University of Cincinnati

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I, Michelle A Mahoney, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

It is entitled:
Educational Facilities: Designing for Everyday Stress in Public, Primary School Environments

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Current trends for primary public school design do not account for the psychological effects everyday stress and trauma have on the ability for students to effectively learn. Set design standards and regulations efficiently disregard designing to alleviate student stress and for child-, community-, demographic-, and age- centered environments in order to foster learning for all students. The aim of this thesis is to define the principal architectural concepts responsible for the creation of a child focused primary school environment integrated with the specific elements needed for the mitigation of everyday stress and trauma on the student.

The relevance and limitations of current primary school design trends will be addressed to situate the discussion of designing schools to mitigate the effects of mental or emotional strain or tension on students. Typically, children are less able to cope with these situations leading to a state of mind ‘turned off’ to learning. A primary school designed for the student needs to respond to the emotional needs of the student while providing a positive first impression of learning. By defining the spatial qualities needed to address the effects of everyday stress and trauma combined with how to design for children and the critique of current design trends, this thesis will present the final design aims and methods for providing an urban, public school for the downtown Cincinnati area meant to mitigate the effects of everyday stress and trauma on students in order to promote learning through the built environment.
I began this thesis looking at the effect poverty had on the ability for young students to perform academically and what it would mean to design a school for students in a specific neighborhood and background. Along this journey my topic has both expanded and contracted to include all primary students but focus only on the effect stress has on learning.

I have spent enough time in certain of Cincinnati’s public elementary schools as well as heard many stories from different groups of teachers to know some of the difficulties these students have in their lives at a young age. As adults we are quick to forget the trials of childhood. We are quick to adopt stress as only for those who are older. Perhaps this is because we want to remember childhood as a time of fun and laughter and without the burdens of growing up. Perhaps it is because we become more aware of stress as we learn what it means and we take on more responsibilities. Perhaps it is just because, as children, we do not have the knowledge to respond to stress appropriately if not for the support of a functional household. No matter the reason, stress plays an integral part of our lives from birth to death.

As architects, it is imperative to remember to design for the human experience. We must remember, people respond to changes, worries, and anxieties of their lives with the same psychological and physiological responses no matter their age, race, gender, or economic backgrounds. The distinction between a successful or failed response is grounded in the individual’s ability to respond to the situation in an appropriate manner to deal with the effects stressors place on an individual’s body, emotions, mind, or spirit. This document is centered on the effects everyday stress has on children in primary school, specifically between the ages of four and thirteen, and how the built environment can be modified to minimize the influence of everyday stress on the students in order to improve learning.
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INTRODUCTION

Everyday stress is a common factor in all people’s lives. Current design trends for primary public school design do not account for the psychological effects stressors have on the ability for students to effectively learn. Set design standards and regulations effectively disregard designing to alleviate student stress and for child-, community-, demographic-, and age- centered environments in order to foster learning for all students. Stress is defined as:

1. a state of mental tension and worry caused by problems in your life, work, etc.;
2. something that causes strong feelings of worry or anxiety;
3. the non-specific response of the body to any demand for change.¹

Stress is caused by stressors. Stressors are a “physical, psychological, or social force that puts real or perceived demands on the body, emotions, mind, or spirit of an individual.”² Everyday stress occurs when there are changes or problems that can be triggered by major or minor life events. For a child, the smallest of changes can trigger bouts of stress that can have positive or negative effects on their mental capability to learn. The same can be said for the school environment. Our environments play a substantial role in how we are able to absorb information. Early images of the school can be metaphorically compared to those of a factory, a hospital, a log, a family, or as a war zone.³ These images place the school environment in the realm as only a place to work rather than a place of learning. This has meant a lack of user-oriented design with further neglect of the recognition of differences in needs, values, and preferences of the building’s users. The factors influencing school design are determined by administrators, public

officials, builders, architects, and others who do not occupy the building being constructed.\textsuperscript{4} As such, when school districts initiate facility master plans, the learning environments created are often focused on a single model of construction with minor adaptations to fit to the programs, theories, curriculum, and users of the specific school. Even then, focus is emphasized on the educational theory and not on the environmental needs that could decrease the inhibitions students can hold towards learning.

The discussion of public primary school design trends today exists in a technical environment based on set square footages per economic value in addition to those design considerations considered to be important at the time of design or dated by when the public school design manuals were created. Education related trends are further defined by the recognition of the necessary changes to the educational environment needed due to evolving curricula and shifts in society as a whole, i.e. technology.

The critique of these design trends exists in the addressing what the effects of everyday childhood stress and trauma have on learning. Exposure to violence, chronic insecurity, loss, hardship and disruption will appear in the classroom as traumatic stress which is beyond the everyday but still important. Such types of stresses cause children to be tuned out, preoccupied, impulsive, unable to concentrate, distrustful and nervous.\textsuperscript{5} Children who are more likely to deal with chronic or long-term stress are more likely to have trouble succeeding in school.

\textsuperscript{4} Ibid, 1-2.

What we need to think about is how to design learning for children in order to present an environment that will relieve student stress through specific environmental considerations and designs. There is an important distinction between designing a space per adult standards versus designing for the perspectives of children. Understanding the environmental qualities needed to reflect a child’s state of mind in order to respond to their needs is important for this endeavor to understand the implications for architectural site, volume, and detail.

Through this approach, a set of design aims will be defined as effective means to encourage students to limit their stress within the school environment. These primary design strategies are safety & security, slowing the pace, creating challenging environments, an open classroom, and a small school population size. By rooting this discussion in the design typologies of the past century, such as the Ford model, finger plan, and 21st century model as presented by Nair & Fielding, we are able to make informed critiques of the base design guidelines for the Ohio School Design Manual. These analyses will provide the necessary information required to present a set of design aims the urban school typology presented in this thesis. This includes the challenges of an urban site in the area of Downtown Cincinnati, Ohio.
CHAPTER ONE

Current Trends in Primary School Design

The design of a school is one of life’s recognizable architectural memories. The school is as familiar to us as the form of a church or of our childhood home because of the time each person spends experiencing the space of our school buildings. Even when we enter a school we never experienced as a child, the similar form of corridors and classrooms recalls to us a nostalgic remembrance of our own early learning experiences. The architecture serves as a form of collective memory from one generation to the next because of the lack of architectural evolution in the design of the school. In other words, current school design trends rarely deviate from the architecture and spatial definitions of prior educational building design. This is especially true for the design of public, primary-level school buildings. However, more research and efforts are being taken to understand the influence of the built environment in education.

Much has been discussed locally, nationally, and globally concerning educational facility design and continually changing educational theories. Organizations such as DesignShare: Design for the Future of Learning, the AIA Committee on Architecture for Education, CHPS: The Collaborative for High Performance Schools, the Programme on Educational Building, and the CELE Exchange: Centre for Effective Learning Environments are all examining the effects of learning environments on the educational experience of students. Also, individuals, such as Prakash Nair, Herman Hertzberger, Christopher Day, and others, have expressed specific interests in the architectural design of school space. These specific organizations and individuals are focused on the design of schools to improve learning environments through the physical place. Others are more concerned only on the academic performance of students. The U.S. Department of Education, the National Center for Education Statistics, the NYU Steinhardt: The Metropolitan Center for Research on Equity and the Transformation of Schools, and state Departments of Education are focused on student performance and the provision of quality
education for all. There are other organizations who are concerned with both facility conditions and academic success such as the American Federation of Teachers (AFT). The range of influence on the realm of student academics leaves conflicting arguments towards the best course of action for the design of current school facilities. As such, we must question whether the school is a space to relay knowledge and thus the architecture does not matter or if the architecture of the school serves as a source of empowerment to the learning process? This thesis encourages the viewpoint of the latter: the architecture of a school can empower student learning.

The state of current primary school design trends in the United States represents the reality of conflicting views by school and governmental administrators, poor perceptions by the community, and strained resources within the schools. Master school facility plans are grand in scale, costly to implement and extremely time consuming. These realities leave public school districts in tough situations in relation to aging school infrastructures and the movement toward more accountability towards academic performance. Unfortunately, the link between the two is often ignored. The same can be said about the connection between the user and the school building. As long as costs and school design manuals remain as the driving force behind school design, individual needs of specific student and teacher communities will never be met. Learning is changing. Students are less likely to learn through dictation and more likely to learn through their own explorations. The trends for school design should be focused more on providing spaces meant for changing learning environments and for feeding the human experience.
Assumption #1: School buildings influence student academic performance.

In 2006, The American Federation of Teachers (AFT), the United States teachers’ union, released a report titled, “Building Minds, Minding Buildings: Turning crumbling schools into environments for learning.” This report begins to address the issue facing thousands of schools and millions of students and staff in the United States: their buildings are inadequate, unhealthy, and unsafe. Yet, at the time of this report, it is noted that some of the supporters of increased accountability in schools are quick to ignore the condition of the school buildings themselves (See Figures 1.01 & 1.02 for existing conditions). A difference of 5 to 17 percentile points is noted between the academic achievements of students in poor quality buildings versus similar students in standard quality buildings. This is compared over the same socioeconomic status and situations of the students and schools. It is important to realize how academic performance is related to facility conditions including how this has been recognized but ignored for at least a decade if not longer by those in the position to influence education policies. The AFT provides recommendations aimed at legislature and funding sources for building and renovating schools (Figure 1.03) while promoting school design to follow high-performance and sustainable design strategies to modernize to meet 21st century educational values and challenges.

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7 Ibid.
Assumption #2: School architecture should encourage learning through exploration.

Herman Hertzberger’s—a Dutch architect with wide-ranging experience, knowledge, and theories on the spatial conditions of learning—*Space and Learning* is a discussion on how architecture and education can influence one another. The issue becomes how to engage the architecture of a school with contemporary educational theories and with the restraints imposed by educational and political institutions. Even as educational theories progressed, school design did not. As Hertzberger describes, “As long as learning goes no further than conveying the officially accepted basic knowledge, all you need is a fixed spatial programme that follows the curriculum as painstakingly as possible: a row of classrooms with a corridor alongside.”

The final goal of new school design is to create spaces for wider ranges of learning beyond the “officially accepted basic knowledge” of traditional school curriculum (Figures 1.04 & 1.05). Hertzberger encourages contemporary schools to become places “of less education and more learning. What is needed is an environment that stimulates and incites learning by asking questions, a climate that provokes exchange and confrontation, intellectually, culturally, and politically.” The school of tomorrow is one that promotes community and the social interaction of young people. It incites curiosity and creativity. It is a place that promotes the growth of the individual through the ability to change and adapt for both education and the needs of the students. Hertzberger coins this as a ‘city of learning.’ The ‘city of learning’ is supportive and it is the job of the spatial design of the school to encourage student involvement within their space. Education is constantly changing. The elements able to be incorporated in a learning environment must allow for a school to change and adapt with differing curriculum, educational theories, and the advances in educational technologies.

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9 Ibid.
Assumption #3: The design of a responsive school is influenced by the user.

Consider how much time young people spend in school buildings. In non-year round school, American students spend, on average, 180 days and approximately 7 hours per day in educational facilities. This does not account for time spent in after school programs and activities. Henry Sanoff, a Professor of Architecture in the School of Design at North Carolina State University, authored School Design (1994) in which he examines what it means to design an effective school environment for students. Sanoff emphasizes how most studies stress certain physical features such as lighting, temperature, acoustics, and floor-space-per-child with an addition of the cost-per square-footage examined by school governing bodies. However, Sanoff promotes designing beyond these physical characteristics to embrace the social environment of the school. School design needs to assess classroom environments from the perspective of the perceived and actual use by students and teachers. Some factors important to this operational standpoint include: privacy, personal space, personalization, social grouping, personal meaning, and participation. This is often an evaluation of behavior. Learning environments become more effective when the users are able to take control and ownership of their environment in order to feel a sense of responsibility and meaning (Figures 1.06 & 1.07). Responsive school environments account for the health and condition of the built environment and the interaction of the users within the space. Design can only go so far to create community and promote learning; but, if the design is there to foster learning through the use of physical characteristics to promote student interaction, then academic success of the student users is a step closer to academic and life resilience.

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12 Ibid, 41-44.
13 Ibid, 41-44.
Assumption #4: The architect is responsible for all realms of human experience.

Architects Prakash Nair, Randall Fielding, and Jeffery A. Lackney define a set of design patterns for 21st century schools. These patterns were determined as a collection of building block elements of spatial types in order to create the school for tomorrow. It is important to note this system is biased towards a specific model for education with a view of the school as a community base for learning without the rigidity of the teacher-above/in-front-of-student mentality.  

The fundamental root of the pattern language method is in the realization that certain recognizable patterns reveal healthy spatial relationships at both large and small scales. In other words, the patterns maintain enough generality to remain relevant even as educational theories shift and the societal meaning of schools change. The meaning behind the patterns is to create an understanding of human relationship to the environment to answer the questions: How does the educational environment affect student learning? What are the realms of experience the architect can influence within their purview of design and planning of space?

Nair, Fielding, and Lackney provide a general understanding of the ability of space to provide human experiences through the building design. The designer has the ability to influence four realms of human experience in the planning of schools: spatial, psychological, physiological, and behavioral. Each realm has specific attributes, as noted by Nair, Fielding, and Lackney, which change human experience. The spatial realm is “intimate, open, bright, closed, active, quiet, connected to nature, monumental, and technological.” The psychological realm is

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15 Ibid, 18-19.
16 Ibid, 18-19.
“soothing, safe, awe-inspiring, joyful, playful, stimulating, creative, encouraging, reflection, spiritually uplifting, and creating a sense of community.”\textsuperscript{17} Thirdly, the physiological realm is “warm, cool, cozy, breezy, healthy, aromatic, textured, and visually pleasing.”\textsuperscript{18} And lastly, the behavioral realm is “independent study, collaborative work, teamwork, physical fitness activity, research, writing, reading, computer work, singing, dancing, performing, presenting, large group work, communing with nature, designing, buildings, teaching, relaxing, reflecting, and playing.”\textsuperscript{19} The important consideration of the designer is to maintain the balance between expressing these positive human experiences without bringing out the qualitative opposites or negatives within the physical design of the school environment. The pattern language approach can remain relevant to the design of schools for the amount of time it may take to become a part of the everyday design language for schools. Understanding these effects provides an avenue to analyzing how we, as designers, view the creation of the learning environment to become a series of human experiences rather than a series of programmatic function.

In today’s primary school design market, it is becoming important to recognize the human experience in relation to the built environment with emphasis in how the environment can improve educational performance for students. We must look at student social interactions and the external experience along with the inner, psychological experience of the student.

\textsuperscript{17} Ibid, 18-19.
\textsuperscript{18} Ibid, 18-19.
\textsuperscript{19} Ibid, 18-19.
Case Study

I.E.S. (Interactive European School) Elementary School, Athens, Greece

The I.E.S. (Interactive European School) Elementary School in Athens, Greece begins to adopt the concept of designing for students in a small school approach. Philosophically, the school aims to support traditional, innovative, and alternative educational theories. It is a “curriculum based on a holistic educational approach [aimed] at the development of every pupil’s intellectual, emotional, social, physical, artistic, creative and spiritual potentials...”\(^\text{20}\) The I.E.S. was designed by Manos Perrakis & Associates S.A. in 2009. The school is an estimated host to 288-320 students from grades one to six.\(^\text{21}\)

The imagery of the school design presents a highly stimulating environment. The potential success of this project is in the creation of a school developed with children in mind. The exterior of the school is characterized by areas of large open space and direct connection to the classroom arcs with classrooms arcing around a central atrium oval. This central oval is the space of the design that begins to show the character of student interaction within the space.

Elements of success in the proposed design include scale, multipurpose space, daylight, nature integration, and a social component. The scale of the


\(^{21}\) Ibid.
school maintains a single story along the main plaza and the interior atrium. This keeps the environment to a small child’s scale and maintains the notion of home-like sizes. The atrium is a long, open space that acts as both circulation and activity space. The classrooms and atrium are characterized by floor to ceiling windows and skylights allowing for a maximum amount of natural light to penetrate to the school floor. The school includes plant life within the interior of the atrium. This integration of natural elements is positive for the students. And finally, the centralizing of the classrooms off the atrium allows for socialization and student interaction throughout the atrium space. This means students can be engaged in activities or small group learning exercises while developing necessary social skills.

The characteristics that exist within scale, multipurpose space, daylight, nature integration, and social components are important as mentioned in earlier noted works. Elements such as scale, multipurpose, and social components serve to construct child-friendly oriented environments. These types of environmental aspects act to create the more home related feel desired for students to improve academic achievement. These are especially important for students where traumatic stresses from outside sources are prevalent. Continuing to elements such as daylight and nature integration, the environment becomes more aesthetically pleasing to the user. Schools in urban locations are faced with a lack of nature to integrate with and can face daylight difficulties depending on the surrounding context. However, the better these can integrate within different school locations, the better the students will do as their environment becomes more pleasing.
CHAPTER TWO
Designing Schools for Everyday Childhood Stress

Stress is an everyday condition of the physical state of human beings. It can be both positive and negative, good and bad, and a motivator or an inhibitor. The challenge is understanding children experience stress the same way as adults but because of their inexperience, children have a harder time dealing with stress’ effects. The older we get the less we see childhood as a stressful time of our lives. Thus, designers rarely consider everyday stress as a prominent factor in building design to be addressed. For a designer, stress becomes part of a design when we are dealing with trauma in a user, like a battered women’s shelter or a major medical treatment center. Everyday stress of the everyday student does not influence building design because as adults we see everyday stress as a part of life and rarely as something needing to be addressed by building design. But what we, as adults, fail to recognize is the major effect everyday stress has on student learning.

A Discussion about Stress

According to the American Psychological Associate (APA), there are three different kinds of stress: acute stress, episodic acute stress, and chronic stress. Acute stress is considered the most common form of stress stemming from demands of the recent past and anticipated demands of the future. Episodic acute stress is the same as acute stress but occurs for people who live in chaos and disorder that stressful crisis is a common and frequent occurrence. Lastly, chronic stress is the stress of long term, no-end-in-site unrelenting demands that wear a

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23 Ibid.
24 Ibid.
person down as they cannot escape its effects. These types of stress correlate to the three types of responses to stress: positive, tolerable, and toxic.

Fig. 2.01. The three primary levels of stress response

Positive stress response serves to provide a brief increase in heart rate and hormone levels usually leading to an ability to react in a productive manner. Tolerable stress response occurs when a serious source of stress occurs but the experience is buffered by relationships with others who are able to provide support in order to deal with the effects of the event. Lastly, toxic stress response occurs when individuals experience a prolonged activation of their stress response systems. This usually occurs with a lack of supportive relationships available to buffer the major effects of stress thus leading to potential future physical and mental health issues.

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25 Ibid.
27 Ibid.
28 Ibid.
29 Ibid.
The Effects of Stress and Learning

Causes of stress in children range from instances of household dysfunction (substance abuse, parental separation/divorce, mental illness, criminal behavior, economics), abuse (psychological, physical, sexual), neglect (emotional, physical), personal (physical health, physical impairments, learning impairments), activities (academics, sports, extracurricular, change), and social (fitting in, making friends, peer pressure, bullying). They range in location, severity, and lasting effects on the child. Some happen at home, others will happen in the community, and others will occur on school grounds. As designers, we have the opportunity to take into consideration the causes and effects of stress in order to design environments meant to alleviate barriers to learning. Common effects stress can have on the human body include headaches, frequent infections, muscular tension, fatigue, skin irritations, and breathlessness. Stress affects the mind by promoting worrying, muddled thinking, the inability to concentrate, nightmares, indecision, negativity, hasty decisions, tuning out, and preoccupation. Emotions are affected by loss of confidence, fussiness, irritability, depression, anger, anxiousness, apprehension, distrust and nervousness. Lastly behavior shift towards accident proneness, over- or under-eating, sleeplessness, restlessness and withdrawing from social situations. These effects can have major implications for a child’s ability to learn.

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31 Ibid, 18-19.
32 Ibid, 18-19.
33 Ibid, 18-19.
According to Louis Cozolino, PhD, “mix enough of these learning challenges together and you will find children who appear unteachable, unreachable, and a waste of educational resources. Exposing closed minds and turned-off brains to knowledge can really be like talking to a wall.” So, if stress can trigger student’s brains to turn them off to learning, how can students be ‘turned on’ to learning again? What are the environmental elements that promote the growth of a student’s learning ability? Cozolino tells of multiple environmental elements that can support children and bring them away from the negative effects that impede learning. These elements include: offering choices, problem solving, and decision making. Open classrooms can help students cope with variations in teacher expectations. Animal based experiments have shown color, sounds, physical obstacles, and brain-based challenges create an enriching and stimulating environment that can have positive impacts on neural growth and learning.” Enticing and interesting environments with elements to explore and challenges to test a child’s ability are the foundation upon which learning can be most effective. Cozolino also includes the level at which a child will feel safe within the list of factors that can help keep learning at a maximum. The environmental qualities of the school provide the human experience. It is this experiential quality which this thesis proposes will allow for the school to provide an opportunity for childhood stress to lessen in the learning environment.

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36 Ibid, 157-158.
37 Ibid, 161.
Designing the Learning Environment

The core concerns for the development of the public, primary school environment are rooted in the EDUCATIONAL: an environment aimed at turning students ‘on’ to learning; the SOCIAL: an environment that encourages positive social interactions; and, the PHYSICAL: an environment aimed to improve students mentally and physically. These core ideals address the areas most affected by stress: the body, mind, emotions, and behavior. Thus, the designer must ask:

How can architectural design be used to mitigate the effects of everyday stress on a primary school student?

How can we, as designers, encourage positive learning experiences through the built environment?

What is education for the 21st century? How can the design of the school reflect the trends of today while serving to create a student-centered environment?

These questions provide an avenue to begin to analyze the connections between the psychology-based research and the spatial environment of the design. Thoughts on how children develop their experiences in the world provide a base for understanding needs, state of mind, and the environmental qualities needed for those conditions.
Assumption #5: Schools should be specifically designed to reduce student stress levels.

The “Hierarchy of Needs” developed by Abraham Maslow (1908-1970) hypothesized humans acted upon the desire to meet their needs and in order to move on to the next need on the list they had to satisfactorily meet the need of the one before it. Maslow identified five needs humans aspire to meet: (1) physiological, (2) safety and security, (3) belonging/love, (4) self-esteem, and (5) self-actualization (Figure 2.07). This thesis proposes students need to meet these same needs in order to be successful in school. Challenges to physical health, personal defense and social acceptance are significant causes of stress to students. The school environment can become the place for releasing anxiety by using the design of the school to develop a sense of well-being/comfort, trust/integrity, wonder/magic, curiosity/sensory exploration, control/creative interventions, and determination to change the world/inspiration (Figure 2.07). Children who are able to progress from one state to the next are more likely to learn and maintain the information as learning will not occur until Maslow’s needs of belonging and self-esteem, the states of mind of wonder, curiosity, and control, and the environmental qualities of magic, sensory exploration, and creative inventions. This middle zone of states is the zone of learning. Identifying design concepts to create an environment to facilitate the student’s arrival in this zone will increase learning while the meeting of these first steps will relieve stress factors related to school and learning failures. This leads to a set of design aims to be applied in this thesis in order to design a primary school with the intention of reducing student stress (Figure 2.08).

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Fig. 2.07. Maslow’s Hierarchy of Needs combined with Day’s State of Mind and Environmental Qualities progression. “Well-being” and “comfort” were added to provide a functional transition to physiological needs, a trustful state of mind, and an environment with integrity.

Fig. 2.08. The five design aims of this thesis in their corresponding progression to Maslow and Day’s progression of human experience.
Design Aim #1: Schools should be designed with safety and security in mind.

In today’s society, the issues revolving around school safety are often focused on exterior threats or those emerging from the students themselves. Often these strategies for safety veer towards active surveillance by cameras, metal detectors, and school guards. However, these strategies do nothing to eliminate stress related to safety and security through the actual design of the building. Today five primary strategies are encouraged to use design to improve school safety. These are providing eyes on the street, a welcoming, secure entrance, transparency, appropriate learning space configurations, and systems for safe community involvement. Passive safety is about being able to observe one’s surroundings. In other words, this means providing varied levels of access for public areas, an appropriate scale for student environments, encourage visual transparency for connectedness and informal surveillance, make the school easy-to-navigate, and facilitate areas for individual retreat. A school is not to be a place to lock students from the dangers of the outside world but to provide a refuge or retreat from often unsafe neighborhoods and home situations. The Third Teacher states it best, “Children are ready to learn only when they are safe and secure, so address those needs before considering any other aspect of a child’s environment.”

Fig. 2.09. “Put Safety Before Study.” See also CPTED principles of design.

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Design Aim #2: Slow down the pace of users to reduce stress amounts.

A straight hallway with no place for rest or removal from the flow of traffic only encourages the quick movements of travel from one destination to the next. There is no chance for positive social interactions within this model. The provision of alcoves, furniture, or choice in pathways discourages high-speed movement and places for students to pause.\(^{42}\) Both exterior and interior sequences of “expansion-contraction, distance-closeness, darkness-light, left-right, and the punctuation of turns, portals, and surface-change, progressively slow both traffic and children’s state.”\(^{43}\) The more a student has to walk through different spaces within a school, the less stress will have a hold on the student. Often this can be an effect of car or bus journey sequences to school in the morning. Changing arrival sequences into a series of slower-paced spaces encourages the release of outside stress for the student before they reach their place of learning, i.e. the classroom.

\(^{42}\) Ibid, 161.

Design Aim #3: Create schools as encouraging environments, not a series of blank walls.

Colors, sounds, physical obstacles, and cognitive challenges encourage positive learning across multiple learning styles and student abilities. We have to remember people learn best in many different ways. Children, especially, need the ability to be hands-on so they can learn by touching, manipulating, and making.\textsuperscript{44} Creating the school as sensory experience roots children in real-life; thus, encouraging a sense of safety and the mental space needed for learning.\textsuperscript{45} As noted in \textit{The Third Teacher}, “Sound, smell, taste, touch, and movement power memory. An environment rich in sensory experiences helps students to retain and retrieve what they learn.”\textsuperscript{46} Defining a student’s learning landscape within the school through these sensory bases encourages deeper learning and recollection of information. For younger students, this is imperative towards creating a comfortable school environment.

\textsuperscript{44} Cannon Design, VS Furniture, and Bruce Mau Design, \textit{The Third Teacher: 79 Ways You Can Use Design to Transform Teaching & Learning} (New York: Abrams, 2010), 175.
\textsuperscript{45} Ibid, 176.
\textsuperscript{46} Ibid, 176.
Design Aim #4: Design with varying spaces for learning from open classrooms to individual alcoves.

Facilitate student choice of activity, curriculum, and physical space to encourage motivation, self-determination and decrease the perception of the biases of others. Students of different ages require different variations in their effective learning environments. “A child’s world expands as he develops. Keep pace by providing environmental experiences that are developmentally appropriate.” A young child experiences the world close to home and gradually expands their realm of knowledge and exploration as they grow older. The same can be said for their educational experience. As a young child first in school, they spend their time learning the basics but as they grow older they approach learning through broader explorations and deeper questions.

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47 Ibid, 111.
48 Ibid, 110.
Design Aim #5: Build schools small.

Small schools typically demonstrate better academic performance, and better relationships between teacher-student and student-student interactions. The environment present in small schools creates the best ratio between the physical and social elements of the school. Small school communities encourage students to be more involved in school activities, have higher student satisfaction, lower crime instances, and less student misconduct. Small schools are more likely to become a tight knit community. Cozolino encourages smaller school sizes because it encourages primitive social instincts because it encourages greater intimacy, familiarity, and personal interactions and connections. Small schools create a more effective, less stressful, learning environment for both students and teachers.


Case Studies

Google Campus, Dublin, Ireland

In today’s current design trends, it is the office space that is embracing the need to respond to the whole picture of human needs. Businesses like Google are creating office environments aimed to promote creativity, innovation, collaboration, and personal wellness. The Google Campus Dublin by Camenzind Evolution + Henry J. Lyons Architects embraces a form of ‘functional whimsy’ in the office place. These whimsical moments create varying environments for worker interaction and individual development needs in order to improve performance. It combines elements of play with those of corporate development. Programmatic layouts and themes promote the company as a whole but also provide the necessary division of spatial characteristics. The key elements to the Google office to be incorporated in the development of a stress reducing school are: street identity, nature indoors, open floor plans with spatial distinctions, intimate and open areas, ambiance, and diversity of space.

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The Children Activity and Learning Centre at the Soneva Kiri resort was designed by 24H-Architecture to provide children with entertaining activities to teach them about ecological awareness.52 The design of the structure is a collection of rooms within rooms. The elements to adopt from this project are: vantage, texture, scale, detail, and the rooms within rooms aspect. Providing vantage to students expands their ability to feel safe and secure within their environment. Texture, scale, and detail all speak to the ability to see the space as an encouraging environment for exploration. It is child-sized and constructed from pieces that decrease the overall scale of the structure because of the smaller elements. And, the inclusion of space within space implies a sense of differing scales and differing levels of privacy within a larger space.

Public, primary schools in the State of Ohio are designed per the guidelines of the Ohio School Facilities Commission and State Architect’s Office. As such, the majority of Ohio’s public K-12 schools are constructed per the *Ohio School Design Manual* (OSDM). Other restrictions are often in place by the governing school district. Nevertheless, the greatest challenge for advancing school design is the lack of desire to take the risk to make schools that are not perpetuating an outdated typology and learning environment. In other words, the challenge in designing educational facilities is rooted in the historical language and design principles and regulations that have instilled themselves within school design.

The purpose of “the school” has historically been the education of students per the learning agenda and morals of a specific cultural time and place. In *School*, authored by Catherine Burke and Ian Grosvenor, the design of school buildings for both the exterior and interior is described as “a symbiotic relationship with ideas about childhood, education and community.” In other words, if one were to examine the history of a school in relation to the built environment, one would be able to track the changing policies and procedures of the educational institution within the walls of the school. At the same time, the exterior of the school will, in time, assist in anchoring the school within the community in which it exists. Often, the

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resources invested in a school are indicative of the value a society assigns to education. The greater the investment placed within a school, the greater the return for the community. One of the greatest challenges that exist for school districts is the maintenance of this building infrastructure. In “Building Minds, Minding Buildings: Turning Crumbling Schools into Environments for Learning” a Boston math teacher is quoted to have said the following in regards to their school conditions, “I think the conditions convey a message to the students: You are not worth the effort of providing and maintaining a good school.” Unfortunately, there are schools around the country in which poor physical environments are the norm. When a school district makes the decision to build a new school it is done with the understanding that the building will need to last for a long time. During the life of a school, it is expected there will be interior renovations and updates, changes in educational program, shifts in curricula mandated at local, state and federal levels, and changing demographics in the neighborhood surrounding the school. Yet, the physical environment often fails to adapt to best serve this changing landscape of continual shifts to the social and educational environment. Often, the social and educational shifts happen faster than the physical environment of the school can adapt to them.

Nevertheless, communities will support school improvement projects, such as Cincinnati Public Schools’ $1-billion Facilities Master Plan. In addition, an early example of this process occurred in the 1800s. During the development of Ohio’s early education system, the state commissioner “urged school directors to remind local citizens that the expense of providing a suitable school building would not recur for a generation” thus promoting the community’s monetary involvement to provide “convenient”

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and sometimes “elegant” one room schoolhouses.”55 It is these projects that show the support that exists within the community for the future of the next generation of learners.

The original design for the school in America was the one-room schoolhouse (Figure 3.01). Interestingly, it was not until recently that this model of school has disappeared from America’s school districts. According to Virginia E. McCormick in Educational Architecture in Ohio, “on the eve of World War I, half of the school children throughout the United States were enrolled in the country’s 212,000 one-room school buildings – nearly ten thousand of them in Ohio.”56 She goes on to state, “consolidation was moving rapidly and the state no longer recommended designs for one-room schools, although a few isolated examples continued in operation until after World War II.”57 By this time, schools were being built to the graded school model. Meaning, classrooms and students are separated and distinguished by their educational year, i.e. first, second, or third grades or ages 6 to 9. In terms of social landscape, the one-room schoolhouse is possibly the most integrated school type to exist within the community. While the shift to grade-based classrooms and school buildings limit the social integration that can occur between different ages of students.

56 Ibid, 32.
57 Ibid, 46.
Early schoolhouses were constructed through the power of the communities in which they served. This led to a gradual build of a network of small schoolhouses positioned within a two mile walking distance for every student.\(^{58}\) It is important for us to realize how integral these schoolhouses were to American communities. Some communities failed after their small schools closed as consolidation happened and graded schools came into being. McCormick states, “This was the price of progress, for many communities were defined by their school district boundaries.”\(^{59}\) Today, school districts like Cincinnati Public Schools are aiming to bring the school back as an integral part of the community. But success is dependent on the desire of the community to be involved and the efforts of the school to re-emerge as the center of city communities once again.

Unlike the days of the one-room schoolhouse, the larger schools of the United States have evolved to reflect the primary shifts in industry and the evolution of educational beliefs, including learning curricula. Nair, Fielding, and Lackney identify four models of school design, including their own, as part of the evolution of school architecture. In the early 20\(^{th}\) Century the school design standard became the “cells-and-bells” or “Ford” model (Figure 3.02).\(^{60}\) It is possibly the most recognizable image of the school for the majority of Americans. The function of this model of school was to quickly and efficiently move student through their education and the knowledge society and culture wanted them to absorb. This is why the model is based off Henry Ford’s

\(^{58}\) Ibid, 32.
\(^{59}\) Ibid, 46.
\(^{60}\) Prakash Nair, Randall Fielding, and Jeffery Lackney, *The Language of School Design: Design Patterns for 21\(^{st}\) Century Schools* (USA: DesignShare, 2009), 24-26.
factory production methods. This model places the teacher as the center of the classroom as the dispenser of knowledge.

The second design shows a minor evolution of the Ford Model to allow for additional learning opportunities outside the four walls of the classroom (Figure 3.03). The corridor is expanded to allow for student-directed and process-based learning to include the minor amount of importance afforded to social learning as an integral part of school design. But, this model still strongly embraces the teacher as the center of student learning.

The third model presented by Nair, Fielding, and Lackney is called the “finger plan” model (Figure 3.04). This model breaks circulation from the linear arrangement of the Ford plan to create hierarchy between primary and secondary common spaces. The classrooms become clustered destinations with a defined identity of space for students. This third model is the basis for many of the school built today. This model provides the classrooms with an Extended Learning Area (ELA) that is shared between a group of classrooms.

The final model is that of the 21st Century Model presented through Nair, Fielding, and Lackney’s patterns (Figure 3.05). The programs of the school are encouraged to blend and overlap to create a collaborative environment that assumes a student-centered approach to the learning process. In this environment, students are given free-choice to pursue the different categories of their education within a confined boundary of programs.

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61 Ibid, 26-27.
62 Ibid, 27.
63 Ibid, 198-206.
The functional program of the school has continually evolved. Instead of a room with desks, there are now a plethora of additional spatial types and functions in order to adapt to an ever changing collection of educational theories and practices. Key elements to consider that help create well-designed, well-built, well-maintained schools are:

- proper siting
- building and classroom sizes conducive to learning
- climate and region appropriate design
- adequate ventilation
- natural daylight
- acoustics
- safety and security
- integrated technology
- supportive infrastructure for special needs students and parents
- adequate staffing

These are the physical factors important to the proper functioning of the school that are important to consider in the design process. For a balanced school, designers must aim to design beyond these physical characteristics to embrace the school as a social environment. School design needs to assess classroom environments from the perspective of the perceived and actual use by students and teachers.

Fig. 3.05. 21st Century Model Overview

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As such the design must include:

- privacy
- personal space
- personalization
- social grouping
- personal meaning
- participation

The school, in many ways, needs to act like a home for the child. It should become a place where the student can face learning with an open mind and an appropriately managed amount of everyday stress. The school must be a place for the distillation of learning material through appropriate design and the right social environment which can be encouraged by specific design elements.

The typical school has a set collection of spaces present no matter the differences in curriculum, learning theory, location, or whether the school is public, private or charter. In Ohio, the design of the majority of public institutions is guided and regulated through the Ohio School Design Manual (OSDM). The OSDM denotes specific categories of spaces for school developments.

The defined spaces per the OSDM for Elementary Schools (Primary Schools) are:

- Academic Core Spaces
- Special Education Spaces
- Administrative Spaces
- Media Center Spaces
- Visual Arts Spaces
- Music Spaces
- Physical Education Spaces
- Student Dining Spaces
- Food Service Spaces
- Custodial Spaces
- Building Services

These categories of spaces are meant to facilitate a collection of activities and uses to support education. The school, as a building type, has an inherent function of learning and teaching. Initial manifestations of the school program only accounted for these three activities.

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66 Ibid, 41-44.
Understanding the extended functions and activities of the school is important to the creation of well-designed school environments. These additional functions and/or characteristics beyond learning and teaching can include:

- Community building
- Interacting
- Problem Solving
- Communicating
- Encouraging
- Observing
- Involving
- Evolving
- Displaying
- Discovering
- Developing

- Collaborating
- Studying
- Playing
- Sustaining
- Manipulating
- Exploring
- Moving
- Relating
- Cooperating
- Caring
- Socializing
- Growing
- Inviting
- Welcoming
- Transparent
- Home-like
- Flexible
- Adaptable
- Changing
- Nurturing
- Preparing

The lists above provide a basis to understanding the function of the proposed program of the school. It is important to note these represent a general feel for the building rather than denoting specific spaces. The OSDM provides a specific list of spaces with their minimum/suggested square footages. The manual also provides suggestions for spatial adjacencies. For this building type, there is a pre-programmed set of guidelines to the design of the building. The important consideration here is what will be the experiential quality and the final sequence and collection of spaces to be included in this school. The primary determinant per the OSDM is the quantity of students to be served in the school. Note the smallest school size calculated per the OSDM is 400 students at 125 square feet per student housed in a building of 50,000 total gross square feet. This total square footage is based off the square footage per student and the recommended minimums for room sizes.

The OSDM, also, provides diagrams of recommended or sample spatial adjacencies (Figure 3.05). These adjacencies present the typical experience of the user. Students, teachers, administrators, parents, volunteers, and community all experience the school environment at one time or other. However, students remain the majority user. The student experience – and by

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association, the teachers, administrators, parents, and volunteers – is a specific collection of spaces experienced day in and day out for all the days of the school year and typically 8 years of a student’s life. These spaces might be identified and described as follows:

- School identification and way-finding signage along street
- Site circulation, parking, and drop-off and pick-up functions (school buses, cars, walkers); ease of access for efficient student transfer
- Main entry; welcoming, prominent, unmistakable, secure
- Main office; secure, observing, functional, individual offices, secretary desk, filing, printing, meeting
- School commons; open, well-lit, gathering spaces, facilitate interaction
- Academic core classroom; well-lit orientation based, defined space, home-like, comfortable, place of discovery, teaching, learning, designed for children, media equipment, classroom materials and shelving
- Specials (i.e. Music, Art, Gym, Media); facilitate activities, defined function, learning, appropriate equipment and storage
- Indoor restrooms; smaller one-person restrooms, observable multi-user restrooms, ANSI regulations
- Cafeteria; cooking, serving, dining, hygiene, conversation, interaction, multi-purpose, stage, well-lit, outdoor access
- Outdoor play space; provided entertainment, jungle gym, basketball, four square, play, activity, exercise
- Extended learning spaces; classroom adjacencies, small group meetings, individualized, beyond the classroom

Additional users, like community groups, are encouraged to utilize the spaces in the school for meetings and activities during after school times. The building is programmed to serve as a Community Learning Center (CLC). These outside users would experience the building through the use of spaces open to the public. The majority of these spaces are the entry, the school...
commons, the cafeteria with multi-purpose elements (i.e. a stage), the gymnasium, the media center (commonly known as the library), and possibly the music and art rooms. The academic portion of the school would normally be cut off from use by the public.

The OSDM provides a basic guideline for the programmed spaces within a school. This thesis aims to promote the adaptation of these guidelines to include the spatial requirements needed to create stress relieving environments for the students in the school.
As much as everyday stressors affect students from every demographic background, there is a portion of the populations of our cities who are more likely to be facing challenges leading to high levels of stress. These are the students who come from the urban locations of cities, often the city core. Schools in urban locations have been labeled with the perception of poor academic performance and an inability to improve. A 1996 Report by the National Center for Education Statistics entitled “Urban Schools: The Challenge of Location and Poverty” aims to statistically analyze these perceptions. The report begins by stating:

Researchers and educators often link this perceived performance of urban youth to home and school environments that do not foster educational and economic success. Moreover, urban educators report the growing challenges of educating urban youth who are increasingly presenting problems such as poverty, limited English proficiency, family instability, and poor health. Finally, testimony and reports on the condition of urban schools feed the perception that urban students flounder in decaying, violent environments with poor resources, teachers, and curricula, and with limited opportunities.68

Poor perceptions do nothing to encourage students to learn. Students in high poverty communities face problems beyond a perception of failure that continue to press a negative outlook for those users.

Dr. Pamela Cantor has the following to say about issues facing young children as they develop academically:

Today, one in four children in the United States is growing up in poverty. Many of these children are exposed to violence, chronic insecurity, loss, hardship and disruption…They show up in the classroom in the form of traumatic stress, which has unique and often profound effects on the developing brain. Such stress causes children to be tuned out, preoccupied, impulsive, unable to concentrate, distrustful and nervous. It interferes with their ability to focus, to interact with others, to tackle rigorous academic material and progress in school successfully.69

As such, perception and reality begin to create a vicious cycle hindering students in high poverty communities from achieving academic resiliency and success. The less the students are able to focus on academic coursework, the less likely they are to succeed in future educational endeavors. In the United States today over 16.1 million people under 18 years old are living in poverty with the number on the rise.70 This is the reality for our schools today. Child poverty is on the rise and so are the factors that hinder positive academic performance. The creation of a design framework for children facing these challenges, in order to foster the release of outside stresses and thus encourage learning participation, will promote the ability of governing school bodies to understand the benefits for focused school design over the one-size fits all design strategy. And, hopefully, provide a supportive framework for beneficial learning experiences for those students within the boundaries of their community.

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Cincinnati Public Schools overall is aiming to respond to the issue of performance of academically poor students. The school district maintains “typical urban school district demographics, including 77 percent ethnic minorities, 70 percent poverty, and 20 percent students with disabilities.”71 In order to respond to this issue in relation to school design, the community in which the school sits must fit within these parameters. As a personal challenge, this thesis will be approached from the design as a response to the conditions existing in inner city communities. Figure 4.01 shows the percentage of people below the poverty line in Cincinnati’s urban core as shown by the U.S. Census Bureau. These maps indicate the greatest numbers of people in poverty to be located in central Cincinnati including the Central Business

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District (CBD), Over-the-Rhine (OTR), West End, Queensgate, Lower Price Hill, CUF, and Avondale. In these neighborhoods the average is over 40 percent of the population below the poverty line. Figure 4.02 shows the greatest percentage of people living in poverty to be north and west of the CBD. In order to keep this thesis within the inner, urban core, potential sites are narrowed to the intersection of the CBD, OTR, and West End. The census data for the neighborhood of West End shows a population below the poverty line at approximately 2,550 individuals. This is slightly larger than the approximately 2,289 individuals below the poverty line in OTR. Even the CBD hosts 877 individuals living below the poverty line. In total, these three neighborhoods are home to 5,716 individuals earning less than $23,283 per year for a family of four and $11,945 per year for an individual below age 65.

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73 Ibid. Poverty thresholds for 2012 are $23,283 per year for a family of four and $11,945 per year for an individual below age 65.

74 Ibid.

75 Ibid.
family of four and $11,945 per year for an individual below age 65. Additionally, there are 1,817 elementary aged students within these three neighborhoods. Only three Cincinnati Public Schools serve this age group within these three neighborhoods: Hays-Porter Elementary (West End), Rothenberg Preparatory Academy (OTR), and the School for Creative and Performing Arts (Citywide Magnet). Only two, specifically serve the neighborhoods in which they are situated: Hays-Porter and Rothenberg. These neighborhoods, combined, present specific design challenges to the effective ability of a school to combat student stress through the designation of a population more likely to be suffering from the ill effects stress can have on children through their high poverty levels.

The selected site is situated at the corner of Plum Street and West 9th Street. The benefits of the location of this site for a school include close proximity to cultural learning centers,
important civic locations, and the richness of the busy downtown environment. Henry and Suzanne Lennard wrote about the broken relationship between the child and the city. Cities are now designed for adults and tend to neglect the needs of their younger inhabitants. But, “children’s social and emotional development is enhanced in cities that provide a meaningful physical environment that addresses them, that stimulates their imagination and fantasy, and that provides a legible environment for them to explore and make their own.” 78 If children are able to make positive associations with their cities, they are more likely to have greater affection and loyalty to their community. 79 The learning environment has the power to introduce students to the larger centers for knowledge and growth in the city. The Central Business District Location places the school in close proximity – within a one mile radius – to Cincinnati icons like Music Hall, City Hall, the Cincinnati Museum Center at Union Terminal, the Contemporary Art Center, and the main branch of the Public Library of Cincinnati and Hamilton County. This encourages walking field trips, during which students get to experience the urban landscape, learn to navigate their city, and encourage the use of the existing resources for education the city has to offer for young students.

The site is positioned along a street with significant historical context along West 9th Street as the site is diagonal to Cincinnati City Hall and is wrapped by the 9th Street Historic District designated on 9th Street between Vine Street and Plum Street in the Central Business District. It is characterized by a cohesive assemblage of 19th and early 20th century urban architecture. It is an important representation of the 19th century “walking city” environment. 80 The built architecture represents a diverse sampling of Greek Revival, Italianate, and Queen Anne styles. 81

81 Ibid.
Primary concerns for the construction of the school include: re-establishing the street edge along the north side of West 9th Street and the east side of Plum Street, determining the best circulation for the comings and goings of students and staff, maintain an acceptable building height for the surrounding context and the building function, and integrate the school into the surrounding context through proportion response and street level scale. Providing natural light to the educational functions of the building is also a primary concern. Proper natural lighting increases student performance. According to 3D Daylight Sun studies, the site will be able to maintain significant direct sunlight access in spring through fall. In winter, specific times of day will see increased shadow lengths causing less direct sunlight to the lower levels of the building as well as decreasing the hours in the day for full contact, direct sunlight. For an urban area, the possible access to direct daylight is substantial in comparison to the center of the Central Business District. Little green-space exists in this district of downtown Cincinnati. The nearest green-spaces of substantial size are Washington Park (three blocks North), and the green-spaces
left from the demolition of the Old Laurel Home communities in the West End (two to three blocks Northwest). Smaller interventions include locations such as Garfield Park (one block Southeast).

Physical characteristics of the site itself include minimal topography change. The most noticeable shift is at Watts Alley where an existing cobblestone pathway extends north-south on the site two-thirds of the total site length east from Plum Street. Today, the site serves as two parking lots separated by Watts Alley. There is no landscaping along the northern edge of West 9th Street but there are two trees along the southern edge including further landscaping elements on the properties in the block between West 9th Street and West 8th Street. There are Cincinnati Metro Bus routes which pass the site on Elm Street, West 9th Street and Plum Street with two bus stops adjacent to the site on West 9th Street, one stop on Plum Street in front of City Hall, and two stops on Elm Street near the intersections of West Court Street and West 9th Street. Routes 1-Museum Center-Eden Park, 6-Queen City, 21-Harrison Avenue, 25X-Mt.Lookout Express, 32-Price Hill-Glenway Crossing-Delhi, 33-Western Hills-Glenway, 40X-Montana Express, 46-Avondale, 64-Glenway Crossing-Westwood, and 67-Sharonville Job Connection travel near the site.
Fig. 4.05. Existing Context Site Analysis
The top challenge for designing a school on this site is the small site footprint of approximately 38,000 square feet. By encouraging the building to remain in this small footprint, we leave options to create exterior outdoor space on grade for student and community use. The small site presents a challenge to maintain a contextually acceptable building height in order to include the appropriate educational spaces within the school, thus calling for creative solutions to spatial concerns. In addition, maintaining a lower height makes the building circulation more comfortable for younger students. The secondary challenge is providing the necessary exterior circulation for morning and evening student drop-off and pick up. Though the goal of the neighborhood school in the city core aims to promote alternative methods for student arrival, such as walking and bicycles, school buses and automobiles will remain a high probability mode of transportation thus requiring adequate circulation area. The realities of the CBD will necessitate on street drop-off and pick-up. Additional concerns include making the architecture iconic but contextual, responding to the necessary strategies to respond to child-centered design for both interior and exterior conditions, and creating a space not only welcoming to student and teacher users but parents and community members as well.
Case Studies

Bronx Charter School for the Arts, the Bronx, New York

In 2004, the Bronx Charter School for the Arts was designed by Weisz + Yoes (WXY) Architecture and is located in Bronx, New York. The school covers grades K-6 with a capacity of about 250 students. This school recognizes the benefits of the small school movement with the limited student capacity. The school was designed through the conversion of an existing factory into the school building. The main program was meant to promote the arts and community participation in a high industrial neighborhood.

The design of the school is a mix of traditional and open concepts and is integrated into the existing urban fabric at the appropriate scale. By converting an existing factory, the school was able to maintain an element of history and context that can be an important community connector. The design of the exterior façade creates a significant presence on the street front. The poor condition for this school is the lack of natural space meaning students have recess within the entry way to the school. The transformation from factory to school on the interior is best exemplified through the main hallway. The school is able to include natural daylight through the clerestory which serves to create a higher quality interior space within this high industrial area. Elements of the design that are significantly successful are the schools integration through clerestories.

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within the community context, the reuse of space, a presence on the streetscape, and the introduction of daylight into a relatively building locked site. Of course, the poor adaptation of this site exists within the lack of natural space. The small size of the school also means the school population remains within the small school population criteria.

Color tends to be an important consideration for schools at primary level. The Athens I.E.S. School, presented in Chapter One, uses bright colors on both the exterior and interior of the building in large swatches. The Bronx School distinguishes itself from the surrounding environment through the use of vertical bands of color on the front façade. Yet, the interior use of color is only applied as accents to wall openings. Either direction is valid but much is dependent on the use and learning goals behind the school vision as to which direction to take. Here we have an opportunity to create a school within the existing box that exemplifies current theories and educational aims beyond the creation of rooms and corridors the school currently uses.
The Reece School, New York City, New York

The Reece School was chartered in 1995 as a non-profit, private elementary school for special needs children, ages 5-13. These children are those who are capable of learning but face social and educational challenges that can inhibit learning. The mission of the school focuses on these specific points:

- Striving for academic excellence while recognizing learning differences in an atmosphere where all students can feel and be successful as well as develop essential academic skills and a lifelong love of learning.
- Providing a nurturing educational environment while supporting each child’s self-esteem and enhancement of social skills to ensure success in the community at large.
- Assisting students in developing self-confidence in their abilities and talents as well as pride in their accomplishments.
- Preparing students for transition to the next educational setting.

Overall, The Reece School aims to provide an individualized educational plan for students who face challenges to learning. In doing so, the school provides an early framework for students to improve their chances later in life by creating a highly supportive environment that diminishes the effect of the students’ obstacles to learning.

The new school building was completed in 2006 and designed by Platt Byard Dovell White Architects. The school was designed with its special program in mind. The colored panes in the window bring large swatches of color into the building. The small site required the building to extend vertically 5 stories.

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84 Ibid.
The school holds 12 classrooms, 8 quiet rooms, special use classrooms, a gymnasium, student library, occupational therapy, speech therapy, and spaces for school psychologists and counselors.\(^6\) The architectural design of the school inserts itself within the existing context through the combination of brick and southern glazing. The school exists in a small school format, and color is used to provide interest within the front façade. In general, the school does much to improve the cognitive abilities of its students and the new school building provides the necessary space for this specialized, small program.

\(^6\) Ibid.
CHAPTER FIVE
Design Conjecture

The design of the school is based on five assumptions and five design aims. The Ninth Street School focuses on providing an environment for students to exercise free choice within their curriculum, to work in small groups or individually, and most importantly, to feel safe and secure within the learning environment. To recap, the five assumptions of this thesis are:

- School buildings influence student academic performance.
- School architecture should encourage learning through exploration.
- The design of a responsive school is influenced by the user.
- The architect is responsible for all realms of human experience.
- Schools should be specifically designed to reduce student stress levels.

These assumptions are focused on what the design of the school building can do to meet the learning needs of the school’s students. The assumptions maintain a generalized perception of the school environment in order to lead to the specific design aims suitable to provide an environment aimed at stress relief for student. The five design aims of this thesis are:

- Schools should be designed with safety and security in mind.
- Slow down the pace of users to reduce stress amounts.
- Create schools as encouraging environments, not a series of blank walls.
- Design with varying spaces for learning from open classrooms to individual alcoves.
- Build schools small.

These design aims provide the necessary base for the design of the school in order to create an environment that has the potential to allow for relief from the stresses of childhood. The following represents the thought process leading to the design of the final project. It is not a depiction of a final solution but rather an illustration of the on-going design process and design implications based on the research presented in this thesis. The elements of the architecture will be explained per the reactions to site, volume, and detail for the clarity of explaining the architectural design to date.
The primary premise of the school is based on a non-graded learning system. This method requires students to learn through the completion of standards at a pace acceptable to the student. Students change classroom location based on their age groups: 4-7 years, 7-10 years, and 10-13 years old. A student’s success in their academics is based on the student’s ability to complete educational standards while being guided by the teachers. This allows for the learning bases for the age groupings to be designed to respond to the needs of the students.

A student in the 4-7 years age range requires a single volume space with all subjects within a single boundary. This boundary maintains a defined distinction between the “home base” or classroom with the school proper. Students at this age benefit from insular and inner-focused learning environments.

Students in the 7-10 years range are allowed a more permeable boundary and more distinction between subject bases. This allows for a greater degree of choice for students to choose their workspace. It becomes a multi-subject space with defined individual subject spaces about a core meeting space. Learning is smaller group oriented.

Finally, the 10-13 year old student group is given the greatest range of freedom of learning through open access to resources in defined subject areas. The bases for the students exist as smaller individual-centered spaces but the teachers require the ability to group the students together for larger lessons and meetings. The focus for students in this age range is to personally develop their learning experience.
Site

To reiterate, the site for the school is located within the Central Business District of Cincinnati at the corner of Plum Street and West 9th Street. The school is meant to be neighborhood-centered; meaning the students who will be allowed attendance to the school should come from within a one mile radius. The one mile radius maintains the West End, Over-the-Rhine, and the Central Business District as the central source for the student population. This notion responds to the strategy iterated in *The Third Teacher*. The strategy, “build close to home,” promotes the notions of a walkable community as well as a close tie between the school and the neighborhood.87 One of the potential sources for everyday stress for students is the trip to school and – whether by bus, automobile, biking or walking – the possibility is high for this morning trip to trigger stress in the student before reaching the school grounds. Building within the students’ neighborhood decreases the time in which students face travel stresses before they reach the learning environment.

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The current design encompasses the entirety of the site footprint heading east from Plum Street. The school has two defined entrances for student access. The primary entrance, with access to the main school office, is off West 9th Street. This entrance serves to allow daytime access to the school for parents and volunteers as well as other guests while school is in session. This responds to the strategy to “put safety before study.” Some of the strategies for expressing safety in design include items such as perimeter legibility, defined permeability, and informal surveillance. These strategies encourage the user to be aware of their surroundings but provide the safe barrier needed to shield students enough to feel safe but allow for the appropriate community access to the interior spaces. The two entrances to the building for students allow for student access along West 9th Street and Richmond Street but only access from West 9th Street during the day. Students have a right to feel safe and secure within their learning environments.

Because the footprint of the school encompasses the entirety of the site, areas such as gardens and play space required a different program strategy in comparison to the traditional location beside the school. For this we “take the ‘ground’ out of ‘playground’” and move these spaces to indoor atriums and the roof of the school structure. This strategy allows the building to encompass the maximum footprint of the site. It also

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88 Ibid, 35.
89 Ibid, 93.
allows for the maximum use of the building’s surfaces with the minimum loss of usable site area because we do not have to include the exterior play space at street level.

The final item to be discussed as part of site considerations is to “let the sunshine in.” The Third Teacher informs us of the trends of school design where the interior focused school were being designed to keep the exterior world out of the school and thus limiting the amount of natural light available to students. This has since been proven to be a detriment to student performance in academics. Increasing daylight decreases absenteeism and improves test performances. Designing for daylight in an urban location poses a sensible amount of difficulty. Directly adjacent buildings as well as taller buildings at further distances can all cause possible daylight access issues. Fortunately, site selection has provided a site with closely adjacent buildings maintaining heights with little over shading of the school building.

Fig. 5.08. Context Elevation Analysis: South side, West Ninth Street.

Fig. 5.08a. Proposed Building South Elevation. Exterior façade of panelized system and glass brick.

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90 Ibid, 47.
91 Ibid, 47.
92 Ibid, 47.
Volume

The school is sited to respond to the urban context in which the building sits. The school is designed to house the three age ranges on five levels. In responding to the site context the school levels are defined by a ground floor of 18 feet till the second floor with the second and third floors maintaining a 16 feet height between the two to correspond to the corner building at the south east corner of the intersection of West 9th Street and Plum Street. In the central volume of the building there is a depression of 13 feet to provide the necessary height volume for the half-gymnasium and the necessary space to provide a designated auditorium. Finally, as the play space is on the roof, significant boundaries are required to protect students. Minimum requirements for this height range between 10 to 12 feet height in safety guards. This maintains an acceptable height for the school in relation to the surrounding context.

The main concern for the volume of the school is the treatment of the maximum volume across the full footprint. The interior volume is broken by two corresponding atrium courtyards around a central circulation volume with similar characteristics to the Activision|Blizzard Headquarters in Santa Monica, California designed by REX in 2013. The main goals for the project were to increase collaboration, community, and creativity. REX accomplished this through the creation of a collaborative nucleus that serves as the host to the new programmatic functions as well as the new central circulation for the building.

94 Ibid.
The design of the nucleus allows for the inclusion of many spaces integrated with the vertical circulation path. The vertical circulation allows for the structure of the nucleus to be integrated within the nucleus and along the outside edges. This allows for the collection of vertical and horizontal pathways of this nucleus to act as folded planes of programmatic space. This allows for structure, circulation, and program to combine to create a unit of space designed to encourage office development.

A similar strategy is employed in the design of the central space of the school volume. This volume contains the combined functions of art, music, science, fitness, media, presentation, and dining. Here the central learning hub holds the combined programmatic function of the educational disciplines outside the students' usual home base. The more connected the disciplines, the more opportunities are available for students to learn through exploration. This space serves a greater purpose for the older age groups of 7-10 and 10-13 years but allows for the younger students to observe the older students and incite curiosity.

**Detail**

The details of the school are numerous. It is important for the design of the interior and exterior of the building promote a complete human experience. This includes items to involve the senses or to create a pleasant feeling in the learning environment. It is important to develop a level of layering and dimension within the materials, lighting, and coloring of the school.

The significance of this is within the first impression a student makes of the learning environment. This is often
incited by the initial experience of the exterior of the school. The design of the exterior of the school is defined by the two-thirds: one-third ratio between the core space for the home-bases and the central learning hub, respectively. The home-bases are characterized by a panelized system with the necessary inclusion of gaps for glazing penetrations as based on the Barnes Foundation by Tod Williams Billie Tsien Architects (TWBTA)\textsuperscript{95} and the Global Center for Health Innovation by LMN Architects.\textsuperscript{96}

The Barnes Foundation in Philadelphia, Pennsylvania is characterized by a horizontally oriented collection of shifting panels. These panels shift to allow larger gaps between the panels themselves as well as providing the necessary cuts to open for penetrations of doors and windows. For the design of the school, this system is combined with the system of shifting vertical panels of the Global Center for Health Innovation in Cleveland, Ohio. The exterior is designed to pull the panels off the ground to provide the greatest amount of transparency along the street in its urban location. The mass of panels is broken by the changing of panel heights vertically to open the exterior façade at the corners and decrease exposure towards the central atrium. The central atrium space is open with a large curtain wall serving to introduce daylighting to the building. For the design of the school, the exposure of the first level opens up the transparency along the street front as well as the ability to observe passers-by. Panel sizes will be changed to


open up for window penetrations. These will be placed per the necessary considerations for the functions beyond in the home base spaces.

Lastly, the central learning hub, first level, and roof boundary is designed to emulate the glass brick system present at the Optical Glass House by Hiroshi Nakamura & NAP. The Optical Glass House’s, located in Hiroshima, Japan, main feature is a 28 feet by 28 feet façade of 6,000, 2 inch by 9.25 inch by 2 in, pure glass block units. The glass blocks are supported by a pre-tensioned steel beam cast with concrete after the 13 tons of the glass brick façade was applied in order to minimize the size of the structure. The entire wall is suspended from the beam by stainless steel bolts on which the bricks were threaded with stainless steel flat bars. The effect is a shimmering wall of glass bricks that reflect the surrounding context when hit with the sun and a correct angle of viewing during the daytime. As well as a crisscross effect of light on the adjacent solid wall surface. And, at night, the glass bricks allow artificial light to filter out of the building and reveal the shapes visible on the interior. The effect is a calming oasis that both shields and reveals the exterior and interior worlds of the architecture depending on the time of day and the ambient daylight conditions.

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98 Ibid.
99 Ibid.
CONCLUDING REMARKS

Everyday stress is a perceived part of everyday life. Unfortunately, stress can become a hazard to the ability for students to absorb academic learning. As architects and designers we have a duty to understand the effect or lack of effect our buildings can have on the user. Currently, trends for primary school design rarely account for psychological effects in students caused by exterior stressors because we, adults, have a difficult time seeing children as being affected by stress. Designers and architects can encourage positive experiences for students as they learn by creating responsive educational environments. To conclude, Christopher Day asks the question, “What should schools say?” and the teachers answered:

I’m welcoming to parents, strangers, but still a school.
The school is worthy of professional respect.
I respect each stage of a child’s growth.
Growing up is fun.
Children’s work and play is as important as adults…

I am magically intriguing, secure – but community-enmeshed.
I will lead you from imagination to inspiration.
I am multilayered, from community-welcoming and active to protected,
   enchanted and reverently sacred.
I rise to an island of magic, lovingly valued.100

So ask yourself, “What should schools say?” Ask what the school says to the students, teachers, administrators, parents, volunteers, and community. Then ask, “What do your users experience?” Is it positive or negative, joyful or painful, fun or serious? Ask if the school will function beyond education to embrace what it means to learn and explore. If the school responds well to the needs of the user, then the architecture of the building will serve to decrease student stress in the learning environment.


**Case Studies**


**Primary School Design Research**


**Stress Research**


