motor skills, fine and gross. Fine motor skills are the ones that allow you to develop the ability to control small muscle movements and complete tasks such as writing and manipulating objects with your hands. Gross motor skills are characterized by the ability to control major movements such as running and jumping. Studies have shown that without the development of gross motor skills it is almost impossible to develop fine motor skills. Gross motor skills lead to the development of balance, body awareness, laterality, major muscle coordination, and spatial orientation and awareness. Activities that facilitate the development of these skills are climbing, jumping, running, balancing, and playing with balls. Most of these activities require outdoor interaction and play. Figure 2.4 graphically represents what motor skills are and activities that facilitate the development of them and which of these activities require

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17 “Motor Skills And Child Development,” Essortment Articles: Free Online Articles on Health, Science, Education & More...
Fig. 2.5 Comparison study of where adults used to play compared to where they do or would let their children play.

If children are not going outside, like studies suggest, then they are most likely not properly developing these skills, which means they will have developmental problems later in life.

A study done in Denmark looked at the differences between two kindergartens, one that participated in outdoor activities on a daily basis and one that was a traditional kindergarten, much like those in the United States. The children in the outdoor kindergarten tested better, were more alert, and had better control and use of their bodies. The children who were “creative” were also more likely to be part of the outdoor kindergarten. This is because play in nature stimulates the imagination, which is a fundamental part of creativity. A similar study found that children who were part of an outdoor day care and played outside everyday, regardless of the weather, had better motor fitness skills - especially in terms of balance and agility - and a greater ability to concentrate.18

Another study, done by Gran in 1997, looked at concentration abilities between two schools, one that had access to unstructured vegetation - nature that is not manicured or specifically landscaped - during recess and one that only had access to standard playground equipment. Gran found that those who had access to the natural environment demonstrated a much greater ability to concentrate during classes and therefore also performed better.19

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18 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
19 Rachel Kaplan and Stephen Kaplan, "Adolescents and the Natural
suggests that it is not just spending time outdoors that is important, it physical interaction with natural, unstructured environments.

Research fully supports the idea that time spent outdoors is beneficial for children, but are children capitalizing on this? The answer is no. From 1997 – 2003 there was a 50 percent decrease in the amount of children that participated in organized outdoor activities such as hiking, camping, and fishing. Studies suggest that children play outside less, and when they do play outside, it is for shorter periods of time.\textsuperscript{20}

In his book, \textit{Last Child in the Woods}, Richard Louv presents the results of a survey he did on parents and their children regarding outdoor activities. Nearly all adults in the survey said that the most important space of their childhood was a natural outdoor area. Less that 50 percent of children ages 8-11 responded the same way. Of the mothers surveyed, 71 percent responded that they played outdoors on a daily basis as children. However, only 26 percent of them said their children play outdoors on a daily basis.\textsuperscript{21} Figure 2.5 shows the results from a similar study that surveyed parents on where they played as children compared to where they would let their children play. The results of this study show that the only place where children play now more than their parents did are indoor activity areas, indoor sports centers, and indoor after school clubs. These studies help prove that children do not spend as much time outdoors now as they did as little as twenty years ago.

**BENEFITS OF NATURE**

It is evident that the creation of spaces that encourage daily contact and interaction with the natural environment is important, especially to those living in urban areas. Many negative effects of living without nature have been explored in previous sections. This section will look at the benefits of living and having contact with nature on a daily basis.

Many studies have been done that suggest green space and interaction with, and views of, nature foster recovery from mental fatigue, physiological, illness, injury, and also helps to restore mental functioning and focusing abilities.\textsuperscript{22} Recreating in wilderness areas has been proven to relax people and reduce the levels of stress or the likelihood that daily activities will result in stress. This is because natural settings provide the right amount and types of stimulus to both stimulate and relax the brain at the same time in a reliably constant setting. Not enough stimulation bores the brain and leads to the dulling of

\begin{itemize}
\item Environment: A Time Out?,” \textit{in} Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations
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\item Richard Louv, \textit{Last Child in the Woods: Saving Our Children from Nature-deficit Disorder}
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\item William C. Sullivan, “Forest, Savanna, City: Evolutionary Landscapes and Human Functioning,” \textit{in} \textit{Urban Place: Reconnecting with the Natural World}
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senses. Without stimulus the brain looks for methods of stimulation and eventually goes to sleep, which leads to deterioration of concentration abilities. Similarly bad, too much sensory stimulation can be stressful and traumatic. Studies have also shown that people who affiliate with nature positively are happier, more able to relax, and more productive than those who do not.

Nature also has physical health benefits. People who interact with nature daily are less likely to get sick or suffer from obesity. An ability to walk in and experience nature has been proven to boost the immune system. Spending time outdoors is also a natural form of exercise. Therefore, people who spend lots of time outdoors are often of a healthier weight than those that live an indoor sedentary lifestyle.

Natural environments promote many healthy social behaviors. A study done in two different Chicago neighborhoods demonstrated that neighborhoods with more green space and vegetation fostered more social activity and less violence or aggression than those that did not. This is most likely because green space has been proven to foster social interaction, which promotes social support. This support has emotional benefits such as happier and more relaxed inhabitants.

Exposure to nature in built environments has been shown to produce less stressful and happier work environments. Though most workplaces consider potted plants, pictures, and decorative art to be “nature,” even these characteristics have been proven to foster physical and mental well-being and enhance productivity. Studies have found that spaces with natural lighting and ventilation, natural materials, and direct and representational contact with nature lead to reduced stress, increased productivity, and happier inhabitants with even greater mental, emotional, and intellectual well-being than those who have access to potted plants and pictures.

In terms of children and education, there are even more beneficial aspects of time spent in nature. Environmental-based educations foster children that test better in all subjects, have higher standardized test scores, improved grade point averages, and stronger problem solving skills. Children in these programs often have better behavioral conduct and attendance records as well. Environmental-based educations are those with curriculums that

23 Christopher Day and Anita Midbjer, Environment and Children: Passive Lessons from the Everyday Environment
26 William C. Sullivan, “Forest, Savanna, City: Evolutionary Landscapes and Human Functioning,” in Urban Place: Reconnecting with the Natural World
28 Richard Louv, Last Child in the Woods: Saving Our Children from Nature-
maximize the amount of learning done in different environments including natural parks, wildlife, and schoolyards, among others. They use real-world natural and sociocultural settings as learning environments.  

Outdoor educational programs are another type of education resulting in healthier, happier children. Outdoor educational programs are organized learning programs that take place in the outdoors. These programs sometimes involve residential or journey-based experiences in which students participate in a variety of challenges in the form of outdoor activities such as hiking, climbing, canoeing, ropes courses, and group games.

Nature is an overwhelming, complex, and ever changing environment. This fosters development better than standard built environments because it promotes adaptability and creativity whereas standard environments are simple, stable, and inadaptable. Though stable environments are beneficial at times, these characteristics make it difficult for children to expand, explore, and grow - activities required for the development of a healthy personality. Time spent in nature integrates formal learning with informal play and is one of the few, if not the only, environments that stimulates all the senses. Since it is unfeasible to expect children to spend all of their time outdoors, it is important to create dynamic spaces that blur the boundary between built form and nature therefore providing the best environment possible for learning and the adaptability necessary for healthy development.

Exposure to natural elements has been proven to reduce symptoms of Attention Deficit Hyperactivity Disorder (ADHD). This is most likely because nature is naturally relaxing and restores mental functioning. It also improves a child's ability to resist stress and depression while at the same time improving cognitive abilities, a topic covered later in the text. Exposure to biology and topographical aspects, such as creeks and valleys, has been proven to enhance awareness, facility of reasoning, and acuity of observation. All of these likely result because time spent outdoors and outdoor play integrates mental skills, emotional health, and social behaviors allowing children to recover, learn, and socialize all at the same time.

29 Anne P. Taylor and Katherine Enggass, *Linking Architecture and Education: Sustainable Design for Learning Environments*
30 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
32 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
33 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
35 Judith H. Heerwagen and Gordon H. Orians, “The Ecological World of Children,” in *Children and Nature: Psychological, Sociocultural, and*
It is evident that living in urban areas affects not only our health and well-being, but also our behavioral patterns. This section briefly touches on three different theories about the consequences that living in cities, and without nature, has on human behavior.

Richard Louv coined the term “nature-deficit disorder” in his book *Last Child In The Woods*. Louv defines this theory as the “human costs of alienation from nature.” It is the summation of all the behavioral issues that people living in cities suffer from - such as depression, anxiety, and obesity - all of which can be attributed to lack of time spent outside. Nature-deficit disorder acknowledges the likelihood a sedentary lifestyle has to leading to depression and attention difficulties in children who do not spend time outdoors. In his theory, Louv also addresses the high rates of physical and emotional illness that children are now suffering from. He believes that by encouraging children to go outside and interact with and experience nature many of these negative effects can be reversed.

**Environmental generational amnesia** is a theory Peter Kahn addresses in his article *Children’s Affiliations with Nature: Structure, Development, and the Evolutionary Investigations*

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**Notes:**

36 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*

37 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
Problem of Environmental Generational Amnesia. This theory is based on the fundamental idea that children consider the environment in which they grew up to be the “norm” in terms of environmental health, quality, and degradation. They therefore compare environmental degradation to the environment in which they grew up.\(^{38}\)

To help prove his point, Kahn used a study he conducted of middle and elementary school students in Houston, Texas. In the study, each child was asked questions about pollution and environmental degradation in order to grasp their understanding of the topics. Most students understood what pollution and environmental degradation were, but when asked about the current state of their environment, almost all of the children answered that they did not have daily contact with pollution, though Houston, at the time, suffered from both serious water and air pollution problems, thus proving the children viewed their environment as normal and only environments in worse conditions were considered polluted or degraded. So far in history, each generation has been raised in a more degraded environment, one with less natural spaces, than the previous.\(^{39}\)

Biophobia is defined as an aversion to, or fear of, nature. Researchers believe that Biophobia is the consequence of living without interaction with nature. People who do not interact with nature begin to fear it and prefer man-made environments to natural environments. Biophobia is characterized by discomfort outdoors, contempt for all non man-made environments, and the view of nature as a disposable resource.\(^{40}\) This is a major issue when considering environmental preservation. If more and more people are suffering from biophobia because they lack the ability to connect to and interact with nature than more people will begin to dislike and fear nature, making it extremely unlikely that they will support policy to preserve and restore natural habitats, even the very ones that have been proven to be essential to human survival.

ENVIRONMENTAL DEGRADATION

The proof of environmental degradation, or the extinction of natural spaces, can be seen by studying habitat destruction, environmental contamination - such as air and water pollution - climate change, resource depletion, and population growth. The amount of species loss and massive declines in biodiversity also point to environmental degradation. 15,000 to 30,000 species become extinct

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40 “Moving from Biophobia to Biophilia: Developmentally Appropriate Environmental Education for Children,” Feasibility, Design and Consulting Services for Leisure, Entertainment, Play, Learning and Mix-use Projects
While high density planning and the minimization of sprawl in urban areas have led to the extinction of nature in urban areas, urban sprawl has been a major cause of the extinction of nature throughout most of the world. Over one million acres of land are developed a year in the United States alone. This is because open space and undeveloped land is being converted into artificial environments required to sustain our current ways of life. The result of this is a massive loss of common species and habitats and a lack of natural environments for humans in urban areas to interact with.

Figure 2.7 compares the amount, types, and density of spaces in 1700 to those in 2000. It splits the types of spaces into three different categories - used, seminatural, and wild. It is evident when looking at this graphic that in 1700 most of the Earth was covered with wild and seminatural woodlands. Now the majority of the Earth is covered with populated woodlands and rangelands and much less wild environments exist. Figure 2.8 shows a similar comparison. It

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represents land use over the last couple of centuries. In 1700 over 50 percent of the Earth’s land was wild with another 40 percent as seminatural woodlands. In 2000 over 50 percent of the land was ‘used’ leaving less than 25 percent to be seminatural woodlands and only 25 percent to be wild.

The industrial revolution led to the creation of large cities, which sparked the separation from the natural environment. However it was the new urbanism movement, an urban planning movement brought to popularity in the 1980s, which pushed nature out of cities completely. New urbanism promotes density and minimization of urban sprawl. Though these aspects can also have positive effects - such as minimization of Greenfield development - they also can be attributed to pushing green space out of cities. The need for high-density development left little room for green spaces and opportunities to interact with nature to remain.

Until recently, survival and advancement of humans has depended on

massively extracting, fabricating from and then disposing of huge quantities of natural resources. Urbanization has historically relied on converting natural environments into homogenous built forms characterized by impervious surfaces. These forms consume huge amounts of resources and materials while creating huge quantities of waste therefore polluting and degrading the natural environment.44

All of the factors discussed in this section have together resulted in a lack of natural environments in cities and worldwide environmental degradation. If current trends in city development or land use do not change, then it will be impossible for the little nature that does still exist in cities to survive. If this happens then it will become more and more difficult for humans to find natural spaces to interact with, which will consequently increase the amount of mental, emotional, and physical health issues suffered by humans - especially those living in cities - rather than reduce them. It is therefore important to create spaces that reduce environmental degradation and encourage interaction with nature.

This chapter has looked at how and why it is important for humans to interact with nature, why they are not, the consequences of this lack of interaction, and the proof that - because of our current lifestyle - the environment is degrading at an exponential rate. Since nature is crucial to healthy lifestyles, and because the environment is continually degrading, it is imperative to the health of humans and the environment to create a methodology of designing built form that integrates nature and building together in order to facilitate

The previous chapter provided a body of research supporting interaction with nature as important for human health and concluded that it is important to create a methodology that integrates building and nature. To determine the best strategies to do this, it is important to first understand what environmental perspectives exist, how people interact with nature, and how nature is valued. This information will lead to a better understanding of the relationship between people and nature so strategies can be developed that facilitate interaction between the two in all scales of built form.

ENVIRONMENTAL PERSPECTIVES

There are two main types of perspectives on nature; resource based and nature based. Resource based perspectives are those based on opinions of how society should behave towards the environment. The three main resource based perspectives are resourcism, conservationism, and preservationism. Resourcism believes that the supply of nature’s resources is finite and it is therefore important to determine the best and most efficient ways to use these resources. Conservationism believes that mankind is a system within an ecosystem and in order for humans to survive they need to work with and respect all other ecosystems. Preservationism is based on the idea that an
intact ecosystem is greater than the sum of its parts individually. Basically, preservationists believe that nature only has value if an ecosystem is completely intact and they therefore believe it is important to preserve entire ecosystems rather than just parts of them. Because these views either believe that nature is a resource for the use of humans or nature needs to be perfectly preserved, people who follow these theories are less likely to assign importance to interaction with nature than those who have nature based views.

Nature based perspectives are those which have a specific view of nature and its purpose, not just how society should behave towards it. The three nature based perspectives are egocentrism, anthropocentrism, and ecocentrism. Egocentrism believes that humans are more important than the environment and that human needs and desires should always come before thinking about the environment. Anthropocentrism is based on the idea that nature’s sole purpose is for the use of humans and it should not be viewed as anything other than a resource. Research has suggested that, much like resource based perspectives, people who associate with these first two nature based perspectives are most likely to devalue interaction with nature - because they view it as a resource rather than an integral part of life - and therefore are more likely to suffer from the consequences of living without interaction.

1 Jeffrey D. Fisher et al., *Environmental Psychology*, 5th ed.
with nature that were discussed in the previous chapter. Ecocentrism views nature and ecosystems as having a value independent of its value to human.2 Environmentalists and theorists have categorized human views and beliefs about nature as they pertain to nature based perspectives. These views will be briefly outlined. Figure 3.2 is a diagrammatic representation of the two types of perspectives.

**Homocentrism** is very similar to anthropocentrism. This theory is based on a belief that nature is for the utility of humans. Humans who associate with this theory believe in human supremacy - that humans themselves are the most central and significant entities in the universe and that all other objects are put on earth for the sole purpose of helping humans thrive. Natural resources and landscapes are nothing more than “raw material” to be transformed for human use. Homocentrism stresses science and its importance in maximizing the output of natural resources for human use.3

Very similar to homocentrism, **human exceptionalism** is based on the belief that humans are more important than nature. This belief stems from the idea that humans have “unique capabilities” and are therefore more important than all other living things. Human exceptionalists do not necessarily believe that nature exists solely to serve humans. However, they do believe that fundamentally, humans have universal rights and the most important thing that matters morally is being human and thriving. Therefore, most people who associate with this theory do not view nature as extremely important or believe it should be preserved because preservation means that humans will need to change their way of life.4

**Land ethic**, developed in 1949 by Aldo Leopold, was the first environmental perspective developed that assigned an importance to nature. Land ethic stresses a need for humans to transition from the belief that nature is an object to conqueror to the belief that nature is an object to be a member of, and belong to. Fundamentally, land ethic is an expansion of human ethics to include nonhuman members of the biotic community, collectively referred to as “the land.”5

In 1973 Arne Næss developed **Deep Ecology**. This theory is based on the belief that normal humans do not have any greater moral significance than other creatures. Biospheric egalitarianism - belief in the equal rights of everything alive to have the ability to thrive - is a fundamental principal of this theory. Deep Ecology is considered “deep” because it not only considers things that are alive as important, but it also associates the word “life” to things like

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2 Jeffrey D. Fisher et al., Environmental Psychology, 5th ed.
4 “On Human Exceptionalism © The Center for Bioethics and Culture Net work,” The Center for Bioethics and Culture Network
5 Aldo Leopold, “The Land Ethic,” in A Sand County Almanac, and Sketches Here and There
rivers, rocks, and landscapes. Deep Ecology was developed as a critique of modernity and people who associate with this theory believe that it is because of the human race’s belief system and way of life that nature is in danger. Therefore, Deep Ecologists are strong promoters of sociocultural change.  

Paul Taylor developed **Biocentrism** in 1986. Very similar to ecocentrism, biocentrism believes that the value of nature is independent to human value. Therefore, ethical actions are those that promote the success of all life on earth, not just human life. Four main principals exist on which biocentrism is based. These principals are; humans are members of a community of life along with all other species and each member is equal; this community consists of a system of interdependence between all members, both physically, and in terms of relationships with other species; every organism is a “teleological centre of life”, that is, each organism has a purpose and a reason for being, which is inherently “good” or “valuable,” and finally; humans are not inherently superior to other species.

Though the concept of **biomimicry** has been around for almost all of human existence, a name was not attributed to the concept until 1974. Otto Schmidt is often accredited as the person who brought the concept to popularity. Biomimicry is the examination of nature, its models, systems, processes, and elements and emulate or take inspiration from them in order to solve human problems. Examples of biomimicry can be seen in certain buildings where architects studied animals and plants and how they heat and cool themselves and then mimicked the same method in building design. An example of this is The Eastgate Center, located in Harare, Zimbabwe. Architect Mick Pearce studied the self-cooling mounds of African termites and then replicated the technologies of the mounds in his design, which is the largest office and shopping complex in the country. The result is a building that required no conventional heating and cooling.

**Biophilia**, given a name in 1995 by Edward O. Wilson, is based on the belief that humans need to have contact with nature because it is in our evolution. Human brains, and bodies, have evolved over thousands of years to live and survive in an environment dominated by nature and therefore, humans have a genetic predisposition to be attracted to natural spaces and other living organisms. Because of this, humans have an innate need to interact with and connect with nature. Many studies have been done that have found that humans prefer natural environments to man-made ones. Studies have also shown that when humans, both young and older ages, participate in both structured and unstructured, hands-on activities in nature they have are more likely to have healthy lifestyles.

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7 R. P. Lanza and Bob Berman, *Biocentrism: How Life and Consciousness Are the Keys to Understanding the True Nature of the Universe*
8 Janine M. Benyus, *Biomimicry: Innovation Inspired by Nature*
9 Stephen R. Kellert, *Kinship to Mastery: Biophilia in Human Evolution and Development*
DEVELOPMENT AND INTERACTION WITH NATURE

When creating a methodology of integrating nature into built form, it is important to understand how humans interact with nature and how this interaction with nature facilitates child development. There are three ways people can interact with nature. These are directly, indirectly, and vicariously.

Direct interaction is defined as unstructured, actual, physical contact with a natural environment that has not been manipulated by humans. Aimless outdoor play of children is an example of this. This type of interaction can also be described as a specific decision to interact with nature. This means a person who decided to go outside for the specific reason of being outdoors is participating in direct interaction. Taking a hike, relaxing outdoors, and exploring nearby parks and green space are also examples of this type of interaction. Direct interaction is often spontaneous, unplanned, and involves

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interaction with self-sustaining features and natural processes.

**Indirect interaction** is interaction with the natural environment that is programmed or organized and takes place in an environment that has been manipulated by humans.\(^\text{12}\) This can be characterized by a presence of nature but not a specific decision to interact with nature.\(^\text{13}\) Biking to work or walking in the park while socializing are examples of this type of interaction. Programmed recess and organized outdoor sports - such as soccer and softball - are also examples of indirect interaction. Settings such as zoos, botanical gardens, nature centers, museums, and parks are all places where indirect interaction takes place.

**Symbolic**, or **vicarious, interaction** is when people experience nature through depicted scenes or representations of it rather than actual physical contact with it.\(^\text{14}\) This can also be called viewing interaction.\(^\text{15}\) Some examples of this are watching a movie about nature, viewing it through a window, or looking at images of nature in a book. Many times, potted plants in buildings are considered symbolic interaction because interaction does not take place in the natural environment.

Today, symbolic interaction is becoming a more and more common replacement for direct interaction. Though symbolic interaction has been proven to minimize a few of the negative effects of living without nature, it is not an adequate substitution.\(^\text{16}\) This is because, though symbolic interaction does facilitate the development of some skills, such as categorization and organization, it does not facilitate the development of physical skills, such as motor skills, nor has it been proven to reduce the emotional effects of living without nature, such as depression or anxiety, or promote mental skills, such as concentration and problem solving.

**STAGES OF LEARNING**

There are three different stages of learning a person goes through. These are cognitive, affective, and evaluative. Cognitive learning is when children develop the ability to think and solve problems. During this first stage children develop evaluation, synthesis, analyzing, application, comprehension, and knowledge skills. Affective learning is when emotional feelings and capacities

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13 Jules Pretty, “Concluding Remarks: Nature and Health in the Urban Environment,” in *Urban Place: Reconnecting with the Natural World*


15 William C. Sullivan, “Forest, Savanna, City: Evolutionary Landscapes and Human Functioning,” in *Urban Place: Reconnecting with the Natural World*

are developed. Skills such as organization, valuing, responding, and receiving are learned during this stage. Evaluative development is when children’s values, beliefs, and moral perspectives are created. During this mode of learning children develop the nine values of nature identified by Stephen R. Kellert in his book *Building for Life: Designing and Understanding the Human-Nature Relationship*. These values are utilitarian, symbolic, scientific, negativistic, naturalistic, moralistic, humanistic, dominionistic, and aesthetic. These values will be defined in more detail later.

Psychologist Benjamin Bloom identified six stages of cognitive, or intellectual, development. These stages are: knowledge, comprehension, application, analysis, synthesis, and evaluation. The stages move from relatively simple to more complex concepts and levels of understanding, problem solving, and thinking and most often happen in sequential and hierarchical manner with one intellectual stage following the preceding one.

Knowledge emphasizes the ability to understand facts and terms and then apply this knowledge to other ideas, concepts, and relationships. Comprehension is when a child develops the ability to take in information, ideas, and concepts and then extrapolate these understandings to other similar situations. Whereas comprehension is characterized by the ability to apply information to similar situations, application is when a child learns to apply ideas, concepts, and principles to a wide range of situations, both similar and not similar. During the analysis stage of development children learn to examine and break down concepts and ideas into parts and then identify relationships between these parts. Synthesis, opposite of analysis, is when children develop the ability to integrate and organize parts into structured wholes and then use this information to identify and understand other relationships. Finally, during the evaluation stage of development children learn to form judgments based on

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18 Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*
<table>
<thead>
<tr>
<th>HEALTH TYPE</th>
<th>SKILLS DEVELOPED</th>
<th>CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BODY (Physical Health)</td>
<td>Multisensory Perception</td>
<td>Seeing, hearing, smell, tasting, touching</td>
</tr>
<tr>
<td></td>
<td>Gross Motor Development</td>
<td>Using large muscles for crawling, walking, running, jumping, playing sports, dancing, coordinating movement (from simple to complex)</td>
</tr>
<tr>
<td></td>
<td>Fine Motor Development</td>
<td>Using small muscles for manipulating objects, gripping, touching, drawing, lettering, painting, cutting, measuring - with accuracy and control; hand-eye motor control</td>
</tr>
<tr>
<td></td>
<td>Wellness</td>
<td>Health, safety, body systems, nutrition, exercising, fitness, taking responsibility for personal and family health, growing, emotional health</td>
</tr>
<tr>
<td>MIND (Mental Health)</td>
<td>Concept Development</td>
<td>Experimenting, discovering, developing ideas across all subjects, building knowledge, and understanding in interdisciplinary ways.</td>
</tr>
<tr>
<td></td>
<td>Labeling, Language, and Literacy</td>
<td>Communicating verbally, reading, listening, writing, multimedia researching, analyzing literature</td>
</tr>
<tr>
<td></td>
<td>Cognition and Creative Problem Solving</td>
<td>Transferring and applying knowledge, sorting information, constructing, sequencing, thinking logically, employing the scientific method, making connections, using technology, and developing the spirit of inquiry</td>
</tr>
<tr>
<td></td>
<td>Ecoliteracy</td>
<td>Understanding ecological principles and natural patterns, networking, relationships, global and systems thinking</td>
</tr>
<tr>
<td>SPIRIT (Emotional Health)</td>
<td>Creative Self-Expression</td>
<td>Dancing, drama/acting, performing, music, visual arts, imagining, creative storytelling, self-identifying and motivation</td>
</tr>
<tr>
<td></td>
<td>Cultural Pluralism</td>
<td>Valuing other cultures, understanding diversity, developing a sense of community, participating</td>
</tr>
<tr>
<td></td>
<td>Valuing and Stewardship</td>
<td>Respecting all life forms, articulating likes and dislikes, forming aesthetic judgments, reflecting, examining ethics, caring for the Earth and each other</td>
</tr>
<tr>
<td></td>
<td>Self and Social Development</td>
<td>Healthy interaction, cooperating, sharing, teamwork, taking pride in accomplishments, learning about emotions, developing a sense of self.</td>
</tr>
</tbody>
</table>
The natural world is varying and provokes many different emotions, often simultaneously. It can be exhilarating, relaxing, scary, and exciting all at the same time and it provides a wide range of subjects in many different forms. Nature is therefore a very powerful stimulus for learning and developing emotions. Exposure to natural spaces is very important for the development of a child’s responsiveness and receptivity. This is because few places can stimulate all of the senses, spark different emotions, and encourage creative thinking and inquiry, intellectual development, and problem solving like nature can. This does not mean that children cannot develop these skills without nature; it simply suggests that nature is the most efficient way to guarantee the development of them. Certain activities that involve the three different levels of interaction can facilitate these stages of learning. Spending time outdoors can facilitate the creation of critical thinking, creativity, classification skills, and sensory diversity, among other things.

Some stages of development are especially facilitated by nature. Because nature provides so many different and changing surroundings, it is one of the best environments to learn organization, labeling, and classification skills, all of which are basic to the first stages of cognitive development. Interaction with nature is also important to the comprehension stage of cognitive development. This is because comprehension is characterized by the extrapolation, translation, and interpretation of facts and ideas. These skills are developed through experience and observation. Nature offers one of the best environments for children to develop these skills because if offers them a wide range of sensory stimulating opportunities through which they can analyze, assimilate, and comprehend facts and ideas.

Affective development breaks down into five stages: receiving, responding, valuing, organization, and characterization by a value. Receiving is when children develop an awareness to information and become willing to receive and consider this information. During the responding stage children develop the ability to react and respond to information, concepts, and situations. Children also develop the ability to gain satisfaction from comprehension during this stage. Valuing is when children learn to associate importance to information and ideas. This is when children first start to demonstrate a consistent set of preferences. During the organization stage children develop

19 Stephen R. Kellert, Building for Life: Designing and Understanding the Human-nature Connection
22 Stephen R. Kellert, Building for Life: Designing and Understanding the Human-nature Connection

Fig. 3.7 (Opposite Page) Outlines the type of health, the skills developed, and the characteristics of each skill developed during the development process.
the ability to internalize these preferences. Finally, in the fifth stage of affective development, characterization, children develop the ability to integrate values and beliefs taken from their developed preferences and apply them to a coherent philosophy of life.²³

Children are very attracted to the natural world. Participating in activities that facilitate this attraction helps children move through the stages of affective development. Affective development is characterized by the development of emotional feelings and capacities. What better environment is there to do this than one which is constantly changing and provides stimuli for basic emotional states such as like, dislike, attraction, aversion, fear, and wonder? There simply is not one. Figure 3.8 is an advancement of Figure 3.6 and represents not only the modes of learning and how they relate to the types of interaction with nature but also applies the stages of each mode of learning.

ENVIRONMENTAL VALUES

Biophilia believes that people are drawn to and value nature because we evolved from nature and it is therefore a genetic predisposition to be attracted to it. There are different types of environmental values that are associated with biophilia. In his article, Experiencing Nature: Affective, Cognitive, and Evaluation Development in Children, Stephen R. Kellert identifies nine different values of nature.²⁴ These values are the outcomes developed during the evaluative stage of learning outlined earlier.

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²³ Stephen R. Kellert, Building for Life: Designing and Understanding the Human-nature Connection

An aesthetic value is the physical attraction and appeal that nature has on children. The development of this value is imperative to a child’s ability to perceive and recognize order and organization. This value leads to the development and understanding of harmony, balance, and symmetry. It also stimulates creativity, curiosity, imagination, and discovery.\textsuperscript{25}

**Dominionistic** values are characterized by the mastery and ability to control nature. There are many adaptive benefits to this value. It is through dominionistic views of nature that children learn independence, confidence to confront the unknown, risk taking, resourcefulness, and courageousness. Participating in activities that require mastering nature provide excellent physical conditioning and have many fitness benefits.\textsuperscript{26} In the past this value was required for human survival. Though humans no longer need to conquer nature to survive, development of this value - the ability to persevere in the face of adversity - still benefits physical and mental health.\textsuperscript{27}

**Humanistic** values are characterized by an emotional bonding and attachment with nature. Studies have suggested that this value is instrumental in a child’s ability to create relationships, self-confidence, and develop intimacy. Receiving affection, forming companionable bonds, and developing cooperation and trust are skills developed through this value.\textsuperscript{28}


\textsuperscript{26} Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*


\textsuperscript{28} Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*
A **moralistic** value is the ethical, moral, and spiritual value of nature. By developing this value children can learn to look for underlying meaning, order, and purpose and apply it to other situations and contexts.\(^{29}\) Through this value people begin to understand the relationship between humans and the natural environment. This value furthers the desire and ethical obligation humans feel to protect and preserve nature.

**Naturalistic** values are characterized by the desire to explore, experience, and discover nature. This value is characterized by the perception of nature as a source for stimulation. This is when children first recognize the desire to be in close contact with nature. There are functional abilities that benefit from this value such as exploration, inquisitiveness, competence, adaptability, and coping capabilities. Participating in the natural world can also instill calm, peace of mind, and a sense of timelessness in humans. The more a person participates in nature, the stronger these feelings will be.\(^{30}\)

**Negativistic** values are those of fear and aversion of nature. Through the development of this value children learn to minimize risk and avoid harm. When developed along with the other values, negativistic values of nature are very healthy. Positive outcomes of this value are the development of awe and respect for nature. It is when this value is developed while other values are not that biophobia tends to develop.\(^{31}\) An ethical view and behavior of nature require levels of awe, respect, and fear.

A **scientific** value is characterized by the knowledge and understanding of nature. Intellectual competence, critical thinking, problem-solving and enhanced abilities for empirical observation and analysis are developed further through this value. For healthy development, people need to know, understand, and adapt to their world with authority. The ability to do these things come from skills in classifying, organizing, and identifying, all of which are skills that result from scientific values of nature.\(^{32}\)

**Symbolic** values are characterized by the recognition that nature is a source for language and imagination. It is through this value that children develop classification and labeling abilities along with observation and analysis capabilities. This value facilitates language development, arguably one of the most important skills of humans. This value is one of the few values that can be developed through vicarious interaction alone. All other values require at least


\(^{30}\) Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*


\(^{32}\) Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*
indirect interaction, or actual time spent outdoors, in order to fully develop.\(^{33}\)

Nature as a source of material and physical reward is a **utilitarian** value. This value is characterized by the desire to interact with nature for physical, material, and commodity advantages. Children further develop self-confidence and self-esteem through this value. This can be done through demonstration of construction abilities and skill in nature. An understanding of the human race’s reliance on nature is also developed through this value.\(^{34}\)

All of these values are developed at distinctive stages during child development. When a child is between the ages of three and six utilitarian, dominionistic, naturalistic, and negativistic values can first be seen. Between the ages of six and twelve humanistic, symbolic, aesthetic, and scientific values are developed. During this time children go through their most rapid cognitive and intellectual growth. This growth is best facilitated by direct contact with nature. It is therefore during this stage that interaction with nature on a daily basis is most important. The final value, moralistic, is developed between the ages of 13 and 17. This stage is also characterized by a rapid and more evident maturation of abstract and conceptual values and reasoning’s of the

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\(^{33}\) Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*

Figure 3.10 once again furthers the modes of learning diagram presented previously. This diagram identifies the ways nature can facilitate the development of these skills. It also identifies what types of interaction are most important for the different stages, skills, and natural activities that facilitate the development of these skills.

The adaptive occurrence of these nine values are essential to physical and mental health. When people participate in activities of adequate and satisfying interaction with nature, they gain physical, mental, and emotional benefits.

**Figure 3.11** (Left) Graphic representation of the nine values of nature associated with Biophilia and the possible character qualities that result when activities that facilitate these values are participated in.

**Figure 3.12** (Right) Graphic representation highlighting one of the nine values of nature associated with Biophilia and the possible character qualities that value.

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When humans, especially children, participate in these activities, many positive character outcomes exist which are characteristics of positive mental, physical, and emotional health. Figure 3.11 is a graphic representation of these values and their benefits. Figure 3.12 highlights one value of nature and all of the benefits derived from activities that facilitate that value.

This chapter outlined the two major environmental perspectives, briefly defined the views associated with the perspectives, and described how children learn, how they value nature, and how nature can be used as a tool to facilitate learning and development. This information, when used in conjunction with the information from the previous chapters, can help inform the creation of a design methodology that integrates nature into built form. By understanding how children view nature and how nature can facilitate learning, design strategies that can be developed that result in spaces that maximize opportunities for these activities to take place.

This thesis has explored the imperative nature of interaction with nature to healthy human development and the perspectives through which people view the natural environment. Interaction with nature on a daily basis is most important for children because, between the ages of 6 and 13, children go through the most important stages of development. Children spend most of their time during these crucial developmental stages at school. Between kindergarten and sixth grade children spend, on average, 7,000 hours in an educational facility. Because of this, an educational facility has been chosen to demonstrate the methodology created in this thesis. In order to develop strategies to integrate nature into built form, it is important to first understand how children develop and what teaching methodologies exist within schools in order to better understand how to create spaces that successfully integrate teaching methods - or how children learn - and nature in a way that results in the healthy development of children.

CHILD DEVELOPMENT THEORIES

There are six categories, or modes, which most child development theories fall into. These are: The Psychoanalytic Tradition; Behaviorism and Social

1 John Caldwell Holt, *How Children Learn*
2 Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*
Learning; Growth of Thought and Language; Computer Analogues and the Self; Environments, Genetic Plans, and the Biological Child; and Moral Development. Within each category two or three major theories on child development exist. The theories will be outlined below. Figure 4.2 outlines the theories briefly, determines whether they are environmentalist based theories, preformationalist based theories, or predeterminist based theories, and analyzes whether the theories address successfully or unsuccessfully nine different categories that relate to the applicability of the theory. Environmentalist based theories are those which stress the importance of environmental experience on nature. Preformationalist based theories believe environmental experiences have little effect on development. Finally, Predeterminist based theories are those that believe environmental experiences have little effect on development.

THE PSYCHOANALYTIC TRADITION

Psychoanalytic theories of development focus on the causes and cures of neuroses. In other words, these developmental theories look at why people become “abnormal.” The two main theorists who have outlined how people develop based on the Psychoanalytic Tradition are Sigmund Freud and Erik Erikson.⁴

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3 R. Murray Thomas, *Comparing Theories of Child Development*
4 R. Murray Thomas, *Comparing Theories of Child Development*
Sigmund Freud developed his theories of development in the 1800s. His theories were, and still are to some degree, extremely controversial. Freud believed that people have two levels of consciousness, conscious and unconscious. The unconscious mind is where people store ideas they are not aware of but that influence the daily actions of humans. Freud is attributed with developing the levels of consciousness, id, ego, and superego. The id - purely instinctual actions and desires - is present at birth. The ego - thoughts focused on the efforts to satisfy needs based on interaction with the environment - comes next and superego - the development of morals and values - comes last. Finally, Freud believed that sexual motives underlie most, if not all, of human behavior.\(^5\)

Erik Erikson was a psychoanalyst in the early 1900s whose goal was to refine the theories of Freud. He has been attributed with three major refinements to Freud’s theories. These are, the development of the healthy personality, which contrasts Freud’s focus on the growth of neurotic behavior, the process of socializing children into a particular culture via the passage through a series of psychosocial stages that are similar to Frued’s psychosexual stages, and finally, the identification of an individual’s need to develop an ego identity through the solving of specified identity crises at each stage of psychosocial development.\(^6\)

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\(^5\) R. Murray Thomas, *Comparing Theories of Child Development*

\(^6\) R. Murray Thomas, *Comparing Theories of Child Development*
Behaviorism and social learning theories focus on the importance of how people act when they are subjected to different environmental conditions. These theories identify observable conditions that influence how humans behave and search for ways principals of learning and social context explain development. The two major theories that fall within this category are Skinner’s Operant Conditioning and Social Cognition Theory and Contextualism.  

Operant conditioning, developed by Burrhus Frederic Skinner in the 1970s, believes that consequences of behaviors influence the future form of that behavior. Basically, when a person experiences something, the consequences of the experience affect how they will respond to the experience in the future. There are three types of consequences; reinforcement, punishment, and extinction. Reinforcements are consequences that causes behavior to occur with more frequency. Punishments are consequences that causes a behavior to occur less frequently, and extinctions, are when no consequence occurs following a specific behavior, which leads to the behavior to occur less frequently and eventually not at all. Skinner viewed learning not as a process of a child demonstrating a behavior once, but as a process of a child demonstrating the given behavior consistently, which led him to develop methods of reinforcement to condition children to perform a specific behavior consistently.  

Much like operant conditioning, social cognition focuses on the role of environmental consequences as a key factor in how people develop. This theory rose to popularity in the 1970s-1990s. In short, social cognition believes that social variables determine behavior and personality and believes that the mental activity of children is not just that of learning and responding to their environment, it is also creative thought, or the ability to manipulate knowledge in their minds to form new understandings. Children’s learning comes from imitating, or modeling, behaviors and actions on those the child observes people surrounding them doing.  

GROWTH OF THOUGHT AND LANGUAGE  
This category of child development searches for patterns of development in children’s cognitive and verbal skills and for the mechanisms that bring these patterns into existence. Theories that fall within this category believe that children pass through distinctive stages, or phases, of development. The two major theories of child development that fall within this category are Piaget’s Cognitive Development Theory, and Vygotsky and the Soviet Tradition. 

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7 R. Murray Thomas, *Comparing Theories of Child Development*  
8 R. Murray Thomas, *Comparing Theories of Child Development*  
9 R. Murray Thomas, *Comparing Theories of Child Development*  
10 R. Murray Thomas, *Comparing Theories of Child Development*
Piaget’s Cognitive Development Theory, developed in the late 1900s, is based on the belief that children develop in order to adapt to the environment in more satisfactory ways. This theory describes how the mind processes new information. Piaget believed that people understand information as it fits into their worldview – a view developed through experiences a person has with their different environments – and when something does not fit within this view, a person must reexamine this view and adjust methods of thinking to accommodate new information. Piaget described four stages of cognitive development. These stages are sensory motor, peroperational, concrete operational, and formal operations and will be discussed further in a later chapter. The stages mostly develop from birth to the age of twelve. In terms of learning and child development, under Piaget’s theory, it is important to first identify which level of development a child is in and then create and encourage activities to help the child advance to the next stage of development. Because Piaget’s theories are based on adaption to the environment, and nature has been proven to help facilitate the development of differentiation skills, nature can act as a facilitator to many of the activities that help children advance from one stage of development to the next.

Vygotsky’s theory, developed in the 1920s, believes that intellectual skills or patterns of thinking that a person displays are not only determined by innate factors, such as inherited intelligence and mental abilities, but are also determined by the activities practiced in the social institutions in which the person is raised. In short, culture and a child’s own experiences are the most important factors of development.

COMPUTER ANALOGUES AND THE SELF

Theories that fall within this category search for the way children gain skills in processing information and how a child’s innermost self develops. Two major theories that fall within this category are Information-Processing Theories and Humanistic Theories.

Information-processing theories use the electronic computer as a means to carry out many functions similar to those that human brains carry out in order to simulate human thought processes. By simulating these processes repeatedly, it is believed computers can be used to discover the nature of human mental operations and how these operations develop during childhood. These theories attempt to explain what happens between the time a child receives an impression of an environment to the moment the child visibly responds to that environment.
Humanistic theories focus on the development of the “self” and how it evolves during the first two decades of existence. Humanistic psychology looks at how an individual views themselves in relation to the environments in which they exist. This theory focuses on experiences as the primary method through which to study humans. Most humanistic theorists reject both behaviorism and psychoanalysis. This is because these two theories neglect to consider human emotions – such as values, feelings, hopes for the future, choices, and creativity – and they often have a negative view of humanity.\(^{15}\)

**ENVIRONMENTS, GENETIC PLANS, AND THE BIOLOGICAL CHILD**

This category focuses on identifying patterns of environmental influence and biological sources of development. This category believes that an individual’s interaction with the environment is the most important factor in development. Three theories that fall within this category are Ecological Psychology, Ethology and Sociobiology, and Bio-electrochemical Model.\(^{16}\)

Urie Bronfenbrenner brought ecological psychology to popularity in the 1930s. It believes that the social and physical settings a child exists in are crucial to their development. Ecological Psychologists believe that behaviors, personality, and intelligence can adapt based on the environment in which a person is placed. It is important to not only understand the meanings that people associate to certain environments, but also why these specific meanings are associated. The mode of analysis used is that of a “Microsystem” – “a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics.”\(^{17}\)

Ethology is the study of the behavior of animals, including humans, especially as that behavior occurs in natural environments. Sociobiology is the study of the biological bases through which members of a species act toward one another and toward members of other species. In terms of child development there are six types of behavior. These are bonding, altruism, social intelligence, dominance, and submission, temporary social separation, and sensitive periods. In short, this theory uses these six categories to study animals to determine ways in which animals respond to experiences and develop and hypothesize on whether or not children respond and develop the same way.\(^{18}\)

The bio-electrochemical model does not describe an established theory of development but rather describes six levels of specificity in a child’s bio-electrochemical composition. These levels of specificity start with the most general and work to the most detail. A child is a single but integrated person who interacts with their surroundings (unitary child level) and is composed of

\(^{15}\) R. Murray Thomas, *Comparing Theories of Child Development*
\(^{16}\) R. Murray Thomas, *Comparing Theories of Child Development*
\(^{17}\) R. Murray Thomas, *Comparing Theories of Child Development*
\(^{18}\) R. Murray Thomas, *Comparing Theories of Child Development*
organs (organic level) which are built up of cells (cellular level) which are built of molecules (molecular level) which are built up of chemical elements that consist of atoms (elemental/atomic level) which are built of electrically charged and neutral particles (subatomic level).\(^\text{19}\) Basically, this model demonstrates that the environment plays no role in human development, but instead, development is based on the interaction of quadrillions of electrically charged and electrically neutral particles that make up a human.

**MORAL DEVELOPMENT THEORIES**

This category of development focuses on how moral reasoning and moral behavior evolve. Theories that fall within this category study the process by which children conform to the culture in which they grow up. Two major theories within this category are Kohlberg’s Moral Development and Integrated Theory on Morals.\(^\text{20}\)

Moral development, developed by Lawrence Kohlberg in the 1950s, focuses on a restricted aspect of a child's life, the development of moral judgment and value. Moral development is simply one aspect of socialization – the process through which children learn to conform to the expectations of their culture. There are three stages of moral development, the preconventional, or premoral, level – when a person follows the rights and wrongs of society - the conventional level – when a person conforms to the values of their family - and the postconventional level – when a person tries to conform to values

\(^{19}\) R. Murray Thomas, *Comparing Theories of Child Development*
\(^{20}\) R. Murray Thomas, *Comparing Theories of Child Development*
Integrated theory on morals focuses on the changes in the systems through which people make moral decisions. This theory believes that no moral value is innate; all are developed as children grow. Much like moral values need to be developed, so too must guilt, self-punishment, and self-reward.²²

Figure 4.3 organizes the theories outlined above by whether they are environmentalist, preformationalist, or predeterminist theories and how strongly they associate with each category.

TEACHING METHODOLOGIES

Like stated earlier, in order to create spaces that facilitate healthy development it is important to understand methods through which children develop and learn. In order to understand the theory behind educational facilities today, it is important to first understand the evolution of education and the educational facility in terms of philosophy and architectural style.

Originally, spaces within houses had no specific function. Furniture was moved within the space as needed. Then, in the 18th Century, spaces within houses began to be assigned specific functions. During this time children spent most of their time in their “playroom.” This space doubled as a play space and as a sleeping area. This allowed for activities and games to extend over long periods of time, which became an important factor in the social development of children.²³

Two important philosophers of this period were Jean-Jacques Rousseau and Friedrich Frobel. These two have been accredited with the creation of developmental stages in child development. Jean-Jacques Rousseau believed that people have to develop their skills. Children did this by interacting with and learning from their surrounding environment. He believed that learning and development is an active process.²⁴ Friedrich Frobel is known for developing the term “kindergarten.” He believed that children have their own set of needs and capabilities and in order to develop these capabilities “activity” was an important part of the learning process.²⁵

In the 19th Century, education, for the first time, took place in its own facility. These facilities were based off the church model, where children surrounded a single head master who taught all children, of all ages, all subjects. Children sat in rows of many students and often did not move from their seats for

21 R. Murray Thomas, Comparing Theories of Child Development
22 R. Murray Thomas, Comparing Theories of Child Development
23 Mark Dudek, Architecture of Schools: the New Learning Environments
24 “Jean-Jacques Rousseau I Philosopher,” Lucidcafé Interactive Café and Information Resource
25 Mark K. Smith, “Friedrich Froebel and Informal Education,” Contents @ the Informal Education Homepage
extended periods of time. The architecture of these facilities often mirrored that of a church as well. The building often consisted of a single, large open space - where all activities took place - ornamented with calm, overbearing order.26

The most influential educational theorist of the 19th Century was E.R Robson. In the late 1800s, E.R Robson developed an educational building type that, for the first time, focused on the health and safety of children. All of his facilities were based on the Prussian system, which consisted of separate classrooms surrounding a single communal, or “drill”, hall. Each classroom consisted of rows of double desks and a larger open space located at the front of the room. This allowed the teacher access to every student in the classroom as well as a space for lectures and presentations to take place at the front of the room.27

Progressive education rose to importance in the late 19th Century with the help of John Dewey. Dewey was the first theorist to suggest that hands on instruction and interaction was a crucial factor in the learning and developmental process.28 This type of instruction and interaction is important because children are very active and therefore their curriculum should reflect this. Dewey believed that learning is a continual process of reorganization, reconstruction, transformation, experimentation, and reflection. He believed that schools should act as cooperative communities where education was various and natural.29

From Dewey’s ideas came Progressive Education, a movement that believed that humans, because they are social creatures, learn best through interaction with other people. A strong emphasis on problem solving and critical thinking facilitated by group work and activities were major characteristics of Progressive Education. Because children learn through doing, use of various learning tools and methods were viewed as crucial for the first time.30

Another educational pedagogy that rose to importance because of John Dewey is experiential education, or “learning by doing.” Experiential education describes an educational process which occurs between a teacher and student that integrates direct experiences into the learning environment and content. Because hands-on activities have been proven to help child development, this theory believes that allowing children to explore the phenomena being studied will help children learn content faster and understand it on a deeper level. Curiosity, initiative, and sense of purpose are qualities found in children who participate in experiential educational programs.31

26 Mark Dudek, Architecture of Schools: the New Learning Environments
27 Mark Dudek, Architecture of Schools: the New Learning Environments
28 Mark Dudek, Architecture of Schools: the New Learning Environments
29 Anne P. Taylor and Katherine Enggass, Linking Architecture and Education: Sustainable Design for Learning Environments
30 Mark Dudek, Architecture of Schools: the New Learning Environments
31 Jennifer A. Vadeboncoeur, “Experiential Education: Information from Answers.com,” Answers.com: Wiki Q&A Combined with Free Online
In the early 1900s, after the First World War, an architectural type, known as the Open-air school, became popular in urban areas. Though originally developed to prevent the spread of tuberculosis, many other health benefits have resulted from this movement. Open-air schools used Progressive Education theories as a basis for the curriculum. It was the architecture of these schools that was unique. Rather than focusing on interior spaces and their connection with one another, Open-air schools emphasize the importance of movement and interaction with outdoor spaces. Therefore, these schools often had open plans, light, airy classrooms, and constant connection to outdoor spaces and classrooms.

In 1910 Maria Montessori developed a method of education known today as the Montessori method. Montessori believed that development and learning does not happen in a steady path but in a set of paths. She also believed that nature, though not the only, was the best facilitator for learning and development because activities that take place in it can be chosen based on the individual’s interests. Rather than having educational activities take place in an inflexible classroom, Montessori used flexible and adaptable environments, both indoors and out, for learning. These well provisioned environments allow for learning to be intellectually and developmentally stimulating. When children learn in this manner Montessori found they were able to sustain concentration longer and perform better because this form of learning tailors activities to the students rather than trying to force the students to adapt to the learning style. As a result of these beliefs, Montessori created her own educational philosophy that emphasizes hands-on learning, the importance of observation, and a curriculum that caters to what she believed were the sensitive periods of development.

In the 1920s a humanistic method of educating, known as Waldorf, was developed. The ideas behind the method were based on the philosophies of Austrian educational theorist Rudolf Steiner. Proponents of Waldorf Education believe that learning is interdisciplinary and rather than focusing on individuals, education should focus on collaborative learning. In Waldorf schools, children are encouraged to use their imagination and creative thinking because it is believed that the development of these skills led to free and morally responsible individuals, which was the main goal of this type of educational thinking.

In the mid 1900s two different schools, Susan Isaac’s Free School and the Sudbury Valley School, were created. Both of these schools focused on a

Dictionary, Thesaurus, and Encyclopedias
32 Mark Dudek, Architecture of Schools: the New Learning Environments
33 Anne-Marie Chatelet, “Open Air School Movement - Encyclopedia of Children and Childhood in History and Society,”
34 Mark Dudek, Architecture of Schools: the New Learning Environments
35 Anne P. Taylor and Katherine Enggass, Linking Architecture and Education: Sustainable Design for Learning Environments
36 Mark Dudek, Architecture of Schools: the New Learning Environments
child’s freedom and the learning and development associated with it. Susan Isaac’s Free School focused on emotions of intelligence and used nature as a form of sensory material to encourage interaction and learning. There was no specific curriculum or required classes. Children and teachers were able to determine how time was best spent. The Sudbury Valley School de-emphasized classrooms and the role of adults in the learning process. Under this philosophy, much like in Susan Isaac’s Free School, children are able to choose their own classes and spend their time as they saw fit, as there was no specific curriculum.  

The educational philosophies most popular today rose to popularity in the 1930s and 1940s. Educational philosophies in both Europe and the United States moved away from authoritarian based systems and towards more balanced approaches, similar to Progressive Education. During this time architecture was viewed as an instrument for change. School facilities moved away from larger industrial looking buildings and towards light, airy, technological buildings. Spaces within schools became larger and less specific than those often found in earlier schools. The importance of social interaction, health, and ventilation also became important factors in every new school design during this time. Most of these factors still hold a strong presence in educational design.  

In the 1950s Benjamin Bloom introduced the concept of Taxonomy of Thinking. Bloom believed that higher levels of thinking existed beyond factual thinking and these levels of thinking happened in stages. He therefore introduced the six stages of cognitive development - knowledge, comprehension, application, analysis, synthesis, and evaluation - that were described in a previous chapter. Bloom encouraged the implementation of standards-based curriculums, which are very popular in public school districts today.  

In the 1970s Viktor Lowenfeld introduced the idea of Art Education. Lowenfeld believed that children are most motivated when they deeply identify with what they are learning. He also believed that creativity is one of the most important skills children need to develop. While developing creativity, Lowenfeld believed children go through identifiable stages of visual self-expression. Teachers should therefore provide students with activities and techniques catered to each stage of development in order to motivate this creativity.  

In the 1980s there were many different theorists who developed philosophies on how to best educate children. The most influential of these theorists was Howard Gardner. This is because it was Gardner who developed the concept

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38 Mark Dudek, *Architecture of Schools: the New Learning Environments*
39 Mark Dudek, *Architecture of Schools: the New Learning Environments*
40 Anne P. Taylor and Katherine Enggass, *Linking Architecture and Education: Sustainable Design for Learning Environments*
41 Anne P. Taylor and Katherine Enggass, *Linking Architecture and Education: Sustainable Design for Learning Environments*
Multiple Intelligences, a concept still very popular in many educational models used today. Gardner acknowledged the fact not all children learn best the same way and therefore identified different intelligences and different activities and strategies that best facilitate each intelligence. These intelligences are verbal/linguistic, logical/mathematical, music/rhythmic, visual/spatial, interpersonal, intrapersonal, bodily/kinesthetic, and naturalistic. 

Environmental-based education are programs that recognizes the importance of their physical environment as a learning tool. The natural environment provides many different backdrops for learning and is itself a form of silent curriculum. This is because simply by being in nature, children learn and develop in ways not possible in a standard classroom. Proponents of this type of education believe the environment which learning takes place is deeply affects the learning and behavior of both children and teachers. Environmental-based education theorists believe this method of educating is successful because it recognizes that natural environments encourage and facilitate interaction and hands-on learning better than any other environment can.

Since this shift of the 1930s and 1940s only two major, radical methods of education have developed. Most theorists since this time have simply added upon the ideas of progressive education. These two shifts are “unschooling,”
and the School of One. The idea of “Unschooling” became a known method of education in the 1970s. Proponents of this type of educational method believe that school itself is not important in the learning process. Rather it is important to let children learn in their own ways. Therefore, instead of creating a curriculum, the adult’s role is to encourage children and facilitate the activities the child sees important in their development.44

School of One is the most recent educational theory that has been developed. Developed in the early 2000’s, a prototype school is currently being created and tested in New York. The idea behind this philosophy is that all children learn differently. Rather than having a single curriculum for all children to follow, each child has their own specialized schedule that they follow every day. The activities can range from group, individual, teacher led, or technologically based. The architecture of this type of school is therefore a large open space broken down into smaller spaces that can be supervised and accessed by a couple of teachers that facilitate the different activities.45

Many different perspectives on how children learn and the best ways to teach them exist. However, one major theme carries through all of these modern perspectives. This is that children learn best through interactive, hands-on, and varying activities. Though children do not all learn best in the same way, they all learn through experience. In order to design successful learning spaces it is important to understand the different methods of learning and how designed space facilitates these methods. Figure 4.9 compares all of the educational theories presented in terms of whether they are environmental based, curriculum based, or architecture based (or a combination of some or all of these) theories.

This chapter has looked at child development theories and educational perspectives in order to better understand how children learn and develop and how designed space can facilitate these processes. Research has shown that nature is crucial to healthy development and it is important to create environments where people can interact with nature on a daily basis. However, in order for these spaces to be successful, it is important to understand how children develop and in what ways nature can facilitate this development and create strategies that integrate these concepts into built form. A chart outlining the teaching philosophies and a graphic time line synthesizing all of the child development theories, educational perspectives, and environmental perspectives can be found in the appendix for further reference.

45 Charles Linn, “The School of One I Architectural Record I Schools of the 21st Century I Features,”
METHODOLOGY

The goal of this thesis is to create a design process which, when applied, results in spaces that integrates nature into built form and encourages interaction with it on a daily basis. The first step of this design process requires researching and fully understanding all of the factors - such as user, building type, scale, climate, desired environmental quality, and architectural style - that apply to the design. Having this understanding allows the designer to choose the factors and theories which are complementary to one another and can be integrated together successfully into a set of design implications. From these implications a series of design strategies can be developed and applied throughout the design process in order to create spaces which have the desired integration of, and interaction with, nature. Each set of strategies identified will be design and site specific - meaning they relate to each design problem differently. By creating unique strategies for each project, designers will be able to create integrated spaces that positively relate to the environment and the surrounding urban context. Spaces designed using this process will foster healthy human lifestyles and development, therefore reversing the negative effects living in cities currently have on humans. Figure 4.2 is a graphic representation of this process.

This thesis demonstrates the design process outlined above through the design of an educational facility in Cincinnati, Ohio. During the first step of
this process applicable factors are researched. For this design, theories and perspectives on child development, educational philosophies, architectural styles, and environmental perspectives were researched in order to better understand how children learn, develop, and interact with and value nature. The next step of this process is to choose complementary theories from each factor that, when applied, will best accomplish the desired level of integration between humans and nature. For this step to be successful, the factors – environmental perspective, educational philosophy, architectural style, and child development – need to be seamlessly integrated into a set of design implications. From these implications, site specific design strategies will be explored in order to determine the best design solution to accomplish successful integrated spaces. For this project, the successfulness of the design will depend on the ability of the spaces to integrate learning, environment, and architecture into one cohesive design. During the design process it is crucial for a back-and-forth between scales - urban to human - to take place in order to best integrate all factors at all levels of design.

The Theory and Research chapters of this thesis provided the information for the first step of the design process - factor identification and research. The second step - choosing complimentary theories and perspectives from each factor and resulting implications - will be outlined in this chapter. Each chosen theory and perspective will be provided with a brief description of why it was chosen.

ADDITIONAL FACTORS

The factors outlined in the previous chapters are not the only important factors to understand and consider in order to create spaces that successfully integrate nature into spaces for learning. The issues of scale and climate, along with consideration of how people perceive their environments, are also important factors for consideration.

SCALE

In order to be healthy, people - especially children - need to interact with and experience nature at all scales of built form. For this to be possible, design strategies need to be created and implemented at all scales of design. There are four major scales of built form: urban, street, building, and human. The urban scale refers to the city or entire downtown region of a city. The street scale addresses strategies on the neighborhood level. The building scale looks at how nature is integrated into the actual facility and finally, the human scale addresses how humans actually physically interact with their environment. A back-and-forth between these scales is necessary during the design process for these strategies to be successfully implemented. This is because it is important to determine how design strategies applied at one scale effect the design at another scale. For example, a strategy applied at the urban scale will
have an affect on design decisions at the human scale as well. It is therefore important to look at all strategies at all scales. Figure 5.3 represents these four scales and translates how the specific design demonstrated in this thesis investigation relates to the scales.

Human scale not only addresses how humans actually physically interact with nature, but it also addresses the difference between the scales of users. For example, adults are taller than children and therefore have different scale requirements than children do. Therefore, material selection, furniture size, space proportions, window locations, and many other factors are all design decisions that need to be made with scale of user in mind. It is also important to understand how children experience space - because of the difference in scale - differently than adults do. To children objects such as furniture and half-height partitions break up a space in a much different way than they do for adults.

Since an elementary educational facility's primary user is a child, it is obvious that the designed spaces, especially classrooms, should cater to the scale and experience of the child. However, interaction with nature is not only important for children. Since adults inhabit educational facilities on a daily basis as well, it is important to consider how they experience space during the design process. Because of this, all programmed spaces need to consider both adult and child scale design solutions in order to create the healthiest environment for all users.

**PERCEIVING ENVIRONMENTS**

When designing, it is important to understand how people perceive the environments in which they exist. There are two ways a person can perceive a new environment. These are positively and negatively. Two main contributors exist which indicate whether a person will perceive a new environment as positive or negative. There are previous experiences in similar environments
and the level of stimulation a space provides. Spaces with very high or very low levels of stimuli are often perceived negatively. This is because they cause over or under (respectively) stimulation of the brain.

If a space is perceived negatively a person then copes with the space. Much like when perceiving a space, a person can either cope positively or negatively with the space, both of which have consequences. How a person perceives, and copes with a specific environment will most likely be repeated any time the person is subjected to a similar environment.¹ Figure 5.5 graphically represents this process.

This process is important to understand because if urban spaces can be designed to create only positive perceptions, then the negative methods of coping will be minimized, therefore reducing some of the negative health effects urban spaces currently have on humans. However, perceptions are not just created when a person enters a building or steps onto a site. Perceptions of an

¹ Paul A. Bell, Jeffrey D. Fisher, and Ross J. Loomis, *Environmental Psychology*
experience can start as soon as a person makes a decision to do something, such as go to school. It is therefore important to consider aspects such as approach and the conditions of the surrounding context - among other things - when attempting to create positive perceptions of a space or experience.

CLIMATE

It is through climate and context that design solutions become site specific. This is because climatic conditions play an important role in determining which strategies will be successful design solutions for identified implications. Throughout the United States alone there are many different climatic regions. What these boundaries are varies greatly depending on the theorist. For this thesis, a simplified version of Norbert Lechner's climate analysis from his book, Heating, Cooling, Lighting: Design Methods for Architects, will be used to identify the primary climatic regions in the United States. These simplified climatic regions are outlined in Figure 5.6. Along with briefly describing each climatic zone, a set of basic, climatic, design priorities – important design factors to consider – will be given. The set of basic design priorities that are applied to each zone are:

1. Keep heat in and cold out during the winter
2. Maximize winter sun
3. Protect from cold winter winds
4. Keep hot temperatures out during the summer
5. Protect from summer sun
6. Use evaporative cooling in the summer
7. Use thermal mass to flatten day-to-night temperature swings
8. Use natural ventilation to cool in spring and fall
9. Use natural ventilation for cooling and removal of moisture
10. Avoid the creation of additional humidity

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Figure 5.6 Outline of climatic zones.
Zone one is characterized by a very mild climate. Cool temperatures and rain are common in winter. This zone is often overcast but potential for solar heat gain still exists in some regions because of the small heating load required by the mild climate. Large variations in microclimates exist because of the high variation in elevation throughout this zone. The climatic design priorities for this zone are: keep heat in and cold out during the winter, maximize winter sun, and protect from cold winter winds.3

Though they are all relatively similar, variations exist throughout zone two. Some regions are characterized by extremely hot, dry summers and moderate winters while others are characterized by cold, windy winters and warm, dry summers. Summer temperatures are often very high but humidity is not a problem. The climatic design priorities for this zone are: keep hot temperatures out during the summer, protect from summer sun, use evaporative cooling in the summer, use thermal mass to flatten day-to-night temperature swings in the summer, keep heat in and cold out in winter, protect from winter winds, maximize winter sun, and use natural ventilation to cool in spring and fall.4

Zone three has a severe climate. It is mostly cool and in the winter temperatures often fall below freezing. Low temperatures, snow, and high winds are important concerns in the winter season. Summers are very hot but are very short and therefore are less of a concern that winters. The climatic design priorities for this region are: keep heat in and cold out in winter, protect from cold winter winds, and maximize winter sun.5

Zone four climates have long, severe, hot, humid summers and short, mild winters. Humidity is a major problem in this region causing little differentiation in temperature between summer days and nights. Coastal breezes do exist in some regions during the summer. An abundance of sunshine is available in the winter for solar heating. The climatic design priorities for this zone are: keep hot temperatures out in the summer, allow natural ventilation for cooling and removal of moisture in the summer, protect from summer sun, avoid the creation of additional humidity, protect from cold winter winds, maximize winter sun, keep in heat and out cold in winter.6

Characterized by cold winds and severe winter temperatures, zone five is similar to both zone three and seven, though milder. High temperatures and high levels of humidity are common in the summer and therefore often require high cooling loads. The climatic design priorities for this zone are: keep heat

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3 Norbert Lechner, Heating, Cooling, Lighting: Sustainable Design Methods for Architects
4 Norbert Lechner, Heating, Cooling, Lighting: Sustainable Design Methods for Architects
5 Norbert Lechner, Heating, Cooling, Lighting: Sustainable Design Methods for Architects
6 Norbert Lechner, Heating, Cooling, Lighting: Sustainable Design Methods for Architects
in and cold out in winter, protect from cold winter winds, maximize winter sun, keep out hot temperatures in the summer, protect from summer sun, and use natural ventilation for summer cooling.\(^7\)

**Zone six** is characterized by long, hot, and humid summers and short but cool winters. Humidity is a major problem in this region. The climatic design priorities for this zone are: allow natural ventilation for cooling and removal of moisture in the summer, protect from summer sun, avoid the creation of additional humidity, maximize winter sun, and protect from cold winter winds.\(^8\)

The climate in **zone seven** has mostly cool temperatures that often fall much below zero in the winter. Snow and winter winds are also common in the winter. Summers are mostly mild, though short, hot periods are not uncommon. Sun is available in 50 percent of daylight hours so solar heat gain in the winter is possible and shading is required in the summer. The climatic design priorities for this zone are: to keep heat and cold temperatures out during the winter, protect from winter temperatures and wind, maximize winter sun, protect from summer sun, and use natural ventilation for summer cooling.\(^9\)

**FACTOR INTEGRATION**

Figure 5.7 is a graphic representation of all theories and perspectives discussed so far in this thesis investigation. Each theory, theorist, perspective, and precedent were placed and identified on the diagram based on whether they are fundamentally architecturally based, environmentally based, or theoretically based. This process was done to help determine which factors to integrate into the design methodology. The size of the circle associated with the topic is proportional to how well the topic integrates with the concepts explored in this thesis. The chosen theory or perspective from each factor will be identified below with a brief description as to why it was chosen. A more in-depth analysis of each theory or perspective will be provided in the following chapter.

**Biophilia** will be the environmental perspective through which nature will be brought into built form in urban spaces. This theory was chosen because of its fundamental concept; that humans have a need to interact with nature. This perspective reinforces the idea that in order to develop in a healthy manner, humans need to interact with and associate with nature on a regular basis. This is evident through research and because society's migration away from nature has resulted in many negative health effects and behaviors that now need to be reversed for humans to continue to thrive.

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\(^7\) Norbert Lechner, *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*

\(^8\) Norbert Lechner, *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*

\(^9\) Norbert Lechner, *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*
The child development theory that will be utilized is Piaget's stages of cognitive development. This theory was chosen because of the importance the theory places on environmental experiences and participating in activities that facilitate the development from stage to stage. The Stages of Cognitive Development require a balance between focuses on mental, physical, and emotional health, all three of which are important for healthy development.

**Progressive Education** is the educational philosophy chosen for exploration for this thesis. This methodology acknowledges that every student learns differently and hands-on activities and a variety of experiences are needed to streamline the learning process. Research has shown that natural environments are the best environments for activities facilitating this learning process to take place. Much like humans are social and need to interact with other people, they also need to interact with their surrounding environments.

The architectural style this methodology will be delivered through is an open-
An open-air school was chosen because of the health benefits - such as better motor fitness skills and less illness - which result from the open spaces and their constant connection to the outdoors which are characteristics of these schools. Spaces in open-air schools are constantly connected to, and interacting with, nature. This integrates seamlessly with the idea that interaction with nature is crucial to healthy child development. The result of this thesis will be a contemporary open-air school that combines open planning, access to outdoors, and natural spaces with modern educational philosophies.
INTEGRATION

The design process created in this thesis requires an in-depth exploration into all of the factors that will affect the design of the space. This exploration will lead to the integration of concepts and identification of design implications important to the success of the proposed design. The factors for exploration are biophilia, open-air schools, progressive education, and the stages of cognitive development. Each chosen theory or perspective will be explored in depth in this chapter. Through this exploration a series of design implications will be identified.

BIOPHILIA

Biophilia is the belief that humans are innately attracted to natural settings, systems, and processes because it is from nature that we biologically evolved. The term literally means “love of life or living systems” and was coined by Edward O. Wilson to describe the inherent human affinity for life. Throughout history, the affinity for natural processes and life and participation in activities and lifestyles based in nature are what allowed humans to evolve, adapt, and persist into the thriving species we are today.1 Because this attraction and affinity towards nature is a biological process, it is most likely that interaction

1 Kellert, Stephen R. “Dimensions, Elements, and Attributes of Biophilic Design.” In Biophilic Design: the Theory, Science, and Practice of Bringing Buildings to Life
with nature is most important for children. Therefore it is crucial for children to interact with nature repeatedly and in many different ways and situations in order to effectively develop. Studies have shown that encouraging a connection with nature and participating in activities with hands-on contact with nature in both structured and unstructured settings has mental, physical, and emotional health benefits for humans. Figure 6.2 depicts this process and some of the possible benefits for children. Many proponents of biophilia believe that degraded natural environments do not remove or diminish the affinity for natural spaces out of humans, it simply diminishes our understanding and appreciation for the role nature plays in healthy human development.

Many proponents of biophilia believe it is crucial to bridge the gap between the modern, built environment and nature. From this belief stems biophilic design – an innovative approach that emphasizes and facilitates the maintaining, enhancing, and restoration of the positive effects associated with experiencing nature, especially in built form, in order to restore interaction between humans and nature. This approach places an importance on architectural elements

Fig. 6.2 Representation of the positive outcomes biophilic activities have on human mental, emotional, and social health.

<table>
<thead>
<tr>
<th>Unstructured Activities</th>
<th>Structured Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress Relief</td>
<td>Engagement with School</td>
</tr>
<tr>
<td>Sensory Engagement</td>
<td>Engagement with Local Community</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>Empowerment &amp; Ownership</td>
</tr>
<tr>
<td>Connectedness to Others</td>
<td>Meaningful Learning Experience</td>
</tr>
<tr>
<td>Freedom to Discover, Explore &amp; be Creative</td>
<td>Self-Confidence</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>Sense of Achievement</td>
</tr>
<tr>
<td>Caters to Different Learning Styles</td>
<td></td>
</tr>
<tr>
<td>Care &amp; Nuturing Skills</td>
<td></td>
</tr>
</tbody>
</table>

CHILDREN’S MENTAL, EMOTIONAL AND SOCIAL HEALTH

<table>
<thead>
<tr>
<th>Younger ages</th>
<th>Older ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands-on Contact with Nature</td>
<td></td>
</tr>
</tbody>
</table>

BIOPHILIA

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2 Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*


4 Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*
such as windows, daylight, fresh air, plants and green spaces, natural materials, and decorative motifs from the natural world in order to create spaces that echo the environment people evolved from. Spaces that have successfully done this in the past have been proven to help people function healthier, heal faster, and learn better.5

Many elements and attributes, outlined in Figure 6.3, of biophilic design have been identified. They can be categorized into environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human-nature relationships. Environmental features involve the use and integration of well-recognized features and characteristics of the natural world into the built environment. Natural shapes and forms represent the simulations of the natural world often found on building facades and within interiors. The element that stresses the importance of integrating and incorporating natural elements and processes in built form, rather than just mimicking them, is natural patterns and processes. It is important to implement natural features, such as daylighting, during the design to create spaces that evoke similar emotional responses to those natural spaces often evoke. Culture is an important part of the affinity towards nature. Place-based relationships stress the integration of culture with nature.

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5 "Reconnecting with Nature Through Biophilic Design « The Dirt," The Dirt
and vernacular design. Finally, evolved human-nature relationships focus on the actual relationship between humans and nature.  

Biophilic design seeks to create **restorative environmental design**. Environmentally restorative spaces seek to not only minimize the lasting effect the built environment has on nature but also reverse and restore the connection between humans, nature, and the built environment. It does this by fostering positive experiences of nature, therefore enriching the body, mind, and spirit. This type of design encourages the integration of low-impact technologies with forms and features found in nature. Biophilic and restorative design forms a connection between human environmental values, ecological health, and landscape features which result in many socioeconomic benefits. This relationship is outlined in Figure 6.4.

Restorative design has two basic dimensions. These dimensions are organic or naturalistic design and vernacular or place-based design. Organic design is characterized by the use of forms in built form that direct, indirectly, or symbolically represent human’s affinity towards nature. This does not mean a building has to be curvilinear to be organic. This can be implemented through use of water, vegetation, natural lighting, natural ventilation, and material choice. Vernacular design encourages buildings to connect to their surrounding context through consideration of the culture, ecology, and history.

Through the implementation of vernacular and organic design, a relationship between sociocultural factors, ecological diversity, and sense of place can

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6 Stephen R. Kellert, *Kinship to Mastery: Biophilia in Human Evolution and Development*
7 Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*
be created. By designing spaces that integrate all three types of interaction with nature into the design dimensions described previously, biophilic values can be created. The development of these values has been proven to lead to the development of emotional health, intellectual skills, and a moral/ethical perspective on nature. These relationships and processes are outlined in Figure 6.5.  

PROGRESSIVE EDUCATION

Though it is hard to describe progressive education in a single, fixed definition, there are some principles that are consistent throughout all theories. These principles are: every child requires unique needs, community and social learning are important, learning is a process or journey, and product production is important. In order to facilitate these principles, hands-on learning, adaptable spaces, and mentor-apprentice relationships are often common characteristics of a progressive curriculum. The goal of progressive education is to instill a respect for diversity and develop critical and socially engaging intelligence in all humans. These qualities enable children to grow into adults who can successfully participate and understand community issues and affairs in a collaborative manner.

Some fundamental qualities and characteristics of progressive curriculums are an emphasis on learning by doing, experiential learning, integrated curriculum, emphasis on problem solving and critical thinking, group work, development of social skills, collaborative and cooperative learning, education for social responsibility and democracy, integration of community service, future-looking subject content, de-emphasis on the textbook, varied learning resources, learning by discovery, individual and group learning, emphasis on life-long learning, and evaluation based on projects and products rather than tests. Progressive curriculums are normally more flexible and student interest oriented. Teachers act as facilitators in the learning process and encourage the learning process through use of a wide variety of tools and resources.

Progressive education is different from traditional education because progressive education stresses a movement away from the traditional classroom organization of a teacher at the head of the room who instructs, via lecture, a group of children who sit in desks facing the teacher. Often these spaces are organized linear along a double-loaded corridor. Figure 6.6 represents this traditional form of layout and Figure 6.7 shows an example of a similar classroom layout.

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8 Stephen R. Kellert, *Building for Life: Designing and Understanding the Human-nature Connection*
9 Alfie Kohn, *Progressive Education: Why It’s Hard to Beat, but Also Hard to Find*
10 “Progressive Education - Definition of Progressive Education,” Private Schools - Data and Information About Private Schools
11 “Progressive Education - Definition of Progressive Education,” Private Schools - Data and Information About Private Schools
12 Alfie Kohn, *Progressive Education: Why It’s Hard to Beat, but Also Hard to Find*
more open classroom plan, one likely to be used on a progressive curriculum.

There are certain values through which educational philosophies are analyzed. These are attention to the whole child, community, collaboration, social justice, intrinsic motivation, deep understanding, active learning, and view of child. In terms of attention to the whole child, progressive educators believe that children need to not only become good learners, but also good, moral people. Therefore, education is about more than academics, intellectual growth, and proficiencies. It is also about social learning and moral and emotional development.¹³

Progressive educators view community as an important aspect of learning because learning is not something that happens to children in separate stages and at different locations. Research has shown that children learn from their environment and from the people in their environment. Interdependence and independence are both equally important skills to developing healthy human personalities.¹⁴

Collaboration is important to progressive curriculums because learning takes place in environments with multiple people. Though some activities require individual participation, collaborative learning not only teaches academic skills, but it also teaches teamwork, collaborative problem-solving, sharing, and compromise.¹⁵

Sense of place, community, and responsibility towards others are not values that disappear as soon as a child walks out of a school. These qualities are not confined to the classroom. Rather they are skills developed in a classroom that help children locate themselves in different environments of different scales. These environments can include friends, ethnic groups, cultures, and geographical regions. Activities that foster commitment to diversity and an ethical responsibility to others help develop qualities of social justice.¹⁶

Proponents of progressive education believe that when students are interested in what they are learning and how they are learning, they develop an intrinsic motivation to keep learning. Because of this philosophy, progressive educators question how homework, tests, and assignments are given. Assigning these tasks in ways that motivate students helps to promote long-term learning and not just short-term skills development.

For long-term learning and development children need to develop short-term

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¹³ Alfie Kohn, Progressive Education: Why It’s Hard to Beat, but Also Hard to Find
¹⁴ Alfie Kohn, Progressive Education: Why It’s Hard to Beat, but Also Hard to Find
¹⁵ Alfie Kohn, Progressive Education: Why It’s Hard to Beat, but Also Hard to Find
¹⁶ Alfie Kohn, Progressive Education: Why It’s Hard to Beat, but Also Hard to Find
memorization and a **deep understanding** of all topics covered. Proponents of this educational philosophy believe specific facts only matter in a given context. Therefore development through projects, problems, and questions is encouraged more than development of lists, facts, and skills. This also requires interdisciplinary teaching rather than teaching subjects individually. Rather than asking children to memorize facts, activities that challenge children to question ideas and think deeply about issues helps them understand concepts and ideas more thoroughly.\(^\text{17}\)

Because all children learn differently, it is important for children to have an active role in their curriculum. This concept is referred to as **active learning**. This process asks children to seek out answers, think through possibilities, and evaluate projects and processes of both students and teachers. Research has shown that this construction of ideas facilitates long-term development better than passively absorbing information and practicing skills.\(^\text{18}\)

Much like active learning, where children help create the curriculum, children needed to be viewed as unique individuals who require different policies, expectations, assignments, and learning styles. Progressive educators, therefore, **view children** as individuals to design a curriculum for, not with. Each teacher, therefore, adapts a given curriculum to ways they best see fit for their students. This means one science class can be very different than the science class next door. However, though different methods and styles are used, the same principles are still taught in both environments.\(^\text{19}\)

**STAGES OF COGNITIVE DEVELOPMENT**

The identification of stages of development and the age at which each stage happens are the two reasons this child development theory was chosen for exploration. Humans do their most important development before the age of 13 and most of the time spent during this time is in school. It is therefore important to understand how children develop and what activities can encourage this development in order to create spaces that successfully facilitate this development and the specified activities. Much of a child’s ability to learn and develop later in life is dependent on the successful development of cognitive skills early in life. Jean Piaget is accredited with first developing the stages of cognitive development children progress through as they learn and develop.

As outlined in a previous chapter, there are four main stages – sensory motor, peroperational, concrete operational, and formal operations – that, for the most part, take place between birth and the age of 12 or 13.\(^\text{20}\) Figure 6.8

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17 Alfie Kohn, *Progressive Education: Why It’s Hard to Beat, but Also Hard to Find*
18 Alfie Kohn, *Progressive Education: Why It’s Hard to Beat, but Also Hard to Find*
19 Alfie Kohn, *Progressive Education: Why It’s Hard to Beat, but Also Hard to Find*
20 R. Murray Thomas, *Comparing Theories of Child Development*
### SENSORY MOTOR

<table>
<thead>
<tr>
<th>STAGE</th>
<th>SUB-STAGE</th>
<th>AGES</th>
<th>CHARACTERISTIC BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflexive Stage</td>
<td>0 - 2</td>
<td>0 - 2 Months</td>
<td>Simple reflex activity such as grasping, sucking.</td>
</tr>
<tr>
<td>Primary Circular Reactions</td>
<td>2</td>
<td>2 - 4 Months</td>
<td>Reflexive behaviors occur in stereotyped repetition such as opening and closing fingers repetitively.</td>
</tr>
<tr>
<td>Secondary Circular Reactions</td>
<td>4</td>
<td>4 - 8 Months</td>
<td>Repetition of change actions to reproduce interesting consequences such as kicking one’s feet to move a mobile suspended over the crib.</td>
</tr>
<tr>
<td>Coordination of Secondary Reactions</td>
<td>8</td>
<td>8 - 12 Months</td>
<td>Responses become coordinated into more complex sequences. Actions take on an “intentional” character such as the infant reaches behind a screen to obtain a hidden object.</td>
</tr>
<tr>
<td>Tertiary Circular Reactions</td>
<td>12</td>
<td>12 - 18 Months</td>
<td>Discovery of new ways to produce the same consequence or obtain the same goal such as the infant may pull a pillow toward him in an attempt to get a toy resting on it.</td>
</tr>
<tr>
<td>Invention of New Means Through Mental Combination</td>
<td>18</td>
<td>18 - 24 Months</td>
<td>Evidence of an internal representational system. Symbolizing the problem-solving sequence before actually responding. Deferred imitation.</td>
</tr>
</tbody>
</table>

### PREOPERATIONAL

<table>
<thead>
<tr>
<th>STAGE</th>
<th>AGES</th>
<th>CHARACTERISTIC BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperational Phase</td>
<td>2 - 4</td>
<td>Increased use of verbal representation but speech is egocentric. The beginnings of symbolic rather than simple motor play. Transductive reasoning. Can think about something without the object being present by use of language.</td>
</tr>
<tr>
<td>Intuitive Phase</td>
<td>4 - 7</td>
<td>Speech becomes more social, less egocentric. The child has an intuitive grasp of logical concepts in some areas. However, there is still a tendency to focus attention on one aspect of an object while ignoring others. Concepts formed are crude and irreversible. Easy to believe in magical increase, decrease, disappearance. Reality not firm. Perceptions dominate judgment.</td>
</tr>
</tbody>
</table>

### CONCRETE OPERATIONAL

<table>
<thead>
<tr>
<th>STAGE</th>
<th>AGES</th>
<th>CHARACTERISTIC BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence for organized, logical thought.</td>
<td>7 - 12</td>
<td>Evidence for organized, logical thought. There is the ability to perform multiple classification tasks, order objects in a logical sequence, and comprehend the principle of conservation. thinking becomes less transductive and less egocentric. The child is capable of concrete problem-solving. Class logic-finding bases to sort unlike objects into logical groups. Categorical labels such as “number” or “animal” now available.</td>
</tr>
</tbody>
</table>

### FORMAL OPERATIONS

<table>
<thead>
<tr>
<th>STAGE</th>
<th>AGES</th>
<th>CHARACTERISTIC BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought becomes more abstract, incorporating the principles of formal logic. The ability to generate abstract propositions, multiple hypotheses and their possible outcomes is evident. Thinking becomes less tied to concrete reality. Formal logical systems can be acquired. Prepositional logic, as-if and if-then steps. Can use aids such as axioms to transcend human</td>
<td>12+</td>
<td></td>
</tr>
</tbody>
</table>
During the sensory motor stage, which takes place between birth and 2 years, a child begins to explore oneself and the environment through the development of motor skills and reflexes. Before progressing to the next stage a child must be able to differentiate oneself from the environment. Techniques geared towards the senses such as changing tones, textures, and smells helps a child achieve this development stage. There are six sub-stages for sensory motor development. These are the reflexive stage, primary circular reactions, secondary circular reactions, coordination of secondary reactions, tertiary circular reactions, and invention of new means through mental combination.

Peroperational development is when children begin to learn language. This stage takes place between the ages of 2 and 7. This is the first stage that needs to be considered during the design of an elementary school. During this stage of development children also begin to personify objects and represent them with symbols. For the first time a child will be able to think about objects and events that are not currently present in the environment. Rather than adapting personal viewpoints and belief systems to fit concepts and ideas, a child in the developmental stage adapts ideas and concepts to fit existing viewpoints. Children in this stage are highly influenced by fantasy. Therefore, teaching methods and activities must take this, and a child’s undeveloped sense of time, into account. Using equipment that provides sensory stimulation and allows for children to have an active role in learning are important. Much like during sensory motor development, sub-stages exist during the preoperational stage of development as well. These sub-stages are the preoperational phase and the intuitive phase.

The concrete operational stage takes place between the ages of 7 and 12. This is when a child begins to think abstractly and make judgments based on

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21 “Piaget’s Cognitive Stages,” Patient Teaching, Loose Leaf Library Spring house Corporation
22 R. Murray Thomas, Comparing Theories of Child Development
23 “Piaget’s Cognitive Stages,” Patient Teaching, Loose Leaf Library Spring house Corporation
24 R. Murray Thomas, Comparing Theories of Child Development
concrete and observable phenomena. This is different than previous stages because in earlier stages a child needs to be able to physically manipulate objects in order to understand them. The importance of hands-on activities, though still important, is not as crucial from this stage on. Activities that help facilitate this stage of development are ones that give children opportunities to ask questions and explain concepts back to an adult. These types of activities are successful because it allows and encourages children to mentally manipulate information.25

The final stage of cognitive development is the formal operations stage. This stage starts at the age of 12 and can continue throughout a person’s entire life. During this stage a child develops the ability to make rational judgments without concrete objects present. Hypothetical and deductive reasons are important skills developed during this stage. The concept of multiple intelligences becomes very important from this stage forward because children will have many possibilities, perspectives, and interests, all of which need to be catered to in manners that best facilitate the development of these skills and ideas.26

During each stage children learn and develop different skills and require a different set of environmental stimuli in order to successfully develop these skills. The natural environment is an excellent setting for this development to take place because it naturally provides a multitude of stimuli in a comfortable but flexible setting. Children can participate in activities in the same, or similar, outdoor environments and learn new skills in new ways without needing to seriously adapt the environment. This is because the outdoors is naturally flexible and provides many different stimuli in many different ways. It is much more difficult to achieve these required, flexible and adaptable, educational environments indoors. This is because, unlike nature, indoor environments are not naturally flexible and do not provide a multitude of stimuli. Figure 6.9 outlines emotional stages children go through during development and the best environmental quality to facilitate these stages.

OPEN-AIR SCHOOLS

Originally designed to prevent the spread of tuberculosis, the open-air school movement began in Europe in the early 20th century and was quickly adopted by the United States. Some characteristics common to open-air schools are: smaller student to teacher rations, connections to nature, integration of fresh air and daylighting into the majority of spaces, an abundance of activities that stimulate physical activity and fitness, and manual training and hands-on activities in order to encourage movement.27

25 “Piaget’s Cognitive Stages,” Patient Teaching, Loose Leaf Library Spring house Corporation
26 “Piaget’s Cognitive Stages,” Patient Teaching, Loose Leaf Library Spring house Corporation
27 “ISL: Open Air Schools in Indiana,” IN.gov
Dr. Bernhard Bendix and Hermann Neufert founded the first open-air school in 1904. The school, Wadeschule of Charlottenburg, was located near Berlin, Germany. The majority of the educational activities took place in nearby wooded environments to provide inner-city children with fresh air – or open-air therapy. Open-air schools grew in popularity very quickly and were often developed as a collective effort between doctors interested in the health of children and educational theorists interested in outdoor educational experience. When first developed, open-air schools did not accept sick children, required constant medical surveillance, provided healthy diets, and encouraged the development of healthy lifestyles. They were often located in remote, natural areas and set up in tents, prefabricated barracks, or repurposed structures. After World War I the movement became organized.

Open-air schools faded out of prominence as the scare of tuberculosis did. They were, however, brought back to popularity after a slight adaptation. Open-air schools became open-air, open-plan environments for children to learn in flexible and experiential environments. These new ideas required architecture that provided wide access to the outdoors, flexibility, visibility, and heating systems that allowed working with windows open year-round. These schools were among some of the first to consider the importance of connections of spaces to one another and to the environment in the learning process.

Many open-plan schools developed since the 1950s use the educational philosophy of progressive education. Open-plan classrooms consist of large, adaptable spaces where many different activities can take place. In contemporary, open-plan schools activity zones are programmed into a space and then partitions and architectural elements are applied to this program to provide the maximum amount of adaptability and flexibility. Some of these zones can include small group, large group, activity center, technology zone, focus group, core-learning area, social learning, and creative arts. The individual zones are then designed based on the activities that will take place there. Predetermining exactly how a child is to interact with and experience a space removes the ability to develop creativity. The implementation of zones into larger spaces allows children the freedom to organize and manipulate space. This flexibility enhances creativity rather than restricting it.

Fig. 6.12 Graphic representation of the importance of each factor at each scale. The darker the color at the scale, the more important the factor is at this scale.

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28 Anne-Marie Chatelet, “Open Air School Movement - Encyclopedia of Children and Childhood in History and Society,”
29 Anne-Marie Chatelet, “Open Air School Movement - Encyclopedia of Children and Childhood in History and Society,”
30 Anne P. Taylor and Katherine Enggass, Linking Architecture and Education: Sustainable Design for Learning Environments
Each factor outlined above has specific design implications related to each scale, all of which are derived from the fundamental principals of each theory or perspective. Design strategies that address one or more implications and are site specific will be developed from these implications in order to create spaces that best facilitate interaction with nature at all scales of built form.

Though every factor has design implications relevant to each scale, not all of the factors are crucial to every scale. Some factors are only crucial to one scale while others have varying degrees of importance at multiple scales. Figure 6.12 is a graphic representation of the scale of importance of each factor at each scale. The darker the color, the more important the factor’s influence at that scale is. For example, open-air school implications are most important at the building scale. Therefore in Figure 6.12 the color correlated with open-air schools is darkest at the building scale. The open-air school also has some importance at the human and street scale. Therefore, in the figure there is color associated with open-air schools at the street and human scale, however, the color is lighter than at the building scale because the integration of open-air school implications at two these scales is not as crucial as it is at the building scale.

Cognitive Development affects design at the urban scale because it stresses the importance of social interaction and transmission in the learning and adapting process. Public spaces should be designed to encourage human
interaction and social activity. The major implication of Cognitive Development at the street scale is based on the fundamental principal that everything a child learns, and all skills developed, are to help children better adapt to the environments they find themselves in. In order to develop these skills, children should be provided with constant opportunities to push boundaries, explore, and alter their surroundings. These environments should be within an accessible distance to the child and are therefore crucial to the street – or neighborhood – scale of design. Cognitive development stresses exploration, experimentation, and unguided experiences as important for children to develop adaptation skills successfully. Nature is believed to be one of the best environments to partake in these activities. Therefore, at the human scale it is important to have spaces where actual physical interaction with nature can take place.

Implications resulting from Biophilia at the urban scale are based on the fact that regardless of the environmental quality of a given surrounding, humans are still innately drawn to natural spaces. Degraded environments do not diminish the desire for affiliation with nature, but they can diminish the role of natural diversity in healthy development. Designing urban spaces that offer an abundance of opportunities to meaningfully interact with natural diversity are crucial. In short, it is important to integrate nature into all aspects of urban planning and design - such as street design, park planning, zoning, etc. – in order to achieve this. At the street scale, it is important to develop strategies that use nature and landscapes to create both built and unbuilt form that evoke emotions and feelings similar to those created by nature. In order to do this, these spaces should be unstructured, variable, and adaptable. Implications resulting from Biophilia at the building scale are based on the fact that humans evolved from nature and therefore affiliate with natural shapes and forms. It is therefore important to relate built form to the surrounding site and ecosystems. Finally, at the human scale implications that result from Biophilia relate to how humans are not just drawn to see nature, they are drawn to physically experience and interact with it. It is therefore important to create spaces with natural materials, shapes, and surroundings that encourage physical contact and interaction.

Progressive Education implications at the urban scale are similar to those of Cognitive Development. They are based on the idea that humans are social creatures and therefore learn best through interaction with other people. Similarly to Cognitive Development, Progressive Education requires an abundance of public spaces that encourage and facilitate social interaction. Much like social interaction is a fundamental principal of Progressive Education, so is group development. Spaces that allow activities encouraging community service and improvement and group interaction are implications of Progressive Education at the street scale. At the building scale Progressive Education stresses varied experiences, resources, and tools for learning, because all children learn differently. This requires adaptable spaces with
open plans so multiple activities can take place in the same space. Learning by doing is an important principal of Progressive Education. Therefore on the human scale, it is important to encourage hands-on projects and experiences.

Open-air schools were originally designed to minimize the negative health effects of living in cities and reduce the chance a child would get tuberculosis. In order for these health benefits to be possible, the surroundings an open-air school exists in need to have natural spaces and clean air. Therefore, implications of this factor at the urban scale are the necessity for clean, healthy air and access to natural spaces. Similar to urban scale implications, the implications at the street scale are the requirement of natural ventilation – and therefore clean air – and natural spaces directly adjacent to the site. Most implications relating to open-air schools exist at the building scale. Outdoor learning spaces, open plans, light and airy environments, and facades that open to the exterior are all building scale design implications relating to open-air schools. Implications for this factor at the human scale are spaces that allow constant access and connection with outdoor space, the importance of an individual's ability to control that access, and the actual physical ability to interact with outdoor environments.

Figure 6.13 is a matrix of the design implications of each factor at each scale that have been discussed. On the matrix, the color of the factor correlates with the color of the scale in which the design implications for that factor are most crucial. For example, the open-air school is most crucial to the building scale because it is the architectural style through which the building will be designed. Therefore the color of the heading for open-air school and building scale are the same.

This chapter explored all of the chosen theories and perspectives in depth and identified important design implications resulting from each theory or perspective. The following chapter will use these implications to create a set of site-specific design strategies for the different scales of built form and for specific, important, programmatic spaces.
STRATEGIES

This chapter will use the design implications outlined in the previous chapter to create a set of design strategies. For this project, an urban elementary school, the goal of these strategies is to determine the best ways to integrate nature into educational spaces. This integration will minimize the negative effects living in urban areas has on human development. The spaces created will encourage interaction with nature and facilitate the learning and development process as well.

In order to create a set of design strategies that result in spaces that fully integrate nature into built form when applied, there are three categories that need to be outlined during the design stage. These are context, content, and educational philosophy. Context is the whole designed environment children learn in, both indoors and outdoors. The content is the curriculum through which children will learn. This includes subject matter and interdisciplinary concepts. Finally, the environmental perspective is the philosophy the educational facility will adopt in order to facilitate learning and development. This outlined philosophy should include concepts on all types of health and development, such as mental, emotional, and physical.¹

Context is the physical setting in which the learning occurs. This can be

¹ Taylor, Anne P., and Katherine Enggass. Linking Architecture and Education: Sustainable Design for Learning Environments
more than just the built environment but should include natural and cultural environments as well. Spaces to be considered are classrooms, circulation spaces, gathering spaces, the school as a whole, outdoor classrooms, and the school grounds, among others. Context needs to include the cultural setting of the school environment as well as the surrounding context the school will be placed in. For this project, the context of the school is an urban elementary school. The surrounding context of the neighborhood will become very important in the success of the design strategies. The school should be a community park as much as a learning environment for children. Spaces need to open up to the public but also keep the children safe and secure. Classrooms, circulation, and outdoor classrooms, or learning landscapes, will be outlined further later in this chapter.

**Content** is what is being learned by the students. For this project, it will be assumed the topics studied are math, science, social studies, visual arts, language arts, music, health, technology, and physical education. However, interdisciplinary teaching methods will be used. Research has shown that learning takes place in an integrated and holistic manner and students who are taught this way often perform better. Rather than focusing on a specific topic a child is to learn, it is more beneficial to focus on a concept or idea to be learned. When education is taught based on concepts and ideas rather than topics, it is easier to make connections between the different disciplines, which allows children to learn in a more holistic manner.

The **educational philosophy** is the way children learn. This philosophy will be determined early in the design process and will influence the types of spaces required in order to accommodate activities the philosophy has found to facilitate learning. As stated early in this thesis, the educational philosophy used for this project will be progressive education. Children learn in different ways so it is important to use the educational philosophy to determine these different ways and what types of spaces facilitate these different learning styles best.

**BIOPHILIA**

Biophilia is a large factor in determining which design strategies will be successful because it is the environmental perspective through which connection and interaction with nature will be accomplished. Biophilia is the innate attraction and affiliation people have towards nature, other species, and natural spaces. It stresses the importance of human connection with nature on a regular basis on healthy human lifestyles. This connection to nature is

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2 Taylor, Anne P., and Katherine Enggass. Linking Architecture and Education: Sustainable Design for Learning Environments
3 Taylor, Anne P., and Katherine Enggass. Linking Architecture and Education: Sustainable Design for Learning Environments
4 Taylor, Anne P., and Katherine Enggass. Linking Architecture and Education: Sustainable Design for Learning Environments
possible in parks, nature centers, woodlands and other unstructured natural areas. This connection is also possible in built form in urban areas when spaces are designed using biophilic design. Biophilic design is an innovative approach to design that emphasizes the importance of not just maintaining and restoring natural systems in urban areas, but also the encouragement of natural experiences.\(^5\)

The goal of biophilic design is to create spaces that are environmentally restorative. The modern design process and approach to the urban built environment has encouraged the massive transformation and degradation of natural systems. Along with the obvious effect – the separation between humans and nature – this form of design has also led to environmental degradation, pollution, massive species loss, and climate change. Restorative environmental design takes sustainable design a step further by coupling high technology but low-environmental impact design strategies with spaces that foster beneficial contact between humans and nature.\(^6\)

Scale is one method through which biophilic design principals can be applied to urban design in order to integrate nature into built form. Much like there

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are several scales to built form and design, there are also several scales of biophilia. Biophilia breaks down into the six scales. These are region, community, neighborhood, street, block, and building. For this thesis the focus will be on the community, street, and building scales of biophilia as well as an added human scale. Figure 7.2 summarizes the biophilic techniques and strategies that can be applied at each scale.7

From these scales of biophilia a series of strategies and priorities can be identified. These strategies and priorities are overall goals as to the environmental quality of the project. It is up to the designer to determine the best way to integrate the strategies into a design. For example, some of the site strategies are to create pathways through natural areas, minimize impervious paving, and incorporate living walls into the design. These strategies lie out the desired end result but do not inform how exactly to accomplish the end result. It is up to the designer to determine which goals are most important and the best ways to accomplish them. Much like biophilia falls into scales, biophilic design strategies fall into different categories. These are the entire project, the site, the building, and the interior. Figure 7.3 is a chart outlining some of the...

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strategies that can be applied. These strategies will be incorporated into the design of an elementary school in the next chapter.

**OVERALL DESIGN PRIORITIES**

Studies have shown that children learn and develop through interaction with their surrounding environments. They learn how to differentiate themselves from their environment and develop skills such as creativity, critical thinking, problem solving, categorization, organization, and labeling, among many others. It is important to provide children with environments that facilitate the development of these skills. Opportunity to interact with nature is an extremely important aspect of these required environments. Outdoor environments foster these skills, especially creativity, better than indoor spaces do because outdoor environments are flexible, adaptable, and stimulating. They provide many different opportunities for children to explore and use their imagination. Indoor spaces on the other hand are often large, less flexible rooms with fewer stimuli.

Though nature is the best facilitator of learning and development, it is impractical to think all learning and educating can take place outdoors. It is therefore important to bring as much nature and natural features into a building as possible to provide as many of the same benefits of outdoor learning as possible indoors. For this to happen, spaces should be designed to blur the boundary between the interior and exterior. As explained in the last chapter, not all regions of the United States have climates that allow outdoor activities year round. To mitigate this blur between interior and exterior spaces will be most successful if a gradient between entirely indoors and entirely outdoors is used. For example, interior spaces can be designed with walls that open to the exterior. This allows the room to be opened up partially or fully to the exterior, providing the level of interaction between the two that is weather appropriate. Another example of this is to provide outdoors spaces that are covered or protected from the elements. This will maximize the amount of time these spaces can be utilized. For example, even if it is raining some activities can still take place outdoors.

Children learn and adapt by exploring and manipulating their surroundings. In order for them to do this successfully they need to be safe and secure but also independent. When pushing their boundaries they need to feel like they are not in danger otherwise they will not be as explorative. At the same time, they need to feel a level of independence in order to feel as though their explorations are their own accomplishments. This requires an interesting dichotomy between types of spaces. One possible way to accomplish this is to provide an interior, or guarded exterior, space that is a “children only” domain. This space can have protective boundaries that provide security but still provide the required level of privacy needed to instill the feeling of independence in children.
<table>
<thead>
<tr>
<th>ARCHITECTURAL ELEMENT</th>
<th>DESIGN CONSIDERATIONS</th>
<th>EDUCATIONAL BENEFITS</th>
</tr>
</thead>
</table>
| Acoustics / Sound Attenuation | - Design with different materials that reflect sound in different ways (glass, concrete, fabric)  
- Design shape of spaces to affect sound (curved wall panels, angles, and ceiling panels)  
- Consider size of spaces and small group usage  
- Stagger wall planes                                                                 | - Measurement  
- Physics of sound  
- Types and intensities of sound  
- Music concepts  
- Sound technology  
- Sound attenuation                                                                 |
| Ceilings                       | - Grid System or space frame for hanging objects  
- Acoustics, sound attenuation  
- Skylights or glass ceilings  
- Up lighting  
- Drop-down furniture  
- Reflectivity and light                                                                 | - Positional concepts  
- Shapes and forms  
- Architecture  
- Structural systems  
- Sound  
- Display  
- Measurement                                                                 |
| Circulation                | - Avoid long narrow double-loaded corridors  
- Install galleries and display systems  
- Use break-out spaces  
- Furnish small areas for socializing and learning - niches, study areas, technology zones  
- Concepts of the street - mall, atrium, etc.  
- Skylights / natural lighting                                                                 | - Art  
- Display / gallery  
- Expression  
- Socialization  
- Technology  
- Spatial configuration                                                                 |
| Floors                        | - Washable floors in project areas  
- Floor graphics  
- Different textures / floorings for different programmatic activities  
- Architecture as wayfinding                                                                 | - Products  
- Materials  
- Textures  
- Graphics  
- Measurement (area)  
- Wayfinding                                                                 |
| Furniture                    | - Tables as desks  
- Flexible, adaptable, moveable  
- Ergonomic  
- Arrangement of furniture best reflects educational practices (not oriented toward teacher at front but toward team / group activities)  
- Partitions                                                                 | - Measurement  
- Adjustability / Flexibility  
- Presentations  
- Teamwork / cooperation / sharing  
- Social skills  
- Gallery / display                                                                 |
### Connections to Nature
- Green technologies
- Natural light
- Openable to the outdoors

### Natural Lighting
- Fenestration for energy observation
- Operable windows
- Orientation and siting of building
- Greenhouse
- Skylights / clerestory windows
- Light shelves up high
- Shades / Louvers
- Use of courtyards
- Furniture placement for maximum benefit

### Walls / Display
- Explore pivotal walls and doors; sliding boards
- Vary textures and colors
- Interactive 3-dimensional walls
- Transparencies
- Interactive living walls
- Natural materials
- Movable / flexible

### Design Considerations
- Ecology
- Holism
- Environments
- Cycles
- Scale
- Natural Resources
- Earth Science
- Sustainability
- Stewardship
- Architecture
- Connectedness

### Educational Benefits
- Shadows
- Reflection / Refraction
- Day / Night
- Seasons
- Weather
- Art
- Health

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**Fig. 7.7** A chart that outlines architectural design elements, what some of the design considerations should be, and the possible educational benefits of the design considerations.
Every aspect of a building can be used as a learning tool in the educational process. Ceilings, floors, walls, acoustics, circulation, lighting, and furniture can all facilitate the learning process. Each of these aspects has certain design priorities or considerations that can result in certain educational benefits. For example, when designing the wall partition system, it is important to consider color, texture, and dimensionality of the wall. Walls designed to have varying dimensions while being moveable can teach spatial concepts along with providing adaptable spaces. Figure 7.7 is a chart that outlines these aspects, what some of the design considerations should be, and the possible educational benefits of the design considerations.

Overall educational spaces should provide direct connections to the exterior, views outdoors, varying levels of flexibility and adaptability, safe and secure environments for learning, varying degrees of “inside” and “outside”, and lots of smaller environments within the larger environment. If schools provide these types of spaces then they will see, not only short-term, but great, long-term improvements in the learning and developmental skills of the students who attend the schools.

**CLASSROOMS**

The most important space in an elementary school to incorporate nature into built form is in the classroom. This is because children spend most of their time at school in the classroom. The elementary school designed for this thesis uses a progressive curriculum. This means that there is an emphasis on varying and hands-on activities. Therefore classroom spaces need to be large, open, flexible spaces with a high level of adaptability. For the design, it will be assumed that the core subjects – math, science, language arts, and social studies – will be taught in an interdisciplinary fashion in academic classroom environments. Health, physical education, visual arts, music, and technology will be taught in specialized classroom environments. The specialized environments will have less flexibility and be more specifically programmed than the academic classroom spaces.

There are many ways classrooms can be laid out in an educational facility. Figure 7.8 is a series of sketches of some of these options. Currently, the most common method of organization is linearly along a double loaded corridor. Many different activities take place in classrooms. These activities require different settings, stimuli, and components. Figure 7.9 depicts what these components are. The different activities that take place can range from individual, small, large, and lecture style activities. Figure 7.10 depicts the different types of activities that take place in an elementary classroom. The design of classrooms need to take into consideration these components and activities. Classroom spaces should be designed to host as many of the activities as possible. In order for classrooms to do this and be of a realistic size, a high degree of adaptability and flexibility are required.
Most commonly, classrooms are square, or rectangular spaces that have little adaptability. These types of classrooms do not provide the best environment for learning because there is only one environment in which to learn. Therefore, all of the different activities required for integrative and holistic learning are not as effective in an unarticulated classroom. Classrooms that are articulated and have “niches” for students to participate in different types of activities requiring different size groups facilitate learning better than those that do not. Figure 7.11 is a diagram comparing the two different types of classrooms.

An articulated classroom is another form of open-plan classroom. Open-plan classrooms are characterized by large spaces with minimal permanent structures. These spaces are often programmed in zones. These zones can be the different types of activities that take place there. Children need a level of structure as much as they need freedom and flexibility in order to learn well. For open-plan classrooms to be successful, partitions to create private, focused spaces are needed as well as a level of organization and structure that is applied to the large space as a whole. Without this, spaces will be chaotic, confusing, and possibly over-stimulating.

Fig. 7.11 Diagram showing the different between an articulated and non-articulated classroom. Articulated classrooms allow for many zones and activities to take place.

Fig. 7.12 (Above top) Example of a programmed two-story classroom space. The space is programmed for multiple different activity zones.
When designing these spaces it is important to determine what activities will take place there and program the space accordingly. Figure 7.12 is an example of a two-story classroom space programmed to accommodate core learning area, activity centers, small group areas, focus groups, technology areas, eco-learning areas, large group areas, social learning spaces, blurred interior to exterior learning areas, children only zones, and project areas. By programming a space it is possible to see where overlaps in programs exist, where privacy is needed, and where permanent structures are required, and where movable partitions will be beneficial. Figure 7.13 is a traditional classroom layout while Figure 7.14 is a complete open-plan classroom layout showing possible furniture arrangements. For more information, open-plan classrooms were discussed in further detail in a previous chapter.

Connection to nature in the classrooms is essential to the learning process. It is important for each classroom to have a direct connection with nature. This can happen in many ways. Figure 7.17 is a series of diagrams exploring the different ways to organize connection with nature, classrooms, and circulation. Though not all activities can take place in an outdoor environment, many can. For this reason a series of outdoor classrooms will need to be provided. Each core-learning area should have access to an outdoor classroom and no more than four core-learning areas should have access to any one outdoor learning area. As previously discussed, a gradient should exist between all fully interior and fully exterior spaces. This will maximize the amount of time outdoor, or partially outdoor activities can take place.
Natural lighting is an extremely important factor in classroom design. Studies have shown that children are healthier and perform better when they are in naturally lit environments. For this and other environmental reasons, such as solar heat gain, it is best to position a longer, narrow building east to west to maximize the amount of natural light and solar heat gain potential a building has. However, it is not always possible to locate classrooms on the south side of a site or to orient a building east to west. It is still important to maximize the amount of natural light in north facing classrooms. There are many ways to do this, such as clerestory windows, skylights, light shelves, and light scoops, among others. Figure 7.15 shows two strategies of how to bring light into north facing classrooms.

**CIRCULATION SPACES**

One of the fundamental beliefs of progressive education is that social learning is very important in the learning and developing process. Children learn by watching those in their surrounding environments and, after the educational process is complete, they become part of the real world. This requires a high degree of social skills. It is beneficial to start the development of these skills at an early age. Circulation spaces in schools are one of the many locations where children have chance meetings and can develop these social skills.⁸

Children respond differently to circulation spaces than adults do. Adults often view these spaces as simple linking point A to point B. Children, on the other hand, view circulation spaces as spaces where there are briefly “free” and able to interact how they see fit. However, how a circulation space is designed can greatly affect the type of interaction that takes place. Though if not designed properly circulation spaces will simply be corridors moving students from destination to destination. One way to avoid this is by giving circulation spaces additional functions. Figure 7.16 is a chart outlining some of the other possible functions of a circulation space that facilitate physical, mental, and emotional skill development.

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It is important to provide children with spaces or niches to pause in circulation spaces for additional activities to take place, such as socializing. Movable components such as plants and furniture can be used to create these spaces and give them more privacy. Window seats and low walls can encourage stopping while views and light can encourage sociability. Circulation spaces should also be zoned. It is important to program a circulation space just like you would a classroom. Designers should create spaces for fast movement, slow movement, and stopping or interacting.

Facilities with no double loaded corridors have more healthy spaces than those that do. This is because in double loaded corridors there is not access or connection with the outdoors while in these spaces. It is just as important to have access to natural spaces when moving through the building as it is in destination spaces. Some studies have found that people are more likely to physically interact with nature when they are moving than when they are at rest. Single loaded corridors with moveable walls and roofs are one design solution. In locations with four distinctive seasons, circulation spaces can be created to open to the exterior in the summer and be turned into conservatories in the winter.

When possible second floor circulation spaces should be turned into balcony spaces overlooking gathering spaces or other circulation spaces. “Hang-out” areas should be provided on balcony circulation spaces so children can stop. These types of spaces provide views and opportunities for socialization along with socially and visually linking levels. When possible, large circulation spaces also used as gathering spaces should have as much daylight as possible. These spaces are most successful if they are at least double height spaces. This maximizes not only natural lighting but also views into and out of the space. The figures on these pages demonstrate some design strategies for circulation spaces.

**LEARNING LANDSCAPES**

It is just as important to design the site of an educational facility, as it is the building. How a site is landscaped can determine how children use it and ultimately, how they learn and develop. It is extremely important to provide a maximum of different possible activities on a site. This can include play structures, opportunities for physical activity, different natural systems, and transitional spaces.

There are many elements of outdoor spaces. These elements are natural, agricultural, multisensory, built, outdoor classroom, cultural, and transitional. Natural elements are the vegetation and other natural systems on the site. Agricultural elements are those where children can learn through interaction with animals and gardens. Multisensory elements are those that cater to the
senses. These elements can include textures, color, smells, and sounds. Built elements are non-natural designed spaces such as weather stations, play structures, and fitness trails. Outdoor classroom elements are elements required by core, outdoor learning areas. Cultural elements are designed elements that help the building relate to the surrounding physical and cultural context. Finally, transitional elements a designed, or programmed, way people move from space to space. Figure 7.21 is a chart outlining the elements of learning landscapes and what the features of each element are.

Another way to break up outdoor spaces is by architectural element. These elements are entrance, equipment, fencing and boundaries, gardens, gathering spaces, landscaping, pathways, and water usage. Much like the interior architectural elements and their design considerations discussed earlier in this chapter, these outdoor architectural elements have factors to be considered during the design process. When designed successfully these spaces can have successful educational benefits. Figure 7.22 outlines the elements, their design considerations, and their educational benefits.

Children learn in an integrated and holistic manner. So, when designing outdoor spaces it is important to create holistic and integrated spaces. Much like a classroom should be programmed to determine where activities will take place and what architecture elements are required, outdoor learning areas require programming as well. All outdoor spaces should be designed in a way to minimize environmental impact and maximize connection and interaction with nature. Transitional spaces should exist to naturally move people from destination to destination. Figure 7.19 and 7.20 are sketches of possible strategies of how to do this.

**STRATEGIES**

The most important spaces of an educational facility geared towards
<table>
<thead>
<tr>
<th>ARCHITECTURAL ELEMENT</th>
<th>DESIGN CONSIDERATIONS</th>
<th>EDUCATIONAL BENEFITS</th>
</tr>
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</table>
| Entrance              | • Portal / shade / protection  
|                       | • Careful orientation toward urban context  
|                       | • Courtyards / plazas  
|                       | • Built-in seating  
|                       | • Plants / Landscaping  
|                       | • Scale elements for children  
|                       | • Optimize organic placement of equipment (ex. slides built into hillside, built-in seating)  
|                       | • Architectonic structures designed for imaginative play  
|                       | • Level changes  
|                       | • Moveable elements / loose parts  
|                       | • Places for manipulative play or work  
|                       | • Shade structures  
|                       | • Equipment for outdoor classrooms  
|                       | • Health and fitness / exercise  
|                       | • Gross and fine motor development  
|                       | • Imagination / creativity  
|                       | • Architectural elements  
|                       | • Positional concepts  
|                       | • Concepts related to outdoor study of all kind  
|                       | • Stewardship  
|                       | • Provide protective boundary without using chain link fence  
|                       | • Use natural boundaries; trees, bushes, hedges  
|                       | • Use art as boundary  
|                       | • Separate age group play areas  
|                       | • Variety of edging materials  
|                       | • Ability to open specific areas to the public  
|                       | • Visibility / supervision  
|                       | • Activity stations / zones  
|                       | • Positional concepts  
|                       | • Lines, angles, shapes, forms, patterns (geometry)  
|                       | • Materials  
|                       | • Display / art  
|                       | • Graphics, color  
|                       | • Botany  
|                       | • Privacy  
|                       | • Supervision  
|                       | • Biology  
|                       | • Life cycle / growth  
|                       | • Health / nutrition  
|                       | • Earth science  
|                       | • Fine and gross motor skills  
|                       | • Ecology / habitat  
|                       | • Vocabulary / labeling  
|                       | • Stewardship / cooperation  
|                       | • Community  
|                       | • Raised bed gardens of all kinds  
|                       | • Container gardens  
|                       | • Vary types of gardens for learning; vegetable, herb, insect, ethnic/cultural, rock, flower, butterfly, historical  
|                       | • Community access  
|                       | • Water recycling systems  
|                       | • Composting bins  
|                       | • Greenhouse  
|                       | • Landscaping  
|                       | • Biology  
|                       | • Life cycle / growth  
|                       | • Health / nutrition  
|                       | • Earth science  
|                       | • Fine and gross motor skills  
|                       | • Ecology / habitat  
|                       | • Vocabulary / labeling  
|                       | • Stewardship / cooperation  
|                       | • Community  

**ARCHITECTURAL ELEMENT**  
- Entrance  
- Equipment  
- Fencing and Boundaries  
- Gardens
## Architectural Elements

### Gathering Space
- Amphitheater / Outdoor stage
- Spaces to accommodate small, medium, and large groups
- Plazas / courtyards
- Focal points; fountains, sculpture, landmark, etc...
- School as park

### Landscaping
- Design to fit the natural landscape, climate, and culture
- Use native plants
- Use natural and indigenous materials
- Preserve, restore, or create habitats
- Include educational opportunities
- Leave some natural space open
- Minimal nonpermeable paving

### Pathways
- Use a variety of ground surface and textures
- Vary path widths
- Use curved, straight, angular, and intersections
- Incorporate fitness and physical health
- Nature trails
- Jogging / bike trails / obstacle course
- Vary ground levels and inclines
- Continue pathways from exterior indoors

### Water Usage
- Design water or wetlands habitats on site
- Set up gray water recycling system
- Turn water systems into educational opportunity

### Educational Benefits
- Drama
- Music / Dance
- Performance
- Fine and gross motor skills
- Size, shape
- Public art
- Socialization
- Earth science
- Ecology / habitat
- Climatic / weather
- Conservation
- Native
- Preservation
- Garden
- Topology
- Sense of place
- Surface
- Texture
- Fitness, health, and exercise
- Nature
- Spatial concepts

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**Fig. 7.22** A chart that outlines outdoor design elements, what some of the design considerations should be, and the possible educational benefits of the design considerations.
encouraging interaction with nature in the educational process are outdoor spaces, classrooms, and circulation spaces. All of the design considerations have been explored in depth. A series of design strategies can now be compiled. The strategies are place in the four scales discussed previously – urban, street, building, human.

URBAN STRATEGIES

Strategy one: Build and develop cities with fingers of green space and an abundance of parks that act as corridors through which to move people through the urban area.

Strategy two: protect unbuilt land as natural ecosystems. Provide access to the spaces and encourage interaction with nature through use of paths and activity stations.

Strategy three: Green all major transportation corridors. Provide green bike and pedestrian paths whenever possible. Connect these transportation paths with green spaces and the community.

Strategy four: Create urban forests to restore natural systems and wildlife in urban areas.

STREET STRATEGIES

Strategy five: Create green “nodes” where different transportation paths cross. These spaces should facilitate many different activities and encourage interaction with nature.

Strategy six: Build low-density roads and parking areas with permeable pavement. Incorporate bioswales and natural shading devices to minimize environmental impact and lower the heat island effect.

Strategy seven: Provide accessible bike and pedestrian paths to all green areas. These pathways should provide a connection with nature and encourage interaction. Provide stopping and resting areas throughout the pathway system.

Strategy eight: Local areas of water such as rivers, ponds, and creeks, provide opportunities for people to interact with nature. These areas should not be covered up. Designed natural spaces to interact with these water systems should be present and accessible.

Strategy nine: Develop community gardens. These gardens should require community involvement and the community should see the benefits. They should be located in accessible and natural areas. Unused brownfields are a
good location.

**Strategy ten:** Green the streets through incorporation of plantings. Provide edible landscapes. This will encourage people to interact with nature as they move through it.

**Strategy eleven:** Encourage greening buildings through local initiatives. An example of this can be tax breaks for buildings with living walls, etc.

**Strategy twelve:** Encourage low impact development. Use policies and strategies that reduce urban sprawl without removing all green space from urban areas.

**BUILDING / SITE STRATEGIES**

**Strategy thirteen:** When positioning a building, locate it on the most unattractive part of the lot. Attempt to orient building east to west to maximize passive environmental strategies.

**Strategy fourteen:** Utilize gardens to encourage community interaction and contact with nature. Gardens should not be too exposed or too private.

**Strategy fifteen:** Shape buildings around existing trees whenever possible. Locate trees in a manner to provide boundaries for outdoor social areas and to provide shade for built elements.

**Strategy sixteen:** Provide seating outdoors so people can rest and relax outdoors. This can be a form of both direct and indirect interaction with nature.

**Strategy seventeen:** Use growing plants and green walls as façade systems. This minimized the environmental impact of the building, helps the building connect with the context, and integrates nature and built form.

**Strategy eighteen:** Integrate courtyards and/or lighted atriums as gathering spaces. These spaces should be landscaped and designed to encourage interaction with nature.

**Strategy twenty:** Use native species in landscaping features whenever possible. Allow some spaces on a site to grow naturally.

**Strategy twenty-one:** Provide constant views of nature and blur the boundary between interior and exterior spaces. Use a gradient to do this.

**Strategy twenty-two:** Provide open space around building and outdoor classrooms for every four indoor core-learning areas.
Strategy twenty-three: Built transitional pathways and pathways through natural and landscaped areas to maximize the amount of interaction with nature possible.

Strategy twenty-four: Provide high levels of natural lighting through skylights, clerestory windows, and operable facades. Opportunities for daylighting also provide opportunities for views. All spaces should have views outdoors.

Strategy twenty-five: Incorporate organic form into buildings

Strategy twenty-six: Incorporate water features, living walls, interior gardens, and roof gardens into the design.

Strategy twenty-seven: Provide interior spaces that are adaptable and flexible. These spaces should have interior access to nature and views outdoors.

Strategy twenty-eight: Program additional functions into circulation spaces and design them to act as social learning areas. These areas should have an abundance of natural lighting and views and access to outdoors. Make these spaces two-story spaces with balconies whenever possible.

HUMAN STRATEGIES

Strategy twenty-nine: Provide natural materials of varying textures and colors for students to interact with

Strategy thirty: Create spaces that facilitate activities requiring physical connection with nature during hands-on activities

Strategy thirty-one: Provide interior and exterior spaces where a child can manipulate the environment. These spaces should include natural elements.

This chapter set out to explore design considerations for the important spaces in an educational facility and compile a series of design strategies that can be applied to the design on an urban elementary school. The project will be described in detail in the Design chapter.
Built projects that attempt to achieve an integration between people and the natural environment already exist. By studying these projects it is possible to determine both successful and unsuccessful design strategies in terms of building, site, and urban design. This chapter looks at multiple projects that achieve, or attempt to achieve, an important aspect of the desired solution. Precedents for site, building, and program will be explored. Additionally, projects in both urban and rural settings will be examined to help determine appropriate design strategies for this investigation. Rural projects are important because some strategies can be taken from them, altered and implemented in urban projects.

The images on the following page are a graphic representation of all of the precedents looked at. Only a few will be explored in depth in this chapter. Figure 8.2 compares the different precedents analyzed with different topics and strategies that have been discussed and whether they were attempted and or successfully accomplished.

**BENJAMIN FRANKLIN ELEMENTARY SCHOOL**
**MAHLUM ARCHITECTS, KIRKLAND, WASHINGTON**

Benjamin Franklin Elementary School is a rural elementary school located on a 10-acre site in a low-density neighborhood in Kirkland, Washington. Before
Fig. 8.2  (Right) Graphic comparison of all the different precedents looked at for this study. Each was analyzed on whether they lightly, strongly, or did not respond to the different architectural and site features. The bold the “X” represents the strongest relationship to factor being analyzed. A regular “X” represents a weaker connection.

Fig. 8.3 Photograph of an outdoor amphitheater and classroom at Thurston Elementary School. The school was designed by Mahlum Architects and located in Springfield, Oregon.

Fig. 8.4 Exterior view of High School #9. Located in LA, this high school was designed by Coop Himmelblau. This building does not connect well with nature but is an iconic symbol to the city.

Fig. 8.5 View of an exterior classroom at Benjamin Franklin Elementary School. The school is located in Kirkland, Washington and was designed by Mahlum Architects.

<table>
<thead>
<tr>
<th>BUILDING TYPE</th>
<th>Thurston Elementary</th>
<th>High School #9</th>
<th>Benjamin Franklin Elementary</th>
<th>Sidwell Friends Middle School</th>
<th>Fuji Kindergarten</th>
<th>Genzyme Center</th>
<th>Nelson-Atkins Museum of Art</th>
<th>The Reichstag</th>
<th>Teton Valley Community School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Facility</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<th>Nelson-Atkins Museum of Art</th>
<th>The Reichstag</th>
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<td>X</td>
<td>X</td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Spaces with Connection to Nature</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td></td>
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<tr>
<td>Green Roof</td>
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<th>Sidwell Friends Middle School</th>
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<th>Genzyme Center</th>
<th>Nelson-Atkins Museum of Art</th>
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<th>Teton Valley Community School</th>
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<tr>
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<td>X</td>
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<td>X</td>
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</tbody>
</table>
Fig. 8.6 Exterior view of outdoor amphitheater at Sidwell Friends Middle School. The school is located in Washington D.C, and was designed by Kieran Timberlake.

Fig. 8.7 An interior view of the classrooms of Fuji Kindergarten in Tokyo, Japan. The school was designed by Tézuka Architects to open up completely to the interior courtyard.

Fig. 8.8 Interior perspective of a classroom at Teton Valley Community School, the winner of the 2009 Open Architecture Challenge.

Fig. 8.9 An interior view of the atrium of the Genzyme Center in Cambridge, Massachusetts, designed by Behnisch Architects.

Fig. 8.10 Interior view looking outside of the Nelson Atkins Museum of Art by Stephen Holl.

Fig. 8.11 Exterior view of the atrium addition to the Reichstag by Foster + Partners.
Fig. 8.12 Image of Benjamin Franklin Elementary School, designed by Mahlum Architects.

the site was a school it served as riding trails with horse paddocks and open green space. The school was designed around the public school district’s philosophy that learning is done best when it is in a collaborative environment.

The school district mandated the program house a 450-student body in a series of four, two-story, classrooms with shared learning areas that also double as common space. The school is designed to have no mechanical ventilation system and instead uses its orientation and layout to naturally ventilate all of the spaces.

The school is comprised of three “fingers” that run east west, allowing maximum north-south glazing. This glazing exists in the classrooms, shared learning areas, commons, and gymnasium. Roof overhangs and shading devises are used to minimize direct solar gain and glare. Two courtyards - or outdoor classrooms - are an integrated part of the design.

Though Mahlum Architects had plenty of opportunities, and a site that would facilitate it, there is a lack of direct connection with the unstructured natural areas adjacent to the building. The two courtyards do create outdoor, planted, learning spaces, but there lacks any unstructured vegetation nearby, or any spaces for kids to explore and interact with in an unstructured environment, which this thesis has proven is essential for healthy development. A beautiful wooded area is located just north of the building, yet only a service and storage building actually physically connect with this area.

Lots of glazing exists throughout the site to maximize the views out of the
building, some of which directly face the wooded area. However, the classrooms do not have any direct connection to nature and no natural vegetation exists within the building. This is especially true for the second story spaces.

The design of Benjamin Franklin Elementary facilitates vicarious interaction and some indirect interaction but very little direct interaction, which is also extremely important. It is important to determine ways to create spaces that allow for educational activities to take place while also allowing direct interaction with unstructured nature. Additionally, it is important to determine
methods of creating structured unstructured interaction with nature. This means that it is important to develop ways to supervise and guide unstructured – or unspecified – interaction with nature without sacrificing the security of the children.

The site is mostly covered with natural materials such as gravel, grass, and landscaped areas. This, along with natural bioswales surrounding the parking, minimize the urban heat island effect and the negative effect the building has on the existing ecosystems.

Overall the building has good use of natural daylight and ventilation and was designed with consideration of the existing site. The design would be more successful if the outdoor classrooms were more free and natural and encouraged direct interacted and unstructured play. There is a strong visual connection to nature throughout the school, but an actual physical connection in all of the spaces is lacking, therefore minimizing the successfulness of the design in integrating children with nature.

**FUJI KINDERGARTEN**
**TEZUKA ARCHITECTS, TOKYO, JAPAN**

Fuji Kindergarten is an educational facility located in Tachikawa, a suburb of Tokyo, Japan. The overarching design concept was to create a space where children can interact with each other and their surroundings in a safe and stimulating environment. The design solution was to create a facility where every space had access to the outdoors. This maximizes the time children can spend outdoors while minimizing hazards, such as children ending up in the streets.

The resulting design is an oval shaped facility with a large interior courtyard. The entire facade enclosing the courtyard is comprised of operable sliding glass panels that allow for the entire interior to be opened to the exterior. The entire roof of the facility is a roof deck that children can easily access and play on. A slide exists to move children from the roof to the ground in a playful manner. No structured activities or play objects exist on the roof in order to
maximize creative play. Each interior space has a skylight which projects out of the roof deck. A rope ladder leads up to each window providing students on the inside access to the roof.

The design and construction of the facility protected much of the vegetation on the site by designing and building around as many mature trees as possible. Throughout the facility, many mature trees grow up through the building providing natural shading for the roof deck. The same operable glass panels that open to the courtyard also surround these trees. This allows these enclosures to be opened and therefore become part of the interior spaces, which allows the tree to be as much a part of the building as they are a part of the environment. This encourages direct interaction with nature on the interior of the building while also blurring the boundary between interior and exterior.

Other than programmed private spaces, such as restrooms and offices, there are no interior partitions breaking up the interior spaces. This maximizes a child’s ability to interact with other children and the environment, which positively affects child development.

Overall the design of Fuji Kindergarten is extremely successful in encouraging interaction with children and their environment. However, though children inhabiting this facility have many opportunities to be “outdoors,” the courtyard is really just a flat, sand covered, surface. Other than the trees within the buildings, little vegetation and nature exist for the children to interact with. So, even though the children have constant access to fresh air, they are unable to receive the benefits that interacting with unstructured nature has on physical, emotional, and mental health that were discussed in previous chapters of this text. This eliminates the effectiveness – other than access to fresh air...
and opportunity for movement and play – of nature as a facilitator for healthy development.

**TANGEMAN UNIVERSITY CENTER**  
GWATHMEY SIEGEL & ASSOCIATES ARCHITECTS,  
CINCINNATI, OHIO

Tangeman University Center (TUC) is an adaptive reuse precedent. This precedent was chosen because the design project this thesis will be demonstrated through will be an adaptive reuse project as well. The building was originally designed in 1935. The rehabilitation and renovation was completed in 2004. The building acts as the student center for the University of Cincinnati and is located centrally on campus.

The new design preserves many of the historic elements of the original design such as the façade facing the central commons, the shed roof, and the distinctive cupola. Because more space was required, a dramatic expansion was part of the renovation. Rather than attempting to mimic the style and form of the original building, the expansion starkly contrasts the old building by wrapping it with a metal clad circular form, which the existing roof and cupola project out of.

Originally the building was cold and dark on the interior. The renovation of the building sought to change this. It did so by gutting the core of the building and adding a three-story skylit atrium. The result is a dramatic, well-lit space that acts as the main gathering space for students. This central space also acts as the major circulation corridor for the building, which was created by stripping the original building to its structural core, opening the plan, and replacing much of the existing gable roof with glazing, maximizing the amount of natural light in the space.

The renovation of TUC is successfully adapted a previously dark, cold, and closed interior into a bright and open gathering space. The contrasting facades
add to the success of the design by clearly distinguishing new from old, allowing the old elegance to remain while at the same time creating a dramatic architectural form with the new addition. Though this design makes no attempt to connect inhabitants with their surroundings or with nature, adaptive reuse strategies can be taken from this project.
Interaction with nature is crucial to healthy human lifestyles and development, especially for children. This is because they are still in their primary development stages. The previous chapters of this thesis outlined a design process that will create spaces that integrate nature into built form. This process requires research into primary factors affecting the design, the identification of design implications, and the creation of resultant design strategies. These process seeks to create spaces that encourage interaction between built form, humans, and the natural environment. The strategies are the ways this interaction and connection is achieved.

BUILDING TYPE

An educational facility is the building type chosen to demonstrate the design process created in this thesis because, as stated earlier, children spend most of their time during crucial stages of development in school. Therefore, a successfully designed educational facility can have the largest impact on healthy development in children. If designed correctly, the architecture of a school can act as a teaching tool facilitating the learning process as much as the activities that take place within a school can.
An elementary school was chosen as the educational facility type because between the ages of 6 and 13, the ages when a child is in elementary school, the most important stages of development occur. Not only do many of the important stages of development happen during elementary school, but nature is also most important during the earlier stages of cognitive development. Integration with nature is therefore most important in a primary education facility.

The elementary school will be located downtown Cincinnati, Ohio and will be part of the Cincinnati Public School District (CPSD). The CPSD is organized into a series of kindergarten through eighth grade (K-8), elementary (K-6), and middle school (7-8) facilities, where enrollment is based on a student’s housing location. Figure 9.2 is a diagram showing the school boundaries in the areas surrounding the site. High schools in the CPSD are all school-of-choice. This means that past middle school, students can choose the high school they wish to attend. Many of the high schools are special focus high schools such as STEM (science, technology, engineering, and mathematics) schools.

Daily interaction with nature in educational facility design is crucial, especially in facilities located in urban areas, where access to nature is extremely limited. This project is located in Over-the-Rhine, a historic neighborhood of Cincinnati, Ohio located near the central business district. Context will become extremely important in determining the best strategies to be applied. Because the school is located in a very urban area, connection to the community will be crucial to the success of the design.

In addition to urban schools lacking access to natural spaces, because of the demographics often associated with inner-city schools, many schools only receive state funding when designing. In order to maximize the design opportunities for this project, a public partnership with be part of the design. The program will include a local community center, environmental educational center, children’s museum, and library. These spaces will be public spaces programmed into the design that can be used by local residents, committees, and groups during school and non-school hours. Additional considerations in terms of approach, entrances, and security will need to be considered in the design of the facility.

**PROGRAM**

Many aspects need to be considered in the design of the program for this facility. In order to achieve maximum funding from the state, rules on size requirements mandated by the state must be followed. An additional programmatic consideration is how the site is approached. Approach will be different based on whether it is by car, bus, or a pedestrian and what type of user they are (visitor, student, faculty). Parking and vehicular circulation will be important considerations since the site is in an urban area and space.
is limited. Since additional programmatic spaces will be part of the design, specific spaces associated with these spaces will need to be outlined. Spaces that can have multiple functions in order to save on square footages will need to be considered.

The Ohio Schools Facility Commission (OSFC) determines state funding to educational facilities. It does this based on maximum funded square foot per student. To facilitate the design process, the OSFC has created the Ohio School Design Manual (OSDM). The manual mandates size minimums and maximums for spaces that the state will fund along with giving design suggestions and requirements for each space. Much of the programming information for this thesis investigation will come from the 2010 OSDM, or will be a variation of design strategies found within the manual. Refer to the Appendix for the completed OSDM K-8 Program. Outlined below are the spaces, and their respective square footages, mandated by the OSDM.

<table>
<thead>
<tr>
<th>Spaces</th>
<th>Square Footage</th>
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<tbody>
<tr>
<td><strong>Academic Spaces – 11,50 SF</strong></td>
<td></td>
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<tr>
<td>Kindergarten Classroom</td>
<td>1,200 SF</td>
</tr>
<tr>
<td>Pre-kindergarten Classroom</td>
<td>1,200 SF</td>
</tr>
<tr>
<td>Elementary Classroom</td>
<td>8,100 SF</td>
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<tr>
<td>Project Laboratory</td>
<td>1,100 SF</td>
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<tr>
<td>Teacher Prep Area / Workroom</td>
<td>300 SF</td>
</tr>
<tr>
<td>Individual Restroom</td>
<td>50 SF</td>
</tr>
<tr>
<td>Storage</td>
<td>200 SF</td>
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<tr>
<td><strong>Special Education Spaces – 1,950 SF</strong></td>
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<tr>
<td>Self-contained Classroom</td>
<td>900 SF</td>
</tr>
<tr>
<td>Workroom / Conference</td>
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</tr>
<tr>
<td>Special Education / Resources</td>
<td>900 SF</td>
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<tr>
<td><strong>Administrative Spaces – 2,360 SF</strong></td>
<td></td>
</tr>
<tr>
<td>Lobby / Reception</td>
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</tr>
<tr>
<td>Secretarial Area</td>
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<tr>
<td>Principal's Office</td>
<td>150 SF</td>
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<tr>
<td>Assistant Principal's Office</td>
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<tr>
<td>Conference Rooms</td>
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</tr>
<tr>
<td>Mail / Work / Copy Room</td>
<td>250 SF</td>
</tr>
<tr>
<td>Storage</td>
<td>150 SF</td>
</tr>
<tr>
<td>Vault / Records</td>
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</tr>
<tr>
<td>In-school Suspension</td>
<td>200 SF</td>
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<tr>
<td>Restroom</td>
<td>50 SF</td>
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<tr>
<td>Guidance Counselor Offices</td>
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<td>Guidance Records / Storage</td>
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<tr>
<td>Heath Clinic</td>
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<td>Parent Volunteer Room</td>
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<tr>
<td><strong>Media Center Space – 1,870 SF</strong></td>
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<tr>
<td>Reading Room / Circulation</td>
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</tr>
<tr>
<td>Media Specialist Office</td>
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</tr>
<tr>
<td>Workroom / Storage</td>
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</tr>
<tr>
<td>Main Control / Equipment Room</td>
<td>300 SF</td>
</tr>
<tr>
<td>A/V Storage</td>
<td>150 SF</td>
</tr>
<tr>
<td>Multimedia Production Room</td>
<td>300 SF</td>
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<tr>
<td><strong>Visual Arts Spaces – 1,400 SF</strong></td>
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<tr>
<td>Art Room</td>
<td>1,200 SF</td>
</tr>
</tbody>
</table>
There are additional spaces and considerations required for the design of this facility that are not outlined by the ODSM program. These spaces are outlined below.

### Arrival Spaces
- Parking
  - Visitor
  - Staff
  - Drop-off / turn around
- Bike / Pedestrian entrance
  - Equipment storage
  - Outdoor Spaces

### Classrooms

### Walking trails
• Supervision
• Playground
• Weather station
• Sheltered area
• Garden
• Bike rack / storage area
• Unstructured vegetated area
• Open Field
• Eating Area

All of the academic spaces outlined above are the maximum square footages funded by the OSDM. These spaces can be larger than required, but not smaller. For a school of 300 children, the OSDM will fund about 125 SF per student. The following analysis is of the spaces required by the OSDM.

There are four types of spaces in terms of privacy. These spaces are public, semi-public, private, and service spaces. Public spaces are spaces where the community can come in openly during and after hours and utilize the spaces. These spaces include all of those programmed for the environmental education center, children’s museum, library, and community center. Some of the academic spaces are able to be used after hours by the public. These spaces are the reading room, gym, and computer lab. Semi-public spaces are spaces that can be used by the public but only when cleared with the schools first. These functions would include community group meetings and the spaces would be classrooms and similar spaces. Private spaces are spaces that should not be accessed by anyone other than students and staff. Service spaces are those spaces that are necessary for the school to operate functions smoothly. The public, if accompanied by staff members, can access some service spaces, such as administration space. Figure 9.10 represents a comparison of sizes of the spaces previously outlined based on their privacy.

The ODSM categorizes the spaces in an educational facility. These categories are: academic core, special education, administrative, media center, visual arts, music, physical education, student dining, technology education, food service, custodial, and building services. Figure 9.11 compares the size requirements for the different categories of the program. The spaces are organized by most square footage required to least. Figure 9.12 breaks apart the each programmatic category and looks at how much square footage is allotted to each specific function. These diagrams will be useful when schematically laying out the design. Categorizing the spaces and comparing them based on required square footages helps determine what spaces need to be located where within the facility.

After determining the required spaces and square footages of those spaces, adjacency studies were done to determine possible layouts for the facility. Again, this helps to determine what spaces should be located where within the facility. The major difference between these adjacency studies and
Fig. 9.10  OSDM program in term of privacy requirements.

Fig. 9.11  OSDM program space categories determined by OSDM manual.

Fig. 9.12  Graphic representation of ratio of individual functions within spatial categories of the OSDM program.
those suggested by the OSDM are that connection to outdoor spaces was considered in the layout. The adjacency studies represent the spaces in terms of their size, privacy requirements, relationship to one another, and their need for exterior access. The spaces are colored based on the privacy categories outlined in Figure 9.10. Required space adjacencies are represented by red arrows, and necessary access to outdoors is represented by green arrows.

The major design implication that can be derived from these studies is that because the majority of the spaces in the facility require access to the outdoors in order to facilitate interaction with nature, forms that maximize the exterior façade will be most successful at achieving the maximum amount of interior spaces with access to the outdoors.

The concept of an outdoor classroom was introduced earlier in this thesis. It is important for students to have actual interaction with exterior spaces. This interaction should be during social activities and during educational activities.

![Fig. 9.13 K-8 space adjacency study. The color of the space correlates with the privacy requirements outlined in figure xx. The green arrows are spaces that require outdoor access. The red arrow signifies the main entrance to the facility.](image)

To facilitate interaction during educational activities the concept of an outdoor classroom has been created. Many contemporary educational facilities incorporate outdoor learning areas into their design. However, most of these outdoor learning areas are not located in urban areas. For outdoor classrooms to work there needs to be direct connection between the core-learning areas and the outdoor classroom. Because classes will need to share time in the outdoor learning areas, it is important to have as many outdoor learning areas as possible. In terms of outdoor core-learning areas, there should be no more than four classrooms assigned to each area.
The classroom organization that seems most successful is that of “pods.” Academic classroom spaces are grouped together in groups of four learning areas. These areas are open plan areas with maximum adaptability. These classrooms have break-out spaces for large group activities and can be arranged around outdoor learning areas. Figure 9.14 is a series of studies exploring the layout possibilities of these classroom spaces.

After determining the most successful classroom “pod” layout, it is important to start to explore how the pods fit together into a whole. It is important to minimize the amount of double loaded corridors present in a design. Double loaded corridors minimize the social activity and interaction with nature that circulation spaces have. Figure 9.15 is an example of one of these layout studies.

SITE

The site chosen for this investigation is the old School for Creative and Performing Arts located in downtown Cincinnati, Ohio. The site is part of the historic neighborhood known as Over-the-Rhine (OTR). OTR is located just north of the central business district of Cincinnati. The site is located on the east side of OTR. The site is located between 14th Street and 13th Street to the north and south respectively, and Broadway Street and Sycamore Street to the east and west respectively.

LOCATION

This site was chosen because the building is already owned by the Cincinnati
Public School District and has no current or planned programmed use. Other reasons the site was chosen were because of the green space already existing on the site adjacent to the building and the size of the site. Educational facilities require a large amount of space and few urban site have the required amount available. This site is one of the few in downtown Cincinnati that has green space with potential. This maximizes the potential for the site to be used as a pocket park or for community activities. The site is borders a residential zone, which increases the chance that local residents will use the green space once it is developed.

An existing building is located on the site. The building was built in 1910 and is one of the many historical buildings that make up OTR and downtown Cincinnati. To preserve the historical quality of the building, the design will be a renovation and addition rather than a redesign.

SITE HISTORY

Over-the-Rhine is believed to be the largest, most intact urban historic district in the United States, along with the largest collection of Italianate architecture. The neighborhood’s distinctive name comes from its builders and early residents, German immigrants of the mid-19th century. Many walked to work across bridges over the Miami and Erie Canal, which used to separate the area from downtown Cincinnati. The canal was nicknamed “the Rhine” in reference to the Rhine River in Germany, so the newly settled area north of the canal was given the name “Over-the-Rhine.”

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1 “History: Significance,” Over-the-Rhine, Cincinnati, OH - IRhine.com
2 “History,” Over-the-Rhine, Cincinnati, OH - IRhine.com
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The revolutions of 1848 in the German states brought thousands of German refugees to the United States. In Cincinnati they settled on the outskirts of the city. In 1850, approximately 63 percent of OTR’s population consisted of immigrants from German states, including Prussia, Bavaria, and Saxony. The new immigrants brought with them a variety of customs, habits, attitudes, and dialects of the German language. Their range of religions, occupations, and classes characterized the OTR German community for the rest of the century.3

German entrepreneurs gradually built up a profitable brewing industry, which became associated with Over-the-Rhine and the city. During the nineteenth century, most Cincinnatians regarded Over-the-Rhine as the city’s premier entertainment district. As the area began to overcrowd, flooding, pollution, and disease became issues. In 1853, 1855, and 1884, race riots took place in Over-the-Rhine. Those who could afford to relocate to the new suburbs in the surrounding hills did so.4

At the turn of the 20th century, the neighborhood population reached a peak of 45,000 residents, with the proportion of German-Americans estimated at 75 percent. By 1915 the more prosperous people left the dense city for the suburbs.5

In 1917, the year the United States declared war on Germany, half of the city’s residents could speak German, and many could speak only German. Although the effort to gain Prohibition of alcohol had long been part of late nineteenth-
century reform movements, it became associated with anti-German sentiment during the war. With the war still underway, the majority of Cincinnatians voted in favor of prohibition, as did a sufficient number of states. Nearly overnight Over-the-Rhine’s 30 breweries, all of them German-American owned, were closed.\footnote{History: Emergence of a New Identity, Over-the-Rhine, Cincinnati, OH - IRhine.com}

With the heart of its economic engine gone, Over-the-Rhine began a slip into decades of economic decline, which prevented new development and ironically helped preserve much of the neighborhood’s historic architecture.\footnote{History, Over-the-Rhine, Cincinnati, OH - IRhine.com}

The Miami and Erie Canal became obsolete as a means of transportation, and were abandoned by the city in 1877.\footnote{History: Early Developments..., Over-the-Rhine, Cincinnati, OH - IRhine.com} The canal became an open sewer within the city. In 1920 the city drained the canal and began construction of the Cincinnati Subway in the canal bed. Central Parkway, which follows the path of the canal, runs over top of the subway system’s tunnels. Construction of the subway stalled halfway through the project, as the city was overcome with monetary issues following World War I. Distracted by the Great Depression, World War II, and the growing popularity of the automobile, the city never again gained enough local support to finish it.\footnote{History: Emergence of a New Identity, Over-the-Rhine, Cincinnati, OH - IRhine.com}

Starting in the 1920s, the city government decided to take drastic efforts to revitalize Cincinnati. A master plan was created but the stock market crash and the Great Depression cause the plan to be put on hold.\footnote{History, Over-the-Rhine, Cincinnati, OH - IRhine.com}

In the 1940s, the war-stimulated industrial economy drew thousands of migrants from Appalachia to Cincinnati.\footnote{History, Over-the-Rhine, Cincinnati, OH - IRhine.com} In the 1950s, the automation of mining and the popularity of oil made the demand for coal decreased sharply leaving many without jobs. In search of work, coal miners from Kentucky and West Virginia migrated to Cincinnati and settled in older neighborhoods, such as Lower Price Hill and Over-the-Rhine. These neighborhoods were chosen because they were located adjacent to the highly industrialized Mill Creek Valley, where work was within walking distance. Because these migrant workers were normally low-income workers, the neighborhoods became associated with poverty and subsequently had a rise in crime rates.\footnote{History: Significance, Over-the-Rhine, Cincinnati, OH - IRhine.com}

During the 1950s and 1960s the city constructed the Mill Creek Expressway, now part of I-75, to accommodate the increased reliance on the automobile. Its construction meant the destruction of the West End, a historically black neighborhood. The construction displaced more than 50,000 predominantly black and low-income residents. Many moved into housing vacancies in nearby neighborhoods.\footnote{History: Emergence of a New Identity, Over-the-Rhine, Cincinnati, OH - IRhine.com}
Over-the-Rhine, where they lived among the poor and working-class white Appalachians.\textsuperscript{13}

The city also created many social service facilities in Over-the-Rhine, but concentrated redevelopment projects in the central business district. By the late 1970s, the city hoped to reinvest in Over-the-Rhine through historic preservation and encourage more affluent residents to move to the neighborhood and revive the area.\textsuperscript{14}

In the 1980s struggling, predominately white artists discovered Main Street’s – one of the major streets running through OTR - vacant buildings and cheap rents. A bar and nightclub called “Neon’s” opened on Main Street in 1984, which would grow in popularity and serve as the catalyst for the Main Street Entertainment District that developed in the 1990s. By the late 1990s there were about 19 clubs and bars on Main Street alone – about a 10-block distance.\textsuperscript{15}

The influx of wealthier residents into the area and growing drug activity led to a dramatic increase in police presence. Following the controversial death of a black man by a police officer, race riots broke out in 2001. These riots effectively killed the Over-the-Rhine renaissance of the late 1990s and set the neighborhood back a decade.\textsuperscript{16} Today many urban renewal projects are going on in the neighborhood. Both residential units and entertainment facilities are being renewed to attract people back to the neighborhood.

BUILDING HISTORY

Though the building on the site was not always known as the School for Creative and Performing Arts, a school has been on the site since October 24, 1831.\textsuperscript{17}

Originally the school was known as Woodward High School, named after William Woodward, the founder of the high school. Upon its inception, it was the only school in the vast territory west of the Allegheny Mountains. Much smaller than the existing school, the first high school sat on one acre of land from Woodward Street, now known as 13\textsuperscript{th} Street, to Franklin Street. Franklin Street is now only an alley within the site. The old Woodward building was 300 feet in length, 170 feet in width, five stories tall, and contained 150 rooms.\textsuperscript{18}

William Woodward began thinking about providing education for the poor in 1819. In 1826, after acquiring some land after the death of a friend, Woodward

\begin{itemize}
  \item \textsuperscript{13} “History,” Over-the-Rhine, Cincinnati, OH - IRhine.com
  \item \textsuperscript{14} “History: Significance,” Over-the-Rhine, Cincinnati, OH - IRhine.com
  \item \textsuperscript{15} “History: Significance,” Over-the-Rhine, Cincinnati, OH - IRhine.com
  \item \textsuperscript{16} “History,” Over-the-Rhine, Cincinnati, OH - IRhine.com
  \item \textsuperscript{17} ‘Old Woodward’: a Memorial Relating to Woodward High School, 1831-1836, and Woodward College, 1836-1851, in the City of Cincinnati.
  \item \textsuperscript{18} Old Woodward’: a Memorial Relating to Woodward High School, 1831-1836, and Woodward College, 1836-1851, in the City of Cincinnati.
\end{itemize}
put his plan into action. In March of 1830 Woodward donated what is now the site of the old School for Creative and Performing Arts. From its original completion in 1831 to the last major renovation, completed in 1910, the building has been rebuilt and renovated 4 times. What exists today was mostly completed in 1910.19

In 1947 the principal of Woodward High School asked for the name “Woodward” to be transferred to a school then known as the Northern Secondary School. The transfer was granted and from then on the school was known as “Old Woodward” and eventually Abigail Cutter Junior High, named after Woodward’s second wife.20

In 1851 females were admitted into school for the first time. In 1976 the magnet School for Creative and Performing Arts took over the “Old Woodword” building, which stands today as one of the oldest public schools in the area.21

In 2010 the School for Creative and Performing Arts completed a new facility and moved, abandoning the existing site. The school is now located just south of Washington Park along Central Parkway while the “Old Woodword” building sits empty with no future plans for use.

ANALYSIS

As previously discussed, the chosen site for this thesis investigation is located in an urban area in Cincinnati. Since the fundamental premise of this investigation relates to interaction with nature, it is crucial to determine where and how many natural spaces exist within the surrounding context of the site. Other than the open space on the project site, very little green space exists in area. Strategies that maximize green space are therefore crucial to the success of this project. There are some small green spaces in the neighborhood, but most of them are planted areas that act as road medians or are on private or abandoned property. Figure 9.29 represents a study of these green spaces. It will important to incorporate strategies that maximize green space as part of the design solution.

Community connectivity, circulation, security, and accessibility will all be important factors in the design of the new school in order to achieve the desired level of interaction with nature and connection of the community with nature. The open space that does exist in the surrounding area is normally parking. This should be addressed as a design strategy on an urban level in this investigation. There is a small park located across the street that can

19 Old Woodward: a Memorial Relating to Woodward High School, 1831-1836, and Woodward College, 1836-1851, in the City of Cincinnati.
20 Old Woodward: a Memorial Relating to Woodward High School, 1831-1836, and Woodward College, 1836-1851, in the City of Cincinnati.
21 Old Woodward: a Memorial Relating to Woodward High School, 1831-1836, and Woodward College, 1836-1851, in the City of Cincinnati.
Understanding both major and minor circulation paths is important when determining entrance locations and site and space adjacencies, especially in terms of security. For example, outdoors spaces where younger children will be playing should be kept to the east side of the site, and away from the busiest street – Sycamore – to minimize the risk of vehicular traffic. Figure 9.28 represents an analysis of vehicular traffic in Over-the-Rhine. The thicker the red line the heavier the traffic is.

The major circulation path approaching the site is Sycamore Street. On the east side of the site Broadway Street is a one-way street going north. Two of downtown’s major circulation paths run a couple blocks north and a couple blocks south of the site. These are Liberty Street and Central Parkway respectively. Sycamore Street connects the two, making it a successful street for approaching and leaving the site. Broadway Street, on the other hand, does not connect with Liberty. This creates problems for vehicular circulation in the area which is a negative aspect. However, it also gives the residential district in that area privacy, allowing it to have the personal, private feeling it currently has. These two factors need to be considered when designing vehicular and bus traffic routes. The next three major routes of traffic are Liberty St. to the north, Central Parkway to the South, and Central to the west. To the east of the site is Interstate 71.

The importance of historical character in OTR is evident when looking at the history of the neighborhood and acknowledging the push to preserve the area's unique architectural heritage. Fig. 9.28 Analysis of major and minor vehicular circulation paths. The thicker the red line is the heavier the route of vehicular traffic is.

Fig. 9.29 Map of major green spaces in the neighborhood.

Fig. 9.30 Diagram showing the different historical and influential buildings. One of the buildings in the area in the existing building on the site.
Pedestrian traffic can be predicted by studying the building use in the area. Figure 9.31 shows the building use for the couple blocks surrounding the site. The buildings to the east of the site are mostly residential buildings along with a bit of industrial and commercial spaces mixed in. To the west of the site is a mix of commercial, mixed-use, and residential spaces. This means pedestrians will be coming from all directions, though most heavily from the east. The red buildings mark abandoned buildings. These buildings act as both a potential, in terms of how the site can be redeveloped, and a danger, in terms of what activities the spaces might currently be used for. Strategies that encourage the development and/or restoration of these buildings should be incorporated into the design. One way to do this is to treat the buildings as a “ruin” and design parks and green spaces around them. This maximizes the amount of green spaces in the area while encourages community interaction.

By looking at the massing and figure field relationships of the site and surrounding areas, it is evident that the areas to the east and north are more dense while areas to the west and south are more spread out. A park to the
west and parking lots to the south characterize these more spread out areas. In terms of massing, the existing building on the site is by far the largest building in the area. It is at least 10 times the size of most of the surrounding buildings, with the exception being a couple of the industrial buildings located south of the site. In terms of relationship between site and building, the building takes up almost 50 percent of the site. The north half of the site is open green space while the south half of the site is characterized by the building and parking.

SITE ANALYSIS AND DESIGN METHODOLOGY

SANY Ning Xiang, located in Ning Xiang, China is a project designed by Perkins + Will. This project is a site analysis and design precedent. When approaching site design, Perkins + Will first analyzed every aspect of the site individually – topography, vegetation, slope, drainage, soil patterns, etc. Each aspect was analyzed to see where on the site preservation was crucial. They then placed these individual analyses on top of each other in order to see how they were integrated and related. By looking at each aspect both individually and collectively, allowed the designers to determine best location on the site for building placement. Using this process allows a location to be chosen that maximizes connection with the site while minimizing the negative effect the building had on the site and surrounding ecosystems.

Since a building already exists on the site, it is not possible to follow this process exactly. However, the major concept – looking at site factors individually and collectively – can be used to determine how the site should be developed, where outdoor spaces should be located, and where an addition, if necessary, should be located. The site was split into topography, roads, buildings, vegetation, site features, and drainage. Each factor was then looked at in a way to see how they were related and where design opportunities existed. Figure xx is a graphic representation of this process.

A conclusion derived from this process was the site is a constant slope from its highest point at the northeast corner to the lowest point at the southeast corner. Minimizing the disturbance of drainage patterns is important in order to preserve existing ecosystems on the site. Most of the vegetation is located on the north and east edges of the site. This vegetation acts as natural barriers
to surrounding buildings.

**DESIGN**

This thesis investigation set out to create a design process that can be applied to urban and architectural design in order to create spaces that better facilitate interaction with nature during both. This process will be applied to the design of an educational facility. It is therefore important to create strategies that integrate nature into both academic and social learning spaces. Therefore, the spaces this design will focus on are the site, classrooms, and circulation spaces. It is important to create strategies that encourage interaction with nature and the environment while also providing structured learning. The previous chapters have outlined the important factors, identified implications
and created a set of design strategies. Some of these are design implications, scale, climate, site analysis, and neighborhood history, among others. The strategies outlined below are the integration of all factors, implications, and strategies into the design process.

**URBAN AND STREET STRATEGIES**

Though an educational facility does not directly effect a larger urban environment. The strategies integrated in the street and building scales will radiate out and effect the urban scale. It is therefore important to encourage the integration of the strategies outline in a previous chapter into the urban design of the area. The strategies in the urban scale can carry down into the street scale in more detail. The most important strategies to this design determined in the previous chapter to this design project are:

**Strategy one:** Build and develop cities with fingers of green space and an abundance of parks that act as corridors through which to move people through the urban area.

**Strategy three:** Green all major transportation corridors. Provide green bike and pedestrian paths whenever possible. Connect these transportation paths with green spaces.

**Strategy five:** Create green “nodes” where different transportation paths cross. These spaces should facilitate many different activities and encourage interaction with nature.
Strategy seven: Provide accessible bike and pedestrian paths to all green areas. These pathways should provide a connection with nature and encourage interaction. Provide stopping and resting areas throughout the pathway system.

Strategy nine: Develop community gardens. These gardens should require community involvement and the community should see the benefits. They should be located in accessible and natural areas. Unused brownfields are a good location.

Strategy ten: Green the streets through incorporation of plantings. Provide edible landscapes. This will encourage people to interact with nature as they move through it.

Strategy eleven: Encourage greening buildings through local initiatives. An example of this can be tax breaks for buildings with living walls, etc.

Strategy twelve: Encourage low impact development. Use policies and strategies that reduce urban sprawl without removing all green space from urban areas.

The diagrams on the surrounding pages represent the ways these strategies can be incorporated into the site of the project. Figures 9.39 and 9.42 are representations of what these strategies can look like in three dimensions.
Approach Strategies

A series of approach possibilities have been outlined in the diagram sketches on the following page. The light purple represents pedestrian traffic, the maroon vehicular, and the dark purple bus traffic. Each of these strategies looks at different locations for parking and whether the different types of traffic should enter the building at the same location or different locations.

Building Strategies

An addition will most likely be necessary on the site because the spaces within the building are not adequate for the style of learning and interaction required in classroom spaces. The addition to the building will most likely be located directly north of the existing building. This is because this area of the site has already been developed, allows a close connection with the existing building and minimizes site disturbance.

Physical education spaces are spaces in an educational facility that are often utilized during school hours and after school hours. The gym currently located in the existing building is not regulation size. A physical education addition is therefore needed if the school hopes to host games at the facility. Because the site was chosen for the amount of green space on the site, it is not desirable to locate a physical educational facility on the direct site. Therefore, as a form of urban infill, a physical educational facility can be located across the street, directly south of the existing building. The two buildings can be connected through use of overhead pedestrian paths.

An exploration into all the different design solutions possible that encourage interaction with nature and blur the boundary between the interior and the exterior has been done. This exploration worked both in section and plan. Some of the examples are represented in the figures on these pages. A study of building shapes that maximized access to outdoors at all levels of the building was then done using the existing building on the site.
The building strategies outlined in a previous chapter that are most important to this design are:

**Strategy thirteen:** When positioning a building, locate it on the most unattractive part of the lot. Attempt to orient building east to west to maximize passive environmental strategies.

**Strategy fifteen:** Shape buildings around existing trees whenever possible. Locate trees in a manner to provide boundaries for outdoor social areas and to provide shade for built elements.

**Strategy sixteen:** Provide seating outdoors so people can rest and relax outdoors. This can be a form of both direct and indirect interaction with nature.

**Strategy eighteen:** Integrate courtyards and/or lighted atriums as gathering spaces. These spaces should be landscaped and designed to encourage interaction with nature.

**Strategy twenty:** Use native species in landscaping features whenever possible. Allow some spaces on a site to grow naturally.
Strategy twenty-one: Provide constant views of nature and blur the boundary between interior and exterior spaces. Use a gradient to do this.

Strategy twenty-two: Provide open space around building and outdoor classrooms for every four indoor core-learning areas.

Strategy twenty-three: Built transitional pathways and pathways through natural and landscaped areas to maximize the amount of interaction with nature possible.

Strategy twenty-four: Provide high levels of natural lighting through skylights, clerestory windows, and operable facades. Opportunities for daylighting also provide opportunities for views. All spaces should have views outdoors.

Strategy twenty-seven: Provide interior spaces that are adaptable and flexible. These spaces should have interior access to nature and views outdoors.

Strategy twenty-eight: Program additional functions into circulation spaces and design them to act as social learning areas. These areas should have an abundance of natural lighting and views and access to outdoors. Make these spaces two-story spaces with balconies whenever possible.

These building strategies can be integrated into the design in many ways. Figure 9.45 is a site plan showing how many of these identified strategies have been integrated into the design.

This chapter has explored the site context, history of the urban area, history of the existing building, and explored which strategies will be most successful in the design of an elementary school in Cincinnati, Ohio.

Fig. 9.47 Series of sketches exploring the ways nature can be integrated into built form.
Fig. 9.48 Series of sketches exploring the ways nature can be integrated into built form.
As humans, we are shaped by the environment in which we exist. The surroundings we interact with mold our behaviors, patterns of life, and habits. Research is now showing that interaction with nature is crucial to healthy human lifestyles. However, most of the population of the world will live in urban areas by the year 2030. In the United States almost 80% of the population already does.

Living in urban areas often means living without daily contact with nature. In most cities, the only contact people have with nature is with the few trees planted along the sidewalks and the few pocket parks that exist within the city limits. Studies have shown this is detrimental to our mental, physical, spiritual, and emotional health.

This separation from nature is most detrimental to those still in their developmental stages, such as children. Therefore, children -- who, for the most part, have no control over the environments they inhabit -- are suffering the most serious consequences of living in urban areas. This is evident by the deteriorating health of today’s youth.

Technology is one of the major reasons we do not interact with nature.
This rapidization of our lifestyles has led to a disconnect between humans and nature. The modern design process and approach to the urban built environment has encouraged the massive transformation and degradation of natural systems. Along with the obvious effect – the separation between humans and nature – this form of design has also led to environmental degradation, pollution, massive species loss, and climate change. Restorative environmental design takes sustainable design a step further by coupling high technology but low-environmental impact design strategies with spaces that foster beneficial contact between humans and nature.

This thesis created a design process which, when applied, results in spaces that integrate nature into built form and encourages interaction with it on a daily basis. This will therefore reverse and minimize the negative effects living in cities has on human health and development.

The first step of this design process requires researching and fully understanding all of the factors -- such as user, building type, scale, climate, desired environmental quality, and architectural style -- that apply to the design. Having this understanding allows the designer to chose the factors and theories which are complementary to one another and can be integrated together successfully into a set of design implications. From these implications a series of design strategies can be developed and applied throughout the design process in order to create spaces which have the desired integration of, and interaction with, nature. Each set of strategies identified will be design and site specific - meaning they relate to each design problem differently. By creating unique strategies for each project, designers will be able to create integrated spaces that positively relate to the environment and the surrounding urban context. Spaces designed using this process will foster healthy human lifestyles and development, therefore reversing the negative effects living in cities currently has on humans. Figure 10.2 is a graphic representation of this process. This thesis demonstrates the design process outlined through the design of an educational facility in Cincinnati, Ohio.

Though this process will vary based on what type of building or space is being designed, if applied to all urban design, then the negative effects -- such as depression, irritability, concentration issues, ADHD, and obesity -- of living in urban areas will be reversed, therefore allowing humans to interact with nature and thrive in urban areas as well as natural areas. This will lead to spaces that encourage interaction, facilitate learning, and promote health. These spaces will therefore foster positive behaviors, habits, and mental, physical, and emotional health rather than negative lifestyles, therefore changing the built environment as we know it.


APPENDIX

Additional information and graphics relating to this thesis can be found in the appendix.
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

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**WORKSHEET**

Enter Grade Configuration
Enter Student Capacity
Square Feet Per Student from Page 2000-2
Total Gross Square Feet Funded

**SELECT ONE**

- Single Story Building
- Multistory Building

Plus Vertical Circulation (for Multistory Buildings) Area Allowable

Total Adjusted POR Gross Square Footage

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<tr>
<td>E-MC Media Center Spaces</td>
<td>1,570</td>
<td>0</td>
<td>1,570</td>
</tr>
<tr>
<td>E-VA Visual Arts Spaces</td>
<td>1,400</td>
<td>0</td>
<td>1,400</td>
</tr>
<tr>
<td>E-MU Music Spaces</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>E-PE Physical Education Spaces</td>
<td>3,700</td>
<td>0</td>
<td>3,700</td>
</tr>
<tr>
<td>E-SD Student Dining Spaces</td>
<td>3,480</td>
<td>0</td>
<td>3,480</td>
</tr>
<tr>
<td>E-FS Food Service Spaces</td>
<td>1,225</td>
<td>0</td>
<td>1,225</td>
</tr>
<tr>
<td>E-CU Custodial Spaces</td>
<td>300</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>E-BS Building Services</td>
<td>9,602</td>
<td>0</td>
<td>9,602</td>
</tr>
<tr>
<td>Facility Total</td>
<td>36,637</td>
<td>0</td>
<td>36,637</td>
</tr>
</tbody>
</table>

Construction Factor (10% multiplied by the facility total)

Minus existing Oversize Area from Master Plan

Minus existing Oversize Area from Master Plan

Adjusted Existing Area

Total Adjusted Gross Square Footage Developed (without Oversize Area)

Difference of SF developed from SF allowable

**NOTES**

1. Existing Gross Square Feet taken from assessment report.
2. Oversize Area also taken from assessment report.
3. The Existing SF column is only used in projects where there are to be building additions.

---

Ohio School Design Manual
Ohio School Facilities Commission

2009

FUTURE FORMS FOR HEALTHY CITIES
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>Qty SF</th>
<th>Area</th>
<th>Qty SF</th>
<th>Area</th>
<th>Qty SF</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-AC-1 Pre-Kindergarten Classroom</td>
<td>1 1200</td>
<td>1200</td>
<td>2 1200</td>
<td>2400</td>
<td>2 1200</td>
<td>2400</td>
</tr>
<tr>
<td>E-AC-1 Kindergarten Classroom</td>
<td>1 1200</td>
<td>1200</td>
<td>2 1200</td>
<td>2400</td>
<td>2 1200</td>
<td>2400</td>
</tr>
<tr>
<td>E-AC-2 Pre-Kindergarten Restroom</td>
<td>1 40</td>
<td>40</td>
<td>2 40</td>
<td>80</td>
<td>2 40</td>
<td>80</td>
</tr>
<tr>
<td>E-AC-2 Kindergarten Restroom</td>
<td>1 40</td>
<td>40</td>
<td>2 40</td>
<td>80</td>
<td>2 40</td>
<td>80</td>
</tr>
<tr>
<td>E-AC-3 Elementary Classroom</td>
<td>14 900</td>
<td>12600</td>
<td>18 900</td>
<td>16,200</td>
<td>24 900</td>
<td>21,600</td>
</tr>
<tr>
<td>E-AC-4 Teacher Prep Area/Workroom</td>
<td>1 300</td>
<td>300</td>
<td>1 300</td>
<td>300</td>
<td>2 300</td>
<td>600</td>
</tr>
<tr>
<td>E-AC-5 Individual Restroom</td>
<td>1 50</td>
<td>50</td>
<td>1 50</td>
<td>50</td>
<td>2 50</td>
<td>100</td>
</tr>
<tr>
<td>E-AC-6 Instructional Material Storage</td>
<td>1 200</td>
<td>200</td>
<td>2 200</td>
<td>400</td>
<td>2 200</td>
<td>400</td>
</tr>
</tbody>
</table>

**Academic Core Total**

<table>
<thead>
<tr>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,630</td>
<td>21,910</td>
<td>27,660</td>
</tr>
</tbody>
</table>

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>Qty SF</th>
<th>Area</th>
<th>Qty SF</th>
<th>Area</th>
<th>Qty SF</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-AC-1 Pre-Kindergarten Classroom</td>
<td>1 1200</td>
<td>1,200</td>
<td>0 0</td>
<td>0</td>
<td>0 1 varies</td>
<td>1,200</td>
</tr>
<tr>
<td>E-AC-1 Kindergarten Classroom</td>
<td>1 1200</td>
<td>1,200</td>
<td>0 0</td>
<td>0</td>
<td>0 1 varies</td>
<td>1,200</td>
</tr>
<tr>
<td>E-AC-2 Pre-Kindergarten Restroom</td>
<td>0 40</td>
<td>0</td>
<td>0 0</td>
<td>0</td>
<td>0 0 varies</td>
<td>0</td>
</tr>
<tr>
<td>E-AC-2 Kindergarten Restroom</td>
<td>0 40</td>
<td>0</td>
<td>0 0</td>
<td>0</td>
<td>0 0 varies</td>
<td>0</td>
</tr>
<tr>
<td>E-AC-3 Elementary Classroom</td>
<td>9 900</td>
<td>8,100</td>
<td>0 0</td>
<td>0</td>
<td>9 0 varies</td>
<td>8,100</td>
</tr>
<tr>
<td>E-AC-4 Teacher Prep Area/Workroom</td>
<td>1 300</td>
<td>300</td>
<td>0 0</td>
<td>0</td>
<td>1 0 varies</td>
<td>300</td>
</tr>
<tr>
<td>E-AC-5 Individual Restroom</td>
<td>1 50</td>
<td>50</td>
<td>0 0</td>
<td>0</td>
<td>1 0 varies</td>
<td>50</td>
</tr>
<tr>
<td>E-AC-6 Instructional Material Storage</td>
<td>1 200</td>
<td>200</td>
<td>0 0</td>
<td>0</td>
<td>1 0 varies</td>
<td>200</td>
</tr>
</tbody>
</table>

**Academic Core Total**

| 11,050 | 0 | 11,050 |
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

<table>
<thead>
<tr>
<th>EXAMPLE</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
<th>see note 1</th>
<th>see note 2</th>
<th>see note 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space</td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-SE-1 Self-contained Classroom</td>
<td>1</td>
<td>900</td>
<td>900</td>
<td>1</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>E-SE-2 Workroom/Conference</td>
<td>1</td>
<td>150</td>
<td>150</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>E-SE-3 Restroom/Shower</td>
<td>1</td>
<td>100</td>
<td>100</td>
<td>1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>E-SE-4 Special Education/Resource</td>
<td>0</td>
<td>900</td>
<td>0</td>
<td>0</td>
<td>900</td>
<td>0</td>
</tr>
<tr>
<td>E-SE-5 Small Self-contained Classroom</td>
<td>0</td>
<td>600</td>
<td>0</td>
<td>1</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Special Education Total</td>
<td>1,150</td>
<td></td>
<td></td>
<td>1,750</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WORKSHEET</th>
<th>New SF</th>
<th>Existing SF</th>
<th>TOTAL SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space</td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-SE-1 Self-contained Classroom</td>
<td>1</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>E-SE-2 Workroom/Conference</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>E-SE-3 Restroom/Shower</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>E-SE-4 Special Education/Resource</td>
<td>1</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>E-SE-5 Small Self-contained Classroom</td>
<td>0</td>
<td>600</td>
<td>0</td>
</tr>
<tr>
<td>Special Education Total</td>
<td>1,950</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

NOTE 1: Self-contained classroom(s) could 'house' various special education programs including, but not limited to, cognitive disability, emotional disturbance, multiple disabilities, etc.

NOTE 2: Workroom/Conference could 'house' orthopedic impairment, autism, speech therapy, occupational therapy, and physical therapy.

NOTE 3: Special Education/Resource could 'house' cognitive disability, hearing impairment, visual impairment, emotional disturbance, orthopedic impairment, autistic, traumatic, brain injury, learning disability, deaf/blindness, etc.

See Chapter 1, Section 1110 for more information.

For student capacities from 1,601 to 2,400 the area remains the same or increases proportionally as indicated in the example.
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-AD-1 Reception Area</td>
<td>1</td>
<td>239</td>
<td>239</td>
</tr>
<tr>
<td>E-AD-2 Secretarial Area</td>
<td>1</td>
<td>239</td>
<td>239</td>
</tr>
<tr>
<td>E-AD-3 Principal's Office</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>E-AD-4 Assistant Principal's Office</td>
<td>0</td>
<td>120</td>
<td>0</td>
</tr>
<tr>
<td>E-AD-5 Conference Room</td>
<td>1</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>E-AD-6 Mail/Work/Copy Room</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-AD-7 Administrative Storage</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>E-AD-8 Vault/Records Storage</td>
<td>1</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>E-AD-9 In-school Suspension</td>
<td>1</td>
<td>225</td>
<td>225</td>
</tr>
<tr>
<td>E-AD-10 Restroom</td>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>E-AD-11 Guidance Counselor's Office</td>
<td>1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>E-AD-12 Guidance Records/Storage</td>
<td>1</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>E-AD-13 Parent/Volunteer Room</td>
<td>0</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>E-AD-14 Health Clinic (incl. RR)</td>
<td>1</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>E-AD-15 Itinerant Personnel Office</td>
<td>1</td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>

**Administrative Total:** 2,163

**NOTE 1:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 300 SF; 551-700: 400 SF

**NOTE 2:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 300 SF; 551-700: 400 SF

**NOTE 3:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 250 SF; 551-700: 300 SF

**NOTE 4:** Student capacity determines SF allowed. 350-400: 50 SF; 401-550: 75 SF; 551-700: 100 SF

**NOTE 5:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 250 SF; 551-700: 325 SF

**NOTE 6:** Student capacity determines SF allowed. 350-400: 300 SF; 401-550: 350 SF; 551-700: 450 SF

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>New SF</th>
<th>Existing SF</th>
<th>TOTAL SF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-AD-1 Reception Area</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-AD-2 Secretarial Area</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-AD-3 Principal's Office</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>E-AD-4 Assistant Principal's Office</td>
<td>1</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>E-AD-5 Conference Room</td>
<td>1</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>E-AD-6 Mail/Work/Copy Room</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-AD-7 Administrative Storage</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>E-AD-8 Vault/Records Storage</td>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>E-AD-9 In-school Suspension</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-AD-10 Restroom</td>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>E-AD-11 Guidance Counselor's Office</td>
<td>2</td>
<td>120</td>
<td>240</td>
</tr>
<tr>
<td>E-AD-12 Guidance Records/Storage</td>
<td>1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>E-AD-13 Parent/Volunteer Room</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-AD-14 Health Clinic (incl. RR)</td>
<td>1</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>E-AD-15 Itinerant Personnel Office</td>
<td>0</td>
<td>120</td>
<td>0</td>
</tr>
</tbody>
</table>

**Administrative Total:** 2,360

**NOTE 1:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 300 SF; 551-700: 400 SF

**NOTE 2:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 300 SF; 551-700: 400 SF

**NOTE 3:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 250 SF; 551-700: 300 SF

**NOTE 4:** Student capacity determines SF allowed. 350-400: 50 SF; 401-550: 65 SF; 551-700: 80 SF

**NOTE 5:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 250 SF; 551-700: 325 SF

**NOTE 6:** Student capacity determines SF allowed. 350-400: 300 SF; 401-550: 350 SF; 551-700: 450 SF

---

**APPENDIX**
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-MC-1 Reading Room/Circulation</td>
<td>1 1,200 1,200</td>
<td>1 1,650 1,650</td>
<td>1 2,100 2,100</td>
</tr>
<tr>
<td>E-MC-2 Media Specialist Office</td>
<td>1 120 120</td>
<td>1 120 120</td>
<td>1 120 120</td>
</tr>
<tr>
<td>E-MC-3 Workroom/Storage</td>
<td>1 150 150</td>
<td>1 200 200</td>
<td>1 250 250</td>
</tr>
<tr>
<td>E-MC-4 Main Control/Equipment Rm</td>
<td>1 300 300</td>
<td>1 300 300</td>
<td>1 300 300</td>
</tr>
<tr>
<td>E-MC-5 Computer Lab</td>
<td>1 1,000 1,000</td>
<td>1 1,000 1,000</td>
<td>1 1,000 1,000</td>
</tr>
<tr>
<td>E-MC-6 A/V Storage</td>
<td>1 100 100</td>
<td>1 150 150</td>
<td>1 200 200</td>
</tr>
<tr>
<td>E-MC-7 Conference Room</td>
<td>0 200 0</td>
<td>1 200 200</td>
<td>2 200 400</td>
</tr>
<tr>
<td><strong>Media Center Total</strong></td>
<td>2,870</td>
<td>3,620</td>
<td>4,370</td>
</tr>
</tbody>
</table>

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>New SF</th>
<th>Existing SF</th>
<th>TOTAL SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-MC-1 Reading Room/Circulation</td>
<td>1 900 900</td>
<td>0 0 0</td>
<td>1 varies 900</td>
</tr>
<tr>
<td>E-MC-2 Media Specialist Office</td>
<td>1 120 120</td>
<td>0 0 0</td>
<td>1 varies 120</td>
</tr>
<tr>
<td>E-MC-3 Workroom/Storage</td>
<td>1 150 150</td>
<td>0 0 0</td>
<td>1 varies 150</td>
</tr>
<tr>
<td>E-MC-4 Main Control/Equipment Rm</td>
<td>1 300 300</td>
<td>0 0 0</td>
<td>1 varies 300</td>
</tr>
<tr>
<td>E-MC-5 Computer Lab</td>
<td>0 1,000 0</td>
<td>0 0 0</td>
<td>0 varies 0</td>
</tr>
<tr>
<td>E-MC-6 A/V Storage</td>
<td>1 100 100</td>
<td>0 0 0</td>
<td>1 varies 100</td>
</tr>
<tr>
<td>E-MC-7 Conference Room</td>
<td>0 200 0</td>
<td>0 0 0</td>
<td>0 varies 0</td>
</tr>
<tr>
<td><strong>Media Center Total</strong></td>
<td>1,570</td>
<td>0</td>
<td>1,570</td>
</tr>
</tbody>
</table>

**NOTE 1:** The size of the reading room/circulation space is equal to 10% of the student capacity multiplied by 30 SF per student.

**NOTE 2:** Student capacity determines SF allowed. 350-400: 150 SF; 401-550: 200 SF; 551-700: 250 SF

**NOTE 3:** Student capacity determines SF allowed. 350-400: 100SF; 401-550: 150 SF; 551-700: 200 SF

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**Ohio School Design Manual 2006**

**Ohio School Facilities Commission**

**E-MC**

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**FUTURE FORMS FOR HEALTHY CITIES**
**APPENDIX**

**Sample School District, SAMPLE ELEMENTARY SCHOOL**

**MUSIC SPACES**

**E-MU**

CHAPTER 2: BRACKETING

The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-MU-1 Music Room</td>
<td>1 1,200</td>
<td>1 1,200</td>
<td>1 1,200</td>
</tr>
<tr>
<td>Music Total</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
</tr>
</tbody>
</table>

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>New SF</th>
<th>Existing SF</th>
<th>TOTAL SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-MU-1 Music Room</td>
<td>0 1,200</td>
<td>0 0</td>
<td>0 varies 0</td>
</tr>
<tr>
<td>Music Total</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**NOTE 1:** Student capacity determines SF allowed. 350-400: 3500 SF; 401-550: 4500 SF; 551-700: 5000 SF

**NOTE 2:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 300 SF; 551-700: 400 SF

**Sample School District, SAMPLE ELEMENTARY SCHOOL**

**PHYSICAL EDUCATION SPACES**

**E-PE**

CHAPTER 2: BRACKETING

The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-PE-1 Gymnasium</td>
<td>1 3,500</td>
<td>1 4,500</td>
<td>1 5,000</td>
</tr>
<tr>
<td>E-PE-2 P. E. Workroom/Storage</td>
<td>1 200</td>
<td>1 300</td>
<td>1 400</td>
</tr>
<tr>
<td>Physical Education Total</td>
<td>3,700</td>
<td>4,800</td>
<td>5,400</td>
</tr>
</tbody>
</table>

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>New SF</th>
<th>Existing SF</th>
<th>TOTAL SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-PE-1 Gymnasium - note 1</td>
<td>1 3,500</td>
<td>0</td>
<td>1 varies 3,500</td>
</tr>
<tr>
<td>E-PE-2 P. E. Workroom/Storage-note2</td>
<td>1 200</td>
<td>0</td>
<td>1 varies 200</td>
</tr>
<tr>
<td>Physical Education Total</td>
<td>3,700</td>
<td>0</td>
<td>3,700</td>
</tr>
</tbody>
</table>
Sample School District, SAMPLE ELEMENTARY SCHOOL

VISUAL ART SPACES

E-VA

CHAPTER 2: BRACKETING

The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

<table>
<thead>
<tr>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 Students</td>
</tr>
<tr>
<td>Space</td>
</tr>
<tr>
<td>E-VA-1 Art Room</td>
</tr>
<tr>
<td>E-VA-2 Kiln/Ceramic Storage</td>
</tr>
<tr>
<td>E-VA-3 Art Material Storage</td>
</tr>
<tr>
<td>Visual Arts Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WORKSHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>New SF</td>
</tr>
<tr>
<td>Space</td>
</tr>
<tr>
<td>E-VA-1 Art Room</td>
</tr>
<tr>
<td>E-VA-2 Kiln/Ceramic Storage</td>
</tr>
<tr>
<td>E-VA-3 Art Material Storage-note1</td>
</tr>
<tr>
<td>Visual Arts Total</td>
</tr>
</tbody>
</table>

NOTE 1: Student capacity determines SF allowed. 350-400: 100 SF; 401-550: 125 SF; 551-700: 150 SF

Ohio School Design Manual 2006
Ohio School Facilities Commission

Sample School District, SAMPLE ELEMENTARY SCHOOL

CUSTODIAL SPACES

E-CU

CHAPTER 2: BRACKETING

The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

<table>
<thead>
<tr>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 Students</td>
</tr>
<tr>
<td>Space</td>
</tr>
<tr>
<td>E-CU-1 Workroom</td>
</tr>
<tr>
<td>E-CU-2 Custodial Office</td>
</tr>
<tr>
<td>Custodial Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WORKSHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>New SF</td>
</tr>
<tr>
<td>Space</td>
</tr>
<tr>
<td>E-CU-1 Workroom - note 1</td>
</tr>
<tr>
<td>E-CU-2 Custodial Office</td>
</tr>
<tr>
<td>Custodial Total</td>
</tr>
</tbody>
</table>
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-FS-0 Warming Kitchen</td>
<td>0</td>
<td>800</td>
<td>0</td>
<td>0</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
<td>1,400</td>
<td>0</td>
</tr>
<tr>
<td>E-FS-1 Kitchen (total)</td>
<td>1</td>
<td>1,400</td>
<td>1</td>
<td>1,925</td>
<td>1</td>
<td>2,450</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1 Preparation Area</td>
<td>504</td>
<td>693</td>
<td>882</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1b Serving Area</td>
<td>476</td>
<td>655</td>
<td>833</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1c Dry Food Storage</td>
<td>154</td>
<td>212</td>
<td>270</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1d Cooler/Freezer</td>
<td>140</td>
<td>193</td>
<td>245</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1e Ware Washing</td>
<td>126</td>
<td>173</td>
<td>221</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-2 Dietician Office</td>
<td>1</td>
<td>75</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-3 Restroom/Locker Rm</td>
<td>1</td>
<td>140</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Food Service Total**

<table>
<thead>
<tr>
<th></th>
<th>1,615</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-FS-0 Warming Kitchen</td>
<td>0</td>
<td>0</td>
<td>varies</td>
<td>0</td>
<td>0</td>
<td>varies</td>
<td>0</td>
<td>0</td>
<td>varies</td>
</tr>
<tr>
<td>E-FS-1 Kitchen (total)</td>
<td>1</td>
<td>1,085</td>
<td>1</td>
<td>1,085</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1 Preparation Area</td>
<td>370</td>
<td>0</td>
<td>varies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1b Serving Area</td>
<td>370</td>
<td>0</td>
<td>varies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1c Dry Food Storage</td>
<td>115</td>
<td>0</td>
<td>varies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1d Cooler/Freezer</td>
<td>115</td>
<td>0</td>
<td>varies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-1e Ware Washing</td>
<td>115</td>
<td>0</td>
<td>varies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-FS-2 Dietician Office</td>
<td>0</td>
<td>75</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>E-FS-3 Restroom/Locker Rm</td>
<td>1</td>
<td>140</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Food Service Total**

<table>
<thead>
<tr>
<th></th>
<th>1,225</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

**NOTE 1:** The size of the kitchen is equal to the sum of preparation area, serving area, dry food storage area, cooler/freezer area, and ware washing area.

**NOTE 2:** The size of the preparation area is equal to the student capacity multiplied by 3.5 SF per student multiplied by 36%.

**NOTE 3:** The size of the serving area is equal to the student capacity multiplied by 3.5 SF per student multiplied by 34%.

**NOTE 4:** The size of the dry food storage area is equal to the student capacity multiplied by 3.5 SF per student multiplied by 11%.

**NOTE 5:** The size of the cooler/freezer area is equal to the student capacity multiplied by 3.5 SF per student multiplied by 10%.

**NOTE 6:** The size of the ware washing area is equal to the student capacity multiplied by 3.5 SF per student multiplied by 9%.

**NOTE 7:** The size of the warming kitchen is equal to student capacity multiplied by 2.0 SF per student.

**NOTE 8:** Only one of the two kitchens is to be used - either E-FS-0 or E-FS-1 - not both.
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### EXAMPLE

<table>
<thead>
<tr>
<th>Space</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-SD-1 Student Dining</td>
<td>1</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>E-SD-2 Stage</td>
<td>1</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>E-SD-3 Staff Dining</td>
<td>0</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>E-SD-4 Table Storage</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td><strong>E-SD-5 Family Restroom</strong></td>
<td>1</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td><strong>Student Dining Total</strong></td>
<td>4,180</td>
<td>4,430</td>
<td>5,280</td>
</tr>
</tbody>
</table>

### WORKSHEET

<table>
<thead>
<tr>
<th>Space</th>
<th>New SF</th>
<th>Existing SF</th>
<th>TOTAL SF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-SD-1 Student Dining - note 1</td>
<td>1</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>E-SD-2 Stage</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>E-SD-3 Staff Dining - note 2</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>E-SD-4 Table Storage - note 3</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td><strong>E-SD-5 Family Restroom</strong></td>
<td>1</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td><strong>Student Dining Total</strong></td>
<td>3,480</td>
<td>0</td>
<td>3,480</td>
</tr>
</tbody>
</table>

**NOTE 1:** The size of the student dining space is equal to one-third of the student capacity multiplied by 15 SF per student or 3000 SF, whichever is greater.

**NOTE 2:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 250 SF; 551-700: 300 SF

**NOTE 3:** Student capacity determines SF allowed. 350-400: 200 SF; 401-550: 250 SF; 551-700: 300 SF
The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### Example

**Sample School District, SAMPLE ELEMENTARY SCHOOL**

**BUILDING SERVICES SPACES**

**E-BS**

CHAPTER 2: BRACKETING

### Sample School District, SAMPLE ELEMENTARY SCHOOL

**BUILDING SERVICES SPACES**

**E-BS**

#### Chapter 2: Bracketing

The following is an example of three sizes of elementary schools. The examples are intended to assist in the development of the summary of spaces.

### Example

<table>
<thead>
<tr>
<th>Space Description</th>
<th>400 Students</th>
<th>550 Students</th>
<th>700 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>SF</td>
<td>Area</td>
</tr>
<tr>
<td>E-BS-1 Large Group Restrooms</td>
<td>1,197</td>
<td>1,197</td>
<td>1,548</td>
</tr>
<tr>
<td>E-BS-2 Custodial Closet</td>
<td>50</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>E-BS-3 Electrical Closet</td>
<td>50</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>E-BS-4 Telecommunications Room (TR)</td>
<td>64</td>
<td>128</td>
<td>2</td>
</tr>
<tr>
<td>E-BS-5 Corridors</td>
<td>6,842</td>
<td>6,842</td>
<td>8,847</td>
</tr>
<tr>
<td>E-BS-6 Mechanical/Electrical Space/Decks</td>
<td>2,360</td>
<td>2,360</td>
<td>3,052</td>
</tr>
<tr>
<td>E-BS-7 Storage Area</td>
<td>1</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>E-BS-8 Central Storage Area</td>
<td>250</td>
<td>250</td>
<td>1</td>
</tr>
<tr>
<td>E-BS-9 Loading/Receiving Area</td>
<td>1</td>
<td>120</td>
<td>1</td>
</tr>
<tr>
<td>E-BS-10 Restroom</td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

**Building Services Total**

| 11,247 | 14,420 | 18,030 |

### Worksheet

#### New SF

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
<th>Qty</th>
<th>SF</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-BS-1 Large Group Restrooms</td>
<td>946</td>
<td>946</td>
<td>0</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-2 Custodial Closet</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-3 Electrical Closet</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-4 Telecommunications Room (TR)</td>
<td>64</td>
<td>64</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-5 Corridors</td>
<td>5,407</td>
<td>5,407</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5,407</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-6 Mechanical/Electrical Space/Decks</td>
<td>1,865</td>
<td>1,865</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1,865</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-7 Outdoor Storage Area</td>
<td>150</td>
<td>150</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-8 Central Storage Area</td>
<td>250</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-9 Loading/Receiving Area</td>
<td>120</td>
<td>120</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-BS-10 Restroom</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Building Services Total**

| 9,602 | 0 | 9,602 |

**Note 1:** The total size of large group restrooms is equal to the sum of the program areas, excluding building services, multiplied by 3.5%.

**Note 2:** The total size of the corridors is equal to the sum of the program areas, excluding building services, multiplied by 20%.

**Note 3:** The total size of the mechanical/electrical space/decks is equal to the sum of the program areas, excluding building services, multiplied by 6.9%.

**Note 4:** Student capacity determines SF allowed. 350-400: 150 SF; 401-550: 200 SF; 551-700: 250 SF

**Note 5:** Student capacity determines SF allowed. 350-400: 250 SF; 401-550: 325 SF; 551-700: 350 SF

**Note 6:** Vertical Circulation refers only to the following: Stairways/stairtowers, monumental stairs, elevators and elevator equipment room.

**Note 7:** Size of TR varies with size of elementary school. See page 4111-7.
<table>
<thead>
<tr>
<th>DATE</th>
<th>THEORIST</th>
<th>PHILOSOPHY</th>
<th>CURRIC.</th>
<th>ARCHITECTURE</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>18th C</td>
<td></td>
<td>Originally rooms in houses had no specific purpose. In 18th C these rooms began to be assigned a specific function.</td>
<td>No specific curriculum but children playrooms often doubled as sleeping areas allowing children's activities and games to extend and develop over periods of time.</td>
<td>18th century House</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Playrooms acted as children's rooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1712-1778</td>
<td>Jean-Jacques</td>
<td>People have to develop skills</td>
<td>Conditioning child through changes to environment, setting traps and puzzles to overcome</td>
<td>Guided experiences to teach children the consequences of their actions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rousseau</td>
<td>Introduction of the developmental process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Children learn from their surroundings (active process)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remove child from society and send to country home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1782-1852</td>
<td>Friedrich Fröbel</td>
<td>Children have unique needs and capabilities</td>
<td>Singing, dancing, gardening, self-directed plays</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Developed &quot;kindergarten&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Important of the &quot;activity&quot; in child's learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;free work&quot; concept</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>19th C</td>
<td></td>
<td>Church based model - children surrounding a master</td>
<td>Full time spent in single classroom with headmaster</td>
<td>Public schools - solid forms; Modern schools - light, airy, practical</td>
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<td></td>
<td></td>
<td>Calm, overbearing order</td>
<td></td>
<td>Traditionalist - neoclassical, heavyweight, robust, inflexible (until 1970s)</td>
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<td></td>
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<td>Progressive - Bauhaus, lightweight, quick, cheap, environmental issues (until 1970s)</td>
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<tr>
<td>1836-1917</td>
<td>ER Robson</td>
<td>1970s-1980s : Estate funded schools</td>
<td>Individual classroom time with instuction, Loss of single headmaster</td>
<td>Based around functions of 18th C house</td>
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<tr>
<td></td>
<td></td>
<td>Issues of health and safety introduced</td>
<td></td>
<td>Confined urban schools</td>
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<td></td>
<td></td>
<td>Prussain system: separate classrooms around a common hall</td>
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<td>Well ventilated, lofty spaces</td>
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<td></td>
<td></td>
<td>Five rows of double desks (so teacher can access each student individually)</td>
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<td>Minimum of 30 square inches of window for every square foot of floor space.</td>
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<td></td>
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<td>Function over aesthetic</td>
<td></td>
<td>Shape determined by layout of classrooms and number of children</td>
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<td>Queen Anne Style: yellow brick with red dressings</td>
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<td></td>
<td>Designer's desire for style led to problematic exterior spaces</td>
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<tr>
<td>Timeline</td>
<td>School Type</td>
<td>Key Principles</td>
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</tbody>
</table>
| 1859-1952 | John Dewey | - Importance of hands-on instruction and stimulating children's senses  
- Schools as cooperative communities  
- Various and natural education  
- Schools should reflect the ideas of society |
| Late 19th C | Progressive Education | - Education based on the understanding that humans are social creatures (learn best through interaction with other people)  
- Children learn as if they are scientists (learn by doing)  
- Strong emphasis on problem solving and critical thinking  
- Group work and development of social skills  
- De-emphasis on textbooks in favor of varied learning resources |
| 1920s | Waldorf Education | - Humanistic Approach  
- Learning is interdisciplinary - Practical  
- Artistic  
- Conceptual  
- Mission: To teach freedom and morality  
- Focus on collaborative learning |
| 1904 | Open Air School | - Prevent spread of tuberculosis  
- Health benefits based on movement  
- Educational experience inspired by progressive education |
| 1910 | Montessori Method | - Human development does not occur in a steady, linear path but in a series of formulative paths  
- Importance of observation  
- Interaction with nature is most productive in terms of development if it is self chosen and founded upon individual interests  
- Best for 2-6 years of age |

**Key Features**

- **John Dewey**
  - Replicated diversity of real world
  - First to include labs, workshops, art, and gym
  - Acknowledged the importance of architecture in education

- **Progressive Education**
  - Integration of community service and service learning projects into the daily curriculum

- **Waldorf Education**
  - Three stages of development:  
    - Early childhood (0-7)  
    - Elementary (7-14)  
    - Adolescence
  - Teachers stick with groups of students for several years

- **Open Air School**
  - Outdoor classrooms  
  - Light, airy, outdoor space for each classroom  
  - Open plan  
  - Adaptability of classrooms

- **Montessori Method**
  - Curriculum catered to sensitive periods of development  
  - Structured and orderly (facilitated, self-directed learning)  
  - Hands-on learning

- **1904 Open Air School**
  - Issue of scale: spaces and furniture that are at the scale of the child
<table>
<thead>
<tr>
<th>Year</th>
<th>School Type</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1924</td>
<td>Susan Isaacs Free School</td>
<td>Importance of freedom, Stress emotions over intelligence, Focused on natural environment, Importance of sensory material. Indoor physical activity different than “drill hall” for first time, No formal lessons or curriculum.</td>
</tr>
<tr>
<td>1930s-1940s</td>
<td>Schools based on scientific principles</td>
<td>Children developed best through social interaction, Shifted away from authoritarianism and towards a more free balanced approach, Concern for health and ventilation, Large institutional buildings with multifunctional spaces.</td>
</tr>
<tr>
<td>1968</td>
<td>Sudbury Valley School</td>
<td>Two basic tenets: educational freedom and democratic governance, De-emphasis of classes, Age mixing, The role of adults, Evaluation, Students and staff are equals, No required curriculum. Students are free to spend their time as they see best fit.</td>
</tr>
<tr>
<td>1970s</td>
<td>Unschooling</td>
<td>Belief in allowing children to learn through their own natural experiences, Encourages exploration of activities that is child led, facilitated by adults, Children are natural learners and do not all learn the same way, No specific architecture, Children are able to use and adapt spaces as they see fit.</td>
</tr>
<tr>
<td>1980s</td>
<td>Herman Hertzberger</td>
<td>Use of architecture to suggest and encourage social relationships between users, Multiple classrooms organized around a central atrium or communal hall.</td>
</tr>
<tr>
<td>2000s</td>
<td>School of One</td>
<td>Personalized and dynamic classroom instruction, Each student participates in multiple instructional modalities both individually led and teacher led, Main reception area, Multiple different spaces with multiple functions from computer labs, individual work spaces, group work spaces, and small work group spaces.</td>
</tr>
</tbody>
</table>
Historical Timeline

18th Century

18th Century Houses

In the 18th Century, spaces within houses began to be assigned specific functions. During this time, children spent most of their time in their "playroom." This space doubled as a play space and as a sleeping area. This allowed for activities and games to extend over long periods of time, which became an important factor in the social development of children.

Jean-Jacques Rousseau

Rousseau is accredited with the creation of developmental stages in child development. He believed that people have to develop their skills. Children did this by interacting with and learning from their surrounding environment. He believed that learning and development is an active process.

Friedrich Frobel

Friedrich Frobel is known for developing the term "kindergarten." He believed that children have their own set of needs and capabilities and in order to develop these capabilities "activity" was an important part of the learning process.

19th Century Schools

In the 19th Century, education, for the first time, took place in its own facility. These facilities were based off the church model, where children surrounded a single head master who taught all children, of all ages, all subjects. Children sat in rows of many students and often did not move from these seats for extended periods of time. The architecture of these facilities often mirrored that of a church as well. The building often consisted of a single, large open space -- where all activities took place -- ornamented with calm, overbearing order.

E.R Robson

The most influential educational theorist of the 19th Century was E.R Robson. E.R Robson developed an educational building type that focused on the health and safety of children. All of his facilities were based on the Prussian system, which consisted of separate classrooms surrounding a single communal, or "drill", hall. Each classroom consisted of rows of double desks and a larger open space located at the front of the room. This allowed the teacher access to every student in the classroom as well as a space for lectures and presentations to take place at the front of the room.

Homocentrism

This theory is based on the utility of nature for the use of humans. Humans who associate with this theory believe in human supremacy, that humans themselves are the most central and significant entities in the universe and that all other objects are put on earth for the sole purpose of helping humans thrive. Natural resources and landscapes are nothing more than "raw material" to be transformed for human use. Homocentrism stresses science and its importance in maximizing the output of natural resources for human use.

Freud’s Psychoanalysis

Psychoanalytic theories of development focus on the causes and cures of neuroses. In other words, these developmental theories look at why people become “abnormal.” Freud believed that people have two levels of consciousness, conscious and unconscious. The unconscious mind is where people store ideas they are not aware of but that influence the daily actions of humans. Freud is attributed with developing the levels of consciousness, id, ego, and superego. Finally, Freud believed that sexual motives underlie most, if not all, of human behavior.

John Dewey

Dewey was the first theorist to suggest that hands on instruction and interaction was a crucial factor in the learning and developmental process. He believed that schools should act as cooperative communities where education was various and natural.

Progressive Education

Progressive Education, a movement that believed that humans, because they are social creatures, learn best through interaction with other people. A strong emphasis on problem solving and critical thinking facilitated by group work and activities were major characteristics of Progressive Education. Because children learn through doing, use of various learning tools and methods were viewed as crucial for the first time.
Ecological Psychology

Ecological Psychology believes that the social and physical settings a child exists in are crucial to their development. Ecological Psychologists believe that behaviors, personality, and intelligence can adapt based on the environment in which a person is placed. It is important to not only understand the meanings that people associate to certain environments, but also why these specific meanings are associated.

Educational Philosophies

Educational philosophies moved away from authoritarian based systems and towards more balanced approaches, such as Progressive Education. During this time architecture was viewed as an instrument for change. School facilities moved away from larger industrial looking buildings towards light, airy, technological buildings. Spaces within schools became larger and less specific than those often found in earlier schools. The importance of social interaction, health, and ventilation also become important factors in every new school design during this time and today as well.
<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Event</th>
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<tbody>
<tr>
<td>1970s</td>
<td>Sudbury Valley School focused on a child’s freedom and the learning and development associated with it. Under this philosophy children are able to choose their own classes and spend their time as they saw fit, as there was no specific curriculum.</td>
</tr>
<tr>
<td>1970s</td>
<td>Susan Isaac’s Free School focused on a child’s freedom and the learning and development associated with it. It focused on emotions of intelligence and used nature as a form of sensory material to encourage interaction and learning. There was no specific curriculum or required classes. Children and teachers were able to determine how time was best spent.</td>
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<tr>
<td>1970s</td>
<td>Ethology / Social Biology is the study of the behavior of animals, including humans, especially as that behavior occurs in natural environments. Sociobiology is the study of the biological bases of the way members of a species act toward one another and toward members of other species. In short, this theory uses these six categories to study animals to determine ways in which animals respond to experiences and develop and hypothesize on whether or not children respond and develop the same way.</td>
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<tr>
<td>1970s</td>
<td>Deep Ecology is based on the belief that normal humans do not have any greater moral significance than other creatures. Biospheric egalitarianism, belief in the equal rights of everything alive to have the ability to thrive, is a fundamental principal of this theory. Deep Ecology is considered “deep” because it not only considers things that are alive as important, but it also associates the word “life” to things like rivers, rocks, and landscapes. Deep Ecology was developed as a critique of modernity and people who associate with this theory believe that it is because of the human race’s belief system and way of life that nature is in danger.</td>
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<tr>
<td>1970s</td>
<td>Skinner’s Operant Conditioning is a learning theory based on the idea that behavior is controlled by its consequences. Operant conditioning believes that consequences of behaviors influence the form of behavior. Basically, when a person experiences something, the consequences of the experience effect how they will respond to the experience in the future. Skinner viewed learning not as a process of a child demonstrating a behavior once, but as a process of a child demonstrating the given behavior consistently, which led him to develop methods of reinforcement to condition children to perform a specific behavior consistently.</td>
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<tr>
<td>1970s</td>
<td>Unschooling is a type of educational method that believes that school itself is not important in the learning process. Rather it is important to let children learn in their own ways. Therefore, instead of creating a curriculum, the adult’s role is to encourage children and facilitate in activities the child sees important in their development.</td>
</tr>
<tr>
<td>1970s</td>
<td>Biomimicry is the examination of nature, its models, systems, processes, and elements to emulate or take inspiration from in order to solve human problems.</td>
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</table>
Information Processing Theories

Information-processing theories use the electronic computer as a means to carry out many functions similar to those that human brains carry out in order to simulate human thought processes. These theories attempt to explain what happens between the time a child receives an impression of an environment to the moment the child visibly responds to that environment.

Social Cognition Theory

Social cognition focuses on the role of environmental consequences as a key role to how people develop. In short, social cognition believes that social variables determine behavior and personality. This theory believes that the mental activity of children is not just that of learning and responding to their environment, it is also creative thought, or the ability to manipulate knowledge in their minds to form new understandings.

Piaget’s Cognitive Development

Piaget’s theories were based on the belief that children develop in order to adapt to the environment in more satisfactory ways. This theory describes how the mind processes new information. Piaget believed that people understand information as it fits into their worldview, a view developed through experience with a person’s environment, and when something does not fit within this view, a person must reexamine this view and adjust methods of thinking to accommodate new information. Piaget described four stages of cognitive development.

Biocentrism

Biocentrism believes that the value of nature is independent to human value. Therefore, ethical actions are those that promote the success of all life on earth, not just human life. Four main principals exist on which biocentrism is based. These principals are; humans are members of a community of life along with all other species and each member is equal, this community consists of a system of interdependence between all members, both physically, and in terms of relationships with other species, every organism is a “teleological centre of life”, that is, each organism has a purpose and a reason for being, which is inherently “good” or “valuable,” and finally, humans are not inherently superior to other species (Clation).

Integrated Theory on Morals

This theory focuses on the changes in the system by which people make moral decisions. This theory believes that no moral value is innate; all are developed as children grow. Much like moral values need to be developed, so too must guilt, self-punishment, and self-reward.

Biophilia

Biophilia was given a name in 1995 by Edward O. Wilson. Biophilia is based on the belief that humans need to have contact with nature because it is in our evolution. Human brains, and bodies, have evolved over thousands of years to live and survive in an environment dominated by nature and therefore, humans have a genetic predisposition to be attracted to natural spaces and other living organisms. Because of this, humans have an innate need to interact with and connect with nature because for thousands of years we evolved for this sole purpose.

School of One

School of One is the most recent educational theory that has been developed. The idea behind this philosophy is that all children learn differently. Rather than having a single curriculum for all children to follow, each child has their own specialized schedule that they follow every day. The activities can range from group, individual, teacher led, or technologically based.