Learning Environments:
Design Solutions for Elementary Schools

Jenny Oi Wah Lei
May 2011

Submitted towards the fulfillment of the requirements for the Doctor of Architecture Degree.

School of Architecture
University of Hawaiʻi

Doctorate Project Committee
Pu Miao, Chairperson
Geoffrey Lewis
Dak Kopec

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We certify that we have read this Doctorate Project and that, in our opinion, it is satisfactory in scope and quality in fulfillment as a Doctorate Project for the degree of Doctor of Architecture in the School of Architecture, University of Hawaiʻi at Mānoa.

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Geoffrey Lewis

Dak Kopec

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ABSTRACT

Children start to acquire physical, cognitive, and psychosocial skills during their attendance in elementary school, which ultimately influences their academic achievement. With a great amount of time spent in school, they quickly learn and are stimulated by the spaces designed for them. Knowledge and skills obtained during childhood affect their overall health and are eventually carried into adulthood.

Historically, the evolution of learning environments was influenced by innovations of designers. The effects the spaces had on education and the well being of the children, however, was not considered in school designs until more recently. Although many parts of the world are beginning to incorporate new ideas to develop and enhance the skills of the children, studies have shown that designs which decrease productivity and progress can still be found in schools today. Because of this, there is a great need for change.

The study of the history of schools will determine common design issues while analyzing new innovations will establish ideas that would enhance the necessary skills for children as well as support the changes of modern day schools. Information on how children develop and methods of teaching will be used as a guide in understanding what spaces are appropriate for development in the schools of today and the future. The information gathered from this research can be used as a starting point for designs of new schools.

The purpose of this study is to create awareness of reoccurring issues in elementary school designs and to inspire creative thinking for new ideas that support and enhance the growth and development of children. The innovative ideas that have emerged should be seen as alternatives to traditional school designs and not as the only solution for new schools. Information acquired does not apply to all learning environments but instead should be altered, manipulated, and applied on a case by case basis.

INTRODUCTION

Elementary schools are educational settings required for the first 4 to 10 years of a child's formal education. In this stage in life, children not only begin their academic journey but also grow physically, cognitively, and psychosocially. It is predicted that children develop through a sequence of steps and milestones, where the skills acquired at a young age would improve over time. Their growth, however, is greatly influenced by factors of the environment and the experiences they have in them. A setting not suitable for a child's development would impact their progress and performance of certain skills. As a result, it would not only affect their academic growth, but also their future capabilities as an adult.

During this critical moment, it is essential to understand how a child grows and how spaces influence their development. Majority of the time, designers create environments appropriate for adults, but educational settings should be designed from a child's perspective, promoting positive growth and fulfilling their needs. In the past, school designs often followed a strict set of requirements, leaving no room for innovation and creativity. Overtime, studies have shown that not only is the academic curriculum important, but also the environment where the teaching and learning takes place impacts a child's developmental progress.

Compared to traditional schools, the academic curriculum and teaching methods today have drastically changed. Technology is also playing a big role in a child's development and learning environments. It is clear that conventional schools were designed poorly and have negative impact on child development, but studies have shown that these schools still exist today. There is a need for change and new ideas. It is critical that solutions for today's schools no longer repeat old mistakes. Innovative ideas for elementary school designs are slowly emerging with designers understanding the important elements of learning environments that enhance the growth and development of the children.

With an understanding of the problems of past and present day schools, a set of new ideas have come about that contrast traditional schools in design. They not only support the modern teaching methods, that fulfill the changed academic curriculum, but they also enhance and improve the skills of the children. These innovations should be incorporated into new schools today:

1. Integration of Technology
2. Flexible Furniture
3. Transformable Classrooms
4. Multi-Functional Hallways
5. Outdoor Learning Spaces
6. Small Eating Areas
7. Challenging Playgrounds

These solutions were developed to prevent reoccurring problems and to improve development of the children in elementary schools. They start with factors that affect all spaces, which are technology and furniture. With an understanding of their impact, they can be integrated into all learning spaces in the school. Specific solutions to spaces of the schools begin with the classrooms, where majority of the school day is spent, to the hallways, which are occupied often, to outdoor spaces available on the site, that can be occupied for learning, to the places for eating lunch, and finally, to the larger areas of the site, the playgrounds. By considering these ideas in the design of new elementary schools, children will be able to acquire, develop, and be proficient in the necessary skills to progress into their next stage in life.

"The architect who designs a school building cannot think only in terms of shelter, or blueprints, or brick and stone and steel. [The architect] must think about the individuals who will use the building. [The architect] must think about the job the building should help to do: the full development of all of each student's potentials. If the architect keeps these things in mind, he may be able to contribute . . . to the achievement of the educator's goals . . . by creating a building that is a tool for the teacher and an expression of the school's educational approach . . . by creating an atmosphere, a mood, to aid the student in every learning task set before him . . . by making the school a place the student looks forward to entering, and one he regrets leaving."[1]

PURPOSE

The goal of this study is to determine the problems in school design of the past and present that negatively affect the development and growth of children in elementary schools. Knowing the issues will encourage innovations from designers for new and future schools. Ideas and information that have emerged from this study indicate solutions that are recommended. These ideas should be altered, manipulated, and applied to reflect the location, school mission, program requirements as well as support the new teaching trends, learning process, and modern technology. They should not be seen as the only solutions for new school designs.

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[1] Perkins, L. Bradford. *Elementary and Secondary Schools*. New York: J. Wiley & Sons, 2001.

SUMMARY OF CHAPTERS

01 | Physical, Cognitive, & Psychosocial Development

A study of how children develop physically, cognitively, and psychosocially is necessary because it will give designers ideas of what spaces to create to enhance their growth. Another study of how teachers instruct their classes and whether or not their methods improve children development is also needed. Although designers are unable to control the activities that occur in the spaces they create, understanding the users' points of view will influence design decisions for creating positive and influential learning environments.

02 | Evolution of Learning Environments

Knowing the history of learning environments advises designers about past mistakes and problems that should be prevented in new and future schools. This includes traditional, non-effective teaching methods that generated poorly designed spaces, which in turn, negatively affected the development of children.

03 | Integration of Technology

Technology has been incorporated into schools for over a century. Although the experimentation with film, radio, and television for teaching was successful when they were first introduced, they created passive learning environments that can no longer be applied in modern day schools. New technologies like computers, wireless internet, and other portable devices, on the other hand, has changed the process of teaching and learning completely, which encourages participation in active learning environments. Integrating new technologies into schools improves efficiency and productivity.

04 | Flexible Furniture

In schools, the teaching methods impact the learning processes, which in turn, influence classroom layouts and arrangements. Teachers having full control of students in traditional schools resulted in furniture bolted to the floor. Contrasting the past, modern day schools promote individual as well as group activities, which require movement and reconfiguration of furniture. The standard "one-size-fits-all" pieces can no longer be used to support these changes. Flexible furniture that supports ergonomics not only accommodates the different activities, but they also improve the health and well-being of the users.

05 | Transformable Classrooms

Unlike middle and high school, where students move from one classroom to the next to learn the contents of various subjects, all subjects taught in elementary school happen in one classroom, excluding physical education. Traditional school designs were inflexible internally which made it difficult for teachers to effectively teach these subjects and as a result, affected the cognitive growth of the students. With transformable classrooms, spaces can be manipulated to support the different lesson plans and could accommodate future changes as well.

06 | Multi-Functional Hallways

Hallway spaces of traditional schools make up 30% of the total square footage. With budgets and rising cost and scarcity of land, new schools cannot continue building double-loaded corridors that only function as circulation spaces. Multi-functional hallways, both indoors and outdoors, can be used for individual and group activities before, during, and after school. With this idea, all spaces of the school are in good use and not wasted.

07 | Outdoor Learning Spaces

Creating indoor-outdoor visual connections is an idea that allows students to ease their eyes from long hours of looking at the board and reading notebooks, textbooks, and computers. Providing exterior learning spaces, on the other hand, allows the body to be in the relaxing and stress reducing natural environments. At the same time, they can also be used for learning and other activities.

08 | Small Eating Areas

Large cafeterias in traditional schools are unsafe and unhealthy for students and other users. The tables and seats were designed for quick cleaning, without the users' needs in mind. Aside of dining, this big space is empty unless used for performances, presentations, or meetings. By incorporating smaller eating areas, students, faculty, and the community can occupy the spaces for individual or collaborative work before, during, and after school, making this place serve multiple purposes.

09 | Challenging Playgrounds

School playgrounds have gone through many changes in the last century. Fun and exciting spaces were once available for children to develop their physical and psychosocial skills, but the constant reports of injuries have caused these playgrounds to be redesigned into boring play spaces. Children are now safer, but they are longer having fun and are not developing the necessary skills. With the right funds, providing challenging, age appropriate play equipments for children of all age groups can be brought back to schools, which can make recess fun again.

10 | Other Considerations

Although there are new solutions to school designs such as the integration of technology, flexible furniture, transformable classrooms, multi-functional hallways, outdoor learning spaces, small eating areas, and challenging playgrounds, there are other factors in schools that need to be considered by designers. This includes the overall school design, characteristics of the site, school's connection with the community, design of the main entrance, and issues with crowding and wayfinding.

01 | PHYSICAL, COGNITIVE, & PSYCHOSOCIAL DEVELOPMENT

01.1 DEVELOPMENTAL PROCESS OF CHILDREN

As designers, it is important to recognize the needs of the clients. In the case of elementary schools, it is essential to understand how children develop during their first 4 to 10 years of formal education because many skills are acquired during this time. Each child physically, cognitively, and psychosocially grows and progresses at their own rate but generally, there are certain tasks and abilities that they should be able to perform during the different developmental stages in their life. With knowledge of this information, designers can generate design ideas that enhance the necessary skills of the children.

01.2 DEFINITION OF TERMS

Physical Development: There are various definitions to this term but in general, physical development refers to specific physical changes that occur during a person's 8 stages of life: infancy, early childhood, middle childhood, late childhood, adolescence, early adulthood, middle age, and old age. The changes that occur at each stage affect their cognitive and psychosocial development.

Cognitive Development: Developed by Jean Piaget, a Swiss developmental psychologist, this theory is divided into 4 stages within the time of birth to adolescence, which refers to the acquisition of the ability to solve problems and reason.

Psychosocial Development: This theory is divided into the same 8 stages as physical development and refers to the psychological and social development of a person, developed by a German developmental psychologist, Erik Erikson. In every stage, a person faces psychological conflict and in order to progress, they must be able to resolve them.

> "As children develop physically, gaining psychomotor control and increased brain function, they become more sophisticated cognitively – that is, more adept at thinking about and acting upon their environment. These physical and cognitive changes, in turn, allow them to develop psychosocially, forming individual identities and relating effectively and appropriately with other people."[2]

01.3 PHYSICAL DEVELOPMENT

On average, children will physically grow 2 to 2.5 inches in height and gain about 7 pounds every year. Along with physical growth, basic motor skills are also attained, developed, and improved over time with practice. Children are physically active and start to perform simple tasks including hopping, swinging, and skipping to more complex activities such as kicking a ball while running or spinning while jumping. They are able to use utensils, including the fork and spoon, as well as write the alphabets and draw geometric shapes. Hygienic tasks such as bathing, brushing teeth, and using the toilet are learned and eventually can be performed on their own.[3] A child's actual skill level, however, depends on the amount of physical activity that is experienced. It has been proven that inactive children mature slower than those who participate in physical activities. Research has also shown that physical activities make bones and muscles stronger and improve strength and balance. Students who exercise outperform those living sedentary lifestyles in many tests including long term memory, reasoning, attention, and problem solving. Those

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[2] "Physical, Cognitive & Psychosocial Development | LIVESTRONG.COM." LIVESTRONG.COM - Lose Weight & Get Fit with Diet, Nutrition & Fitness Tools. http://www.livestrong.com/article/225024-physical-cognitive-psychosocial-development/ (accessed January 20, 2010).
[3] "Child Development Tracker: Developmental Milestones | PBS Parents." PBS. http://www.pbs.org/parents/childdevelopmenttracker/index.html (accessed January 20, 2010).

who are inactive respond slower because they are unable to concentrate or remember materials that were previously learned to solve new problems.

01.4 COGNITIVE DEVELOPMENT

As children develop their physical abilities, studies have shown that the amount of activity actually impacts their cognitive skills. During this period in their life, students obtain basic reading, writing, and math skills. They learn to read and make sense of words and do simple addition and subtraction as early as age 4. They can compose sentences with correct spelling and when they reach third or fourth grade, they start to read paragraphs, understand the content, and eventually are able to form their own paragraphs. During this time, it is common for children to have "make believe" or imaginative thinking that eventually evolves into more mature thinking. Strategic and word games are also enjoyed within this age group and they help to improve their cognitive and language skills. These skills are usually fully developed at the age of 9 or 10 with the exception of problem solving. Problem solving is more difficult because it requires abstract thinking, which is a skill that is usually obtained in a later developmental stage.[4]

Dr. Antronette Yancy, a physician-scientist who studied the effects of physical activity on developing minds, stated that "Kids pay better attention to their subjects when they've been active. Kids are less likely to be disruptive in terms of their classroom behavior when they're active. Kids feel better about themselves, have higher self-esteem, less depression, and less anxiety. All of these things can impair academic performance and attentiveness." This proved to be true when a study was done on children who jogged 30 minutes 2 to 3 times a week for 12 weeks. They all outperformed their pre-jogging test scores dramatically.[5]

01.5 PSYCHOSOCIAL DEVELOPMENT

The psychosocial characteristics of children in elementary school consist mainly of throwing temper tantrums and talking back to parents. They face the challenge of dealing with their emotions and often try to test the authority of their parents. As they get older, they become more independent, have better control over their emotions, and are more aware of their acceptance and belonging amongst their peers. They also learn how to interact with others including their teachers and classmates, which expands their social skills. Girls are typically able to articulate their thoughts while boys hold in their feelings and are more expressive physically.

Children learn from their surroundings at a very young age. In school, the quality of their education is affected by the relationships they have with the other students and their teachers. If a child feels unsafe or misunderstood by the teacher, they will isolate themselves and this affects their ability to learn. A teacher being able to connect with a child is a way of allowing that child to perform well academically. In order for this to happen, smaller, more intimate schools are recommended because it gives the teacher the ability to recognize each individual's learning progress, which makes performance tracking a lot easier. Knowing if a child understands or is confused can be valuable for the teachers because they can learn if the materials taught are effectively being transferred to their students.

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[4] "Cognitive development in the school-age child (ages 6 to 10 years) - ." Revolution Health - Start your Revolution - Revolution Health. http://www.revolutionhealth.com/healthy-living/parenting/school-age-kids/development-milestones/cognitive-development (accessed January 20, 2010).
[5] Medina, John, Richard W. Stevenson, and Mark Pearson. *Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School*. Seattle, Wash.: Pear Press, 2008.

Not only is the relationship between the students and their teachers significant, their relationship with their classmates is just as important. Boys and girls at the age of 10 begin to show distinctive patterns based on their interactions with one another, especially with those of the same-sex. A positive relationship between girls is determined by how they communicate. When they talk, they are intimate and make eye contact. A "best friend" is determined based on the subject that is in discussion, usually secrets. The closeness of the relationships also depends on the amount of information being shared. Boys, on the other hand, perform physical activities together to build relationships and are less verbal.

It is crucial that children develop their psychosocial skills during this time because those who are isolated socially at a young age are emotionally unstable and are often stressed. They feel that they are helpless and have no control over situations. Lack of relationships affects performance and behavior. For example, math achievement is poor and language processing is inefficient. Their memories are also weak and they are unable to concentrate well, which affects the skills needed to excel in school.[6]

Figure 01.01

PHYSICAL, EMOTIONAL, & SOCIAL DEVELOPMENT (AGE 3 TO 11)

Age	Physical	Emotional	Social
3-5	•Body growth slows, more adult proportions develop. •At 6, neural development 90% complete. •From 4 to 8 years, lymphoid development increases from 40% to 90%. •Most children farsighted. •Muscle development begins at 4 years, but larger muscles dominate.	•Tend to fear imaginary or anticipated dangers. •Crying and tantrums diminish, anger can be expressed in words (often by threatening or yelling). •Anger directed at cause of frustration, retained for longer periods of time, but 4-year-olds begin to seek ways to hide it from others. •Channeling anger and frustration is important.	•Begin to understand concept of taking turns and tend to imitate adults. •4-year-olds prefer to spend time playing and cooperating with others and can pick up social cues from surroundings. •5-year-olds prefer to play with others. •May create imaginary playmates if deprived of contact with other children, but most will outgrow these playmates by age 5.
6-8	•Apparent difference between growth rate of girls and boys (girls closer to end growth states, boys taller and heavier). •Nearsightedness may begin to develop at 8 years. •6-year-olds use whole bodies for activities and large muscles are more developed, 7-year-olds more cautious and show ease with fine motor skills, 8-year-olds develop fine motor skills and increased attention spans. •Nervous habits begin to appear at age 7.	•6-year-olds begin to assert independence and demonstrate confidence. •6-year-olds fear the supernatural. •7-year-olds are more stable, narcissistic, polite, responsive, empathetic, less aggressive and can draw connections between cause and effect. •8-year-olds demonstrate greater independence, vacillate between moods, and begin to sense how others feel toward them. •7- and 8-year-olds discover some of their limitations and may hesitate to try new t asks, but 8-year-olds seek to create an external image of competence and confidence.	•Family influence decreases, peers are more important, teachers become authority figures. •6-year-olds have many internal conflicts, resulting in capriciousness. •6-year-olds choose playmates on qualities of age and size (not gender or ethnicity), 7-year-olds are more aware of social status or ethnicity differences among themselves. •7-year-olds are self-critical and often disassociate themselves from frustrations. •7-year-olds are well mannered unless bored, 8-year-olds are more developed socially. •7-year-olds are more conscious of position among peers; boys and girls play separately. •8-year-olds prefer company and approval of peers, and exhibit more self-control and modesty.
9-11	•More resistance to disease. •Steady increases in body measurements: height and weight (girls more than boys), and muscle growth. •Have fine motor skills. • May feel uncomfortable with scrutiny. •Many girls begin showing signs of puberty.	•Fear exclusion from peers. •Prone to outbursts but try to control them. •10-year-olds mild tempered, seek reassurance from others, anger comes and goes quickly. •10-year-olds most afraid of heights and dark. •11-year-olds fear school, friends, for parents' welfare, strange animals, threatening world events; are more easily angered, often resulting in physical violence, but can control outbursts more appropriately.	•Socialize in exclusive groups with own sex (boys' groups gravitate toward bravado and competition, and girls' are well structured and more concerned with maturity. •Develop important individual friendship, which are often fluid. •Ties to family less important than ties to peers; adult shortcomings looked at critically, often leading to conflicts.

01.6 EFFECTS OF TEACHING ON LEARNING

Although designers are able to create spaces for specific functions, how they are actually occupied by the users is beyond their control. Understanding what skills children should acquire by a specific age is one factor to consider during the design process. Identifying the methods of teaching and how it affects the

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[6] "Middle Childhood Development - iVillage Your Total Health." iVillage Your Total Health Home - iVillage Your Total Health. http://yourtotalhealth.ivillage.com/middle-childhood-development.html?pageNum=1#1 (accessed January 20, 2010).

developmental progress is another. Both sets of users play important roles in inspiring innovative designs for child development.

Starting from birth, children are curious of their surroundings. With their fascination of the environment, experimenting and exploring occurs, which allows them to discover and learn. Dr. John Medina, a developmental molecular biologist, stated that "Discovery brings joy. Exploration creates the need for more discovery so that more joy can be experienced." When a child understands a subject, it helps them become experts in that subject, enhancing their confidence. With confidence, they are able to take intellectual risks. Although sometimes influenced by their social and emotional state, how materials are being transferred to a child and how they absorb and retain the information has the biggest impact on their learning process. Something that is unusual, unpredictable, or distinctive can attract attention for a child. The more focus the brain gets, the better the information is absorbed and retained, which results in better learning. The problem with current school system is its inability to capture and maintain the attention of the students. Studies have shown that people usually forget 90% of the information learned in class within 30 days, where majority of it is lost during the first few hours after class. This occurs because information given out to students is taught by "experts" who are familiar with the topics. Oftentimes, teachers transmit too much information at once and students are not given enough time to absorb and understand the materials. Teachers need to remember that they are transferring information to beginners and the brain needs breaks to maintain them.

As a teacher, it is important that the information being taught is interesting enough for the students to maintain their attention. The best way for learning to occur is to have an appealing introduction that summarizes the general subject along with a "hook" that enhances the learning process with real life examples. The most effective way for such learning depends on how the human senses are stimulated, which are affected by the types of media that are used. The more senses impacted, the better the children learn. Studies have shown that students learn when their hearing and vision senses are triggered. When information is presented orally, only 10% is remembered during tests. When there are pictures added, on the other hand, 65% of the information is obtained. It is believed that the sense of sight is the best tool for learning anything. Smell can also be incorporated during tests to bring back information that was transferred when the smell was first introduced.[7]

01.7 CONCLUSION

"It is clear that most school architecture tends to look at spaces in a linear way – that
means we first decide what the space would be used for and then we design the space
for that activity. This kind of thinking ignores the complexity and research about the
human brain and human experience, resulting in the design of static spaces that inhibit
learning."[8]

With a better understanding of how children develop, what tasks they should be able to accomplish, and knowledge on modern teaching strategies, designers can generate innovative ideas for effective, long lasting schools that promote learning and development. It is essential that the design ideas enhance the physical, cognitive, and psychosocial skills of the children because the skills they acquire at this age affect their achievements and abilities as adults in the future.

[7] Medina, John, Richard W. Stevenson, and Mark Pearson. *Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School*. Seattle, Wash.: Pear Press, 2008.
[8] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.

02 | EVOLUTION OF LEARNING ENVIRONMENTS

02.1 HISTORY OF SCHOOLS

In the past, many factors have influenced the evolution of architectural forms and layouts of schools around the world. This includes, for example, the availability of land, the shift in enrollment, the addition of new activities, and the change in instructional methods. Whatever the reasons may be, understanding the evolution of learning environments can inform designers of problematic as well as successful ideas of traditional schools. Knowing the history of schools in the United States, United Kingdom, and Japan will show designers what ideas should be prevented or provided in the designs of new and future schools.
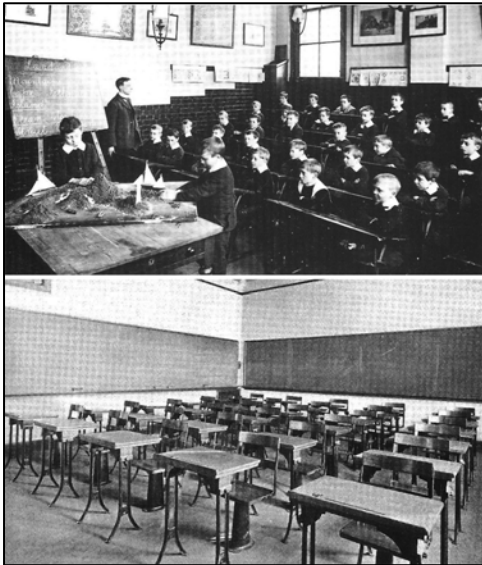
02.2 SCHOOLS IN THE UNITED STATES

Figure 02.01

In the mid 19th century, schools were highly formalized and designed hierarchically, where students were organized in groups based on their eligibility to move to a higher level. As a response to rising land costs, schools were usually located on small sites. Organized by grade level, each classroom had an average of 50 students. Desks and chairs were laid out in rows and columns and were bolted to the floor. They were designed this way so the teacher could have strict control of the students and the setting. Although this setup was simple, it was not beneficial for the children because it was inflexible for different methods of teaching and activities. Space availability became a big issue when population grew, sometimes increasing class sizes to 100 students per class.
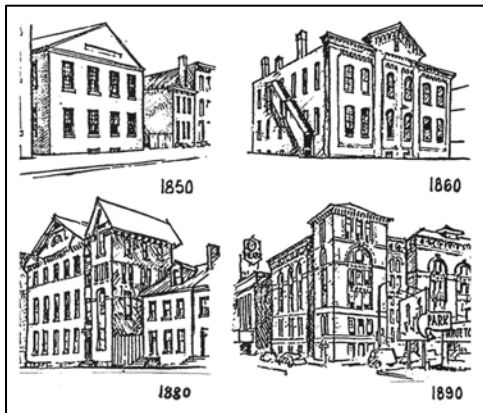
Figure 02.02

Frequent features on the exteriors of the schools during this time included classical designs with pediments, temple fronts, brick walls, axial plans, and pitched roofs. Being on small sites, schools were usually in single structures that were 2 to 4 storeys tall. Because of the lack of site space, they typically had no landscaping, parking, or playgrounds. On the interiors, many consisted of only classrooms and corridors. There was no room for other spaces such as offices or bathrooms.
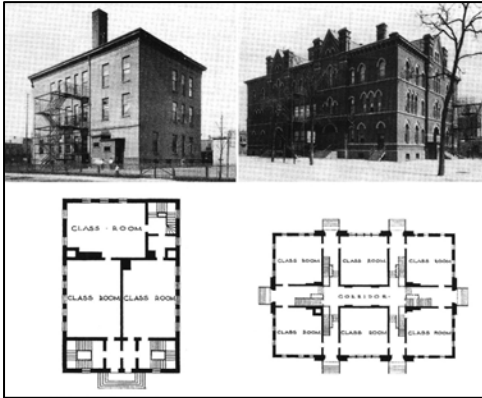
Figure 02.03

Although schools with classrooms and corridors were common during this time, some disregarded the corridors completely and had classrooms and stairs in cube buildings. Each classroom had its own entrances, exits, and stairs. Others that contrasted the typical design included Gothic style buildings with complicated stairs and corridors. Schools that followed these two sets of designs made entering and exiting confusing and problematic for the occupants.

Figure 02.04

As population grew and spaces became crowded, halls/auditoriums were introduced with classrooms clustered around or adjacent to them. Although they were able to accommodate large groups, it was proven unsatisfactory because of acoustic problems.

In the 1940s, more schools were in high demand because existing buildings became too crowded. A new style of architecture dominated the designs of new schools, which created much experimentation and controversy. Modern Architecture was adopted because the simple, rectilinear buildings were easy to plan and inexpensive to build. Although some masterpieces were constructed, many lacked the relationship with the existing community environments and provided little to no green spaces. They also looked industrialized and plain with flat roofs, repeated metal and glass, and no sense of orientation.[9]
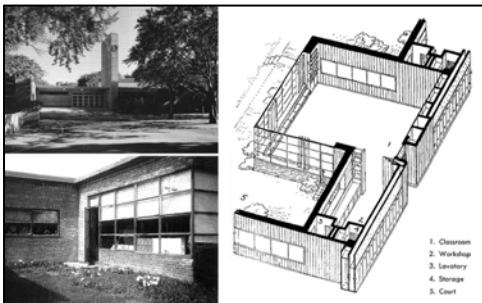
Figure 02.05

Although Modern Architecture created much controversy, Crow Island School in Winnetka, Illinois stood out from the rest and was used as a model in many designs. It was designed to the scale of the children and a variety of learning spaces for different activities, on the inside and outside, was provided, which gave the students a sense of belonging.
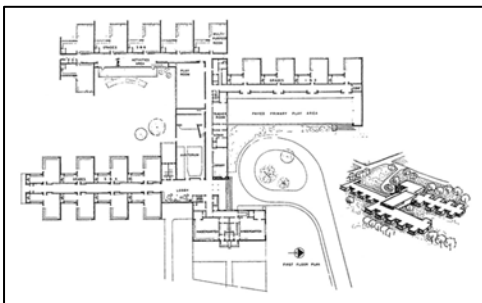
Figure 02.06

It was also successful because it introduced the L-shaped and finger plan concept, which contrasted the formal, axial, multistory, heavy masonry, institutional buildings of the past.

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[9] Brubaker, C. William. *Planning and Designing Schools*. New York: McGraw-Hill, 1998.

The record breaking baby boom post World War II produced a sudden increase in enrollment and demanded new elementary schools. Although Crow Island School was a great influence, building schools quickly became priority. In the 1950s, schools were built cheaply with poorly insulated roofs and walls, cheap hardware, bad quality lighting, minimal ventilation systems, and repeated standardized plans and elevations.
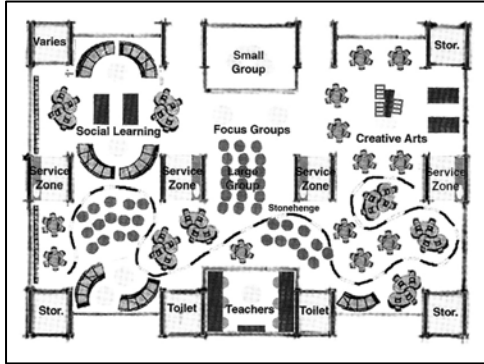

Figure 02.07

In the mid 1960s, open floor plans became popular and was one of the most influential ideas. Contrasting traditional schools, where teachers had full control of everything, new schools with open plans gave students a sense of freedom and independence, requiring less guidance by the teacher. The large, flexible, and impermanent spaces allowed for team teaching and small group activities and could be modified to adapt to the different educational needs of the users.
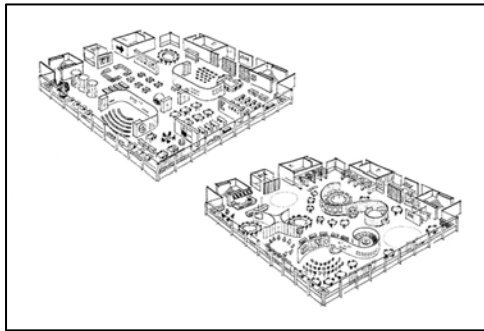

Figure 02.08

Although open floor plans were well liked, this idea eventually failed because noise became an issue and students were easily distracted with the visuals surrounding them. Because of this, many schools with open floor plans renovated and reverted back to old designs with permanent walls and doors. Disney Magnet School in Chicago, Illinois, however, was one of the few open plan schools that remained unchanged.

With the decrease of enrollment between 1970s and 1980s, many school districts realized that they had too much space. As a result, buildings became deteriorated from the lack of funds for repairs and maintenance. From 1980s to 1990s, however, the rise in enrollment and new trends called for reevaluation of old schools and a need for new schools that would continue into the 21st century.[10]
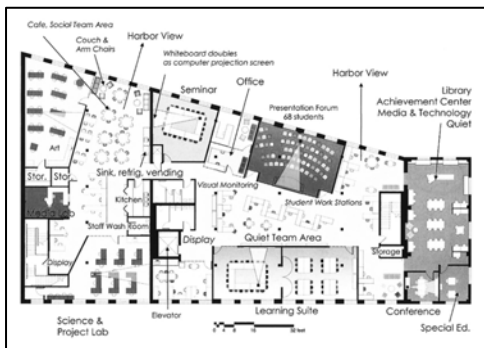
Figure 02.09

In the 1990s, the idea of small learning communities emerged and influenced the designs of new schools. Teachers started new teaching strategies to support the school-within-a-school idea and students were encouraged to participate in both school and extracurricular activities. The idea of flexible spaces was reintroduced which meant providing students with spaces for working alone and in groups. New spaces for other uses were also provided in hopes for longer lasting schools. Harbor City International School in Duluth, Minnesota was one of the first schools to support the new ideas, with both small learning environments and large instructional spaces.

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[10] Walden, Rotraut. *Schools for the Future: Design Proposals from Architectural Psychology*. Cambridge, MA: Hogrefe, 2009.

Today, with the introduction of Internet, educational programs can be offered online where students are able to take courses at school or at home. Although it provides more educational options, the physical spaces for learning are still needed. Schools should be developed to support the growth of the students, the change in teaching methods, and the advancement of technology.[11]
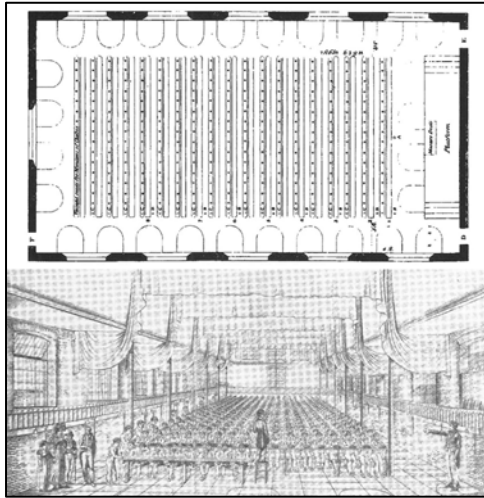
02.3 SCHOOLS IN THE UNITED KINGDOM

Figure 02.10
Since the late Middle Ages, schools consisted of one large schoolroom, about 70 by 32 feet, for 300 students. These schools were taught by a single master/mistress who sometimes had assistants. Long, fixed desks and benches were arranged facing the front where the master/mistress would teach. Furniture on the side aisles faced the side lesson boards that were hung on the walls. Curtains were used to break up and soften the sounds that echoed throughout the large room. This design was problematic because it was inflexible for small group activities. It was also difficult for one master/mistress to teach such a large group of students with different skills and abilities.
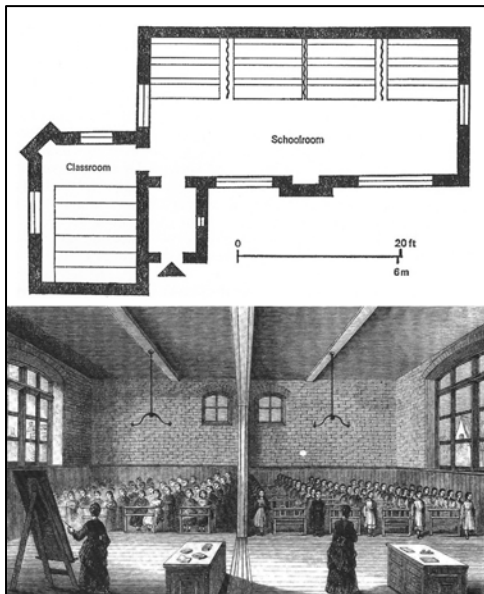
Figure 02.11
A development to the old plan was made in the 19th century with the addition of a classroom space to the schoolroom. The long, rectilinear schoolroom now had 3 rows of desks facing the front. Multiple classes were held in these spaces, taught by separate masters/mistresses, and were divided by curtains. The curtains were pulled back when the head of the school needed to address or make announcements to everyone. The separate classroom attached to the schoolroom consisted of steps for the students to sit, where lessons for smaller groups were conducted. Like many early school designs, the master/mistress was able to control and supervise all the spaces. The lack of windows in this design created uneven lighting and noise became an issue with multiple classes occupying the schoolroom.

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[11] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools.* Minneapolis, Minn.: DesignShare, 2005.

Figure 02.12

At the end of the 19th century, there was a need for larger schools, separating the younger students from the older students. More classrooms, taught by different teachers, were added along a central corridor. Eventually, the corridors were widened and became central halls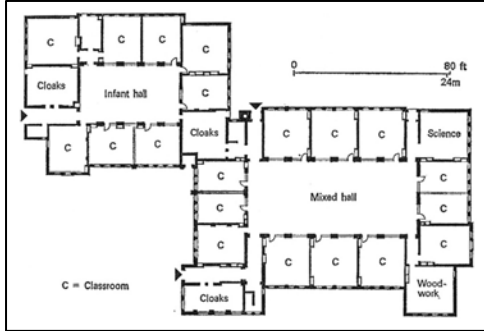 that accommodated two or more classes. Curtains were replaced by walls that were partially glazed. This allowed the head of the school to still keep a watch on how the students were behaving. These glazed partitions were eventually covered because some teachers desired more privacy. The traditional long desks were replaced by smaller ones which made it easier for teachers to pass between the rows to discipline the students.

Between 1900 and 1930, larger sites were available, which resulted in single storey elementary schools. Many were concerned about the previous central hall plan because they did not allow proper lighting and air to flow through the classrooms. Because of this, the idea of veranda schools came about where classrooms were detached from the central halls and arranged in rows with glazed folding doors facing the center. The glazed folding doors were eventually replaced with regular doors.
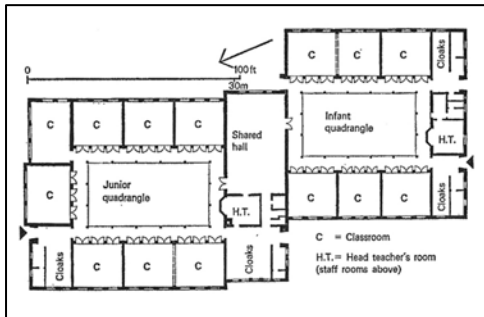
Figure 02.13

The veranda schools later evolved into the quadrangular plan, which supported the change in the role of the teachers and their new teaching methods. The idea of working in small groups was emphasized and easily movable tables and chairs were provided for group arrangements. Classrooms of various sizes were also included for a variety of activities. High level windows were incorporated when the doors for ventilation were closed. A shared hall between the younger and older students allowed for large group gatherings or all school meetings. Quadrangles became an issue during the winter time because the opened doors made the rooms cold and wind would blow papers around. The large amount of glazing on the walls facing the quadrangle also created privacy issues. Providing corridors became the solution for these problems.
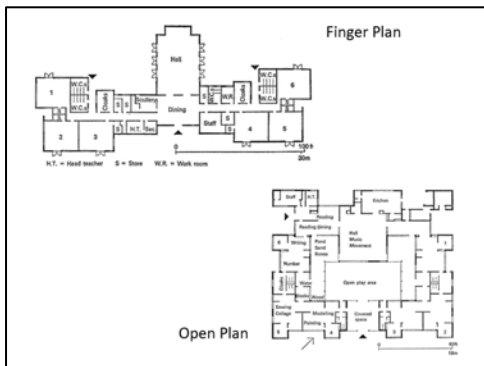
Figure 02.14

Schools built after World War II were similar to those built in the United States at that time. Finger plan schools were typical and the idea of open plans with areas for various school subjects and activities later became popular as well. A problem with these changes is that students were easily confused and lost with multiple teachers in the large space. The many activity areas that are provided in the large space also made them feel like they had no home base to return to.[12]

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[12] Seaborne, Malcolm Vivian John. *Primary School Design*. London: Routledge And K. Paul, 1971.

02.4 SCHOOLS IN JAPAN
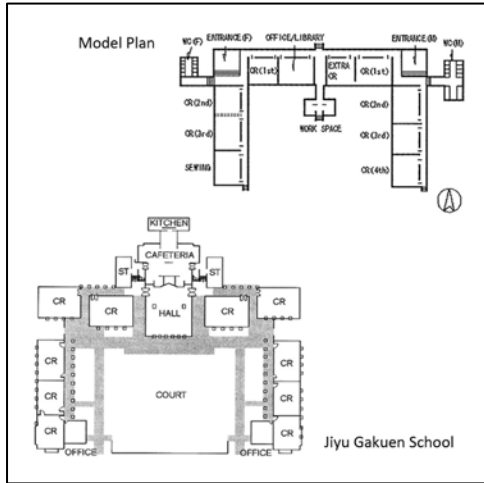
Figure 02.15

Many schools prior to and after the Meiji Era no longer exist in Japan today. Starting in 1890, the central government developed a guideline for elementary school designs in order to standardize schools. A model plan issued in 1895 stated specific details on the size for classrooms and the amount of students per classroom. The model plan had classrooms being placed in a row along a single loaded corridor, which allowed for natural ventilation and lighting. This model plan has been used ever since and can be seen in the design of Jiyu Gakuen School in Tokyo, Japan by architect Frank Lloyd Wright, completed in 1921.
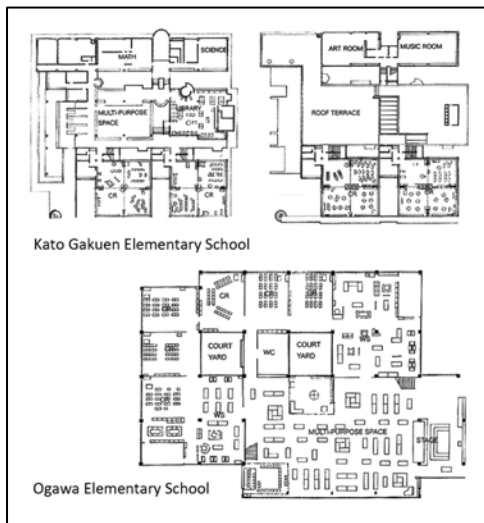
Figure 02.16

Between 1960s and 1970s, the idea of open plan schools was introduced to Japan, which was influenced by the United States and the United Kingdom. Individual learning was encouraged and moveable partitions were incorporated. In 1984, the central government started to promote open plan schools with common spaces for each grade and between the different grades. Wider hallways were also incorporated to function as alternative learning spaces. The idea of open plan schools was applied to both private and public schools. The first private open plan school was Kato Gakuen Elementary School in Shizuoka, Japan and the first public open school was Ogawa Elementary School in Aichi, Japan.
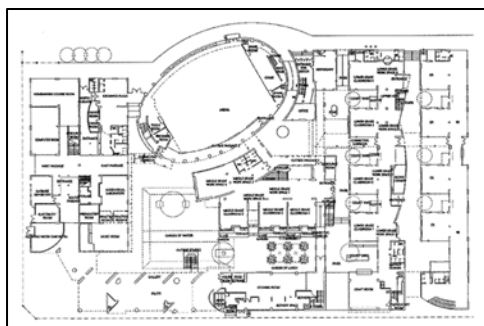
Figure 02.17

Although open plan schools were well liked, some designers felt that they lacked a sense of human scale and private spaces. More recently, designers started to create classrooms for multiple purposes which allowed for individual learning as well as group work. Independent classrooms with their own building, entrance, and outdoor spaces were also included. Some schools even took on different forms and shapes, including oval rooms, zigzag walls, and curved classrooms for the purpose of stimulating the minds and behavior of the students. Utase Elementary School in Chiba, Japan was one of the first schools that had these unique characteristics.[13]

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[13] Walden, Rotraut. *Schools for the Future: Design Proposals from Architectural Psychology*. Cambridge, MA: Hogrefe, 2009.

02.5 CONCLUSION

Although these countries are located in different parts of the world, the historical study of schools in the United States, United Kingdom, and Japan showed many similar design ideas that came about as well as common issues that were faced. While very few schools were successfully designed and kept open, many failed to support the needs of the users and were eventually closed down. With an understanding of the past, designers are not only aware of the problems of traditional schools, but they can also prevent similar issues from reoccurring in new and future schools. They can do so by providing innovative ideas that accommodate modern day teaching methods, learning processes, and enhance the physical, cognitive, and psychosocial skills of the children.

03 | INTEGRATION OF TECHNOLOGY

03.1 TRADITIONAL PROBLEMS

The idea of integrating technology in learning environments is not a new concept. Along with teachers instructing from textbooks and chalkboards, technology has been used in schools to influence the way learners obtain knowledge. This includes the use of films, radios, and television and all of these methods are still used in schools today. Although they were somewhat effective in the past, they are a little outdated for new and future schools because they create passive learning spaces rather than promote active participation and involvement of the students. Each technology was more powerful than the previous, but their effectiveness fell short.

> "I believe that the motion picture is destined to revolutionize our education system."
> (Thomas Edison, 1922)

> "The time may come when a portable radio receiver will be as common in a classroom
> as . . . the blackboard." (William Alexander, 1945)[14]
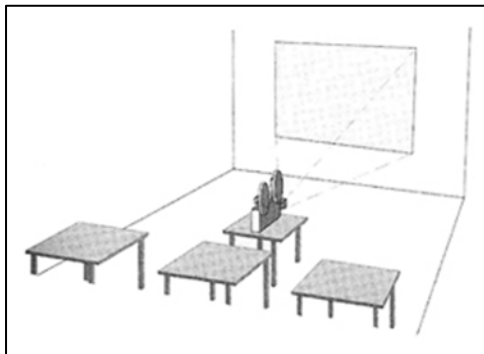
Figure 03.01
In the 1900s, instructional films and movie projectors were introduced into schools mainly to assist teachers in teaching history and physical science. A book was published for each film to explain how to teach with the equipment and its own synopsis and syllabus was also included. Instructional objectives, activities, discussion questions, problems, tests, and a list of references were provided for each film as well. At this time, Thomas Edison of the Edison Company believed that books would eventually be obsolete and that instructing through visuals would be the future of schools. This method was later considered ineffective for many reasons. Not all educators accepted this way of instructing and technical problems arose with the use of this expensive equipment. Not only did teachers lack the skills to operate them, because no training was provided, but they also could not find the right films to fit the classes and changing curriculum.
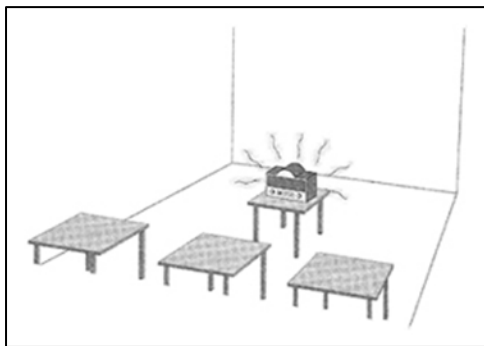
Figure 03.02
Educational radios, established by educators, were introduced into the learning environments in the 1920s. Some schools even developed their own radio stations for instructing different academic subjects. This new method of teaching proved to be worse and failed quicker than films because those broadcasting were not only monotonous and lacked enthusiasm, but they were also unclear and dull in their instructions.

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[14] Perkins, L. Bradford, and Raymond Bordwell. *Building Type Basics for Elementary and Secondary Schools.* 2nd ed. Hoboken, N.J.: John Wiley & Sons, 2010.
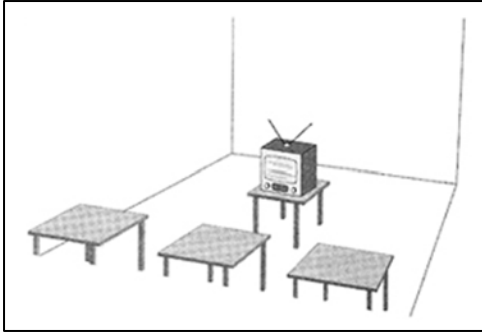
Figure 03.03

In the 1950s, instructional televisions were incorporated into the classrooms. Like previous technologies, educators hoped that it would help them improve the curriculum. Contrasting films, which were costly, portable videocassettes were inexpensive. For this reason, programs viewed by the students became popular for the next decades, but was not the primary method used by the teachers.[15]
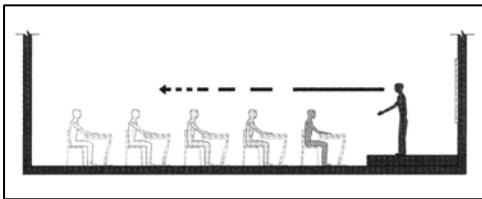
Figure 03.04

Although the incorporation of film, radio, and television in schools were effective for a short period of time, these methods of teaching promoted passive learning environments rather than active involvement of the students. They did not differ from traditional teaching methods, where the teacher instructed in front of the classroom with the students sitting quietly at their seats, absorbing the information. The source of knowledge, whether it was film, radio, or television, was the focal point of the classroom and information was transmitted to the students in a hierarchical manner. Similar linear methods of teaching can still be found in today's schools, but these settings still do not encourage group work or interaction, which is considered necessary and important in modern day schools for enhancing the skills of children.

Between the 1980 and 2000, other technologies were developed and used to enhance teaching and learning. These included microcomputer, computer-assisted instruction (CDI), compact disc (CD), digital videodisc (DVD), personal digital assistants (PDAs), iPods, and mp3 media players, which were also inexpensive and portable. Around the same time in the 1990s, the internet was introduced, which allowed information to be electronically exchanged through interconnected computers. Contrasting the previous technologies, the internet requires active involvement, where anyone could access information and sources quickly. This new technology allows for distant learning and promotes collaboration and communication from users who are in different places and should be integrated into the schools of today and the future.[16]

03.2 MODERN SOLUTIONS
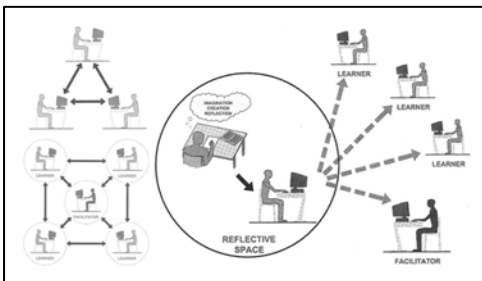
Figure 03.05

The introduction of computers and the internet has drastically changed the process of teaching and learning in modern day schools and will continue to shape schools of the future. Information can be acquired and transferred virtually anywhere at any time. Handheld devices and other interactive tools are also being introduced to create more active learning environments, enhancing the skills of the students as well as the teachers. Internet can be found in every type of environment imaginable: social, cultural, psychological, working, and educational. Anyone with access to a computer can quickly

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[15] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools*. Hoboken, N.J.: J. Wiley, 2010.
[16] Perkins, L. Bradford, and Raymond Bordwell. *Building Type Basics for Elementary and Secondary Schools*. 2nd ed. Hoboken, N.J.: John Wiley & Sons, 2010.

acquire and transmit information anywhere at any time. Not only are students able to use the internet for research and communication, teachers are also able to work and share academic research and other resources with the students and fellow colleagues. With this new method of teaching and learning, both the students and teachers do not need to be in the same physical environment. Teachers can work on their lesson plans in an environment that they are most comfortable in at their own rate, without the need to travel to school. The same idea applies for the students.

There are mixed reviews about teachers teaching and students learning online. Interviews have been made where many teachers stated that teaching online is similar to face-to-face instruction and the only difference is the medium used. Some found this method to be very effective, flexible, and more convenient. Teaching and learning is not limited to a scheduled class time like traditional classrooms. With flexible work hours, teachers are given more time to think, research, and review their information before they transmit them to the students online. This allows them to create interesting activities and assignments for a more active virtual learning environment where lectures can still be held, discussions can still be made, and group work can still occur. Interactions between the teacher and students can happen in real time or at different times. Without the presence of a physical learning environment, all students are expected to participate in order to receive an evaluation and grade from the teacher. This environment of active involvement creates opportunities for the students where they can share their understandings and concerns for the information that is being discussed. Some teachers noticed that active participation also allows them to know their students better, strengthening their relationships. The role of the teacher changes from being the focal point of the classroom to a facilitator online, sharing and discussing with the students.

Although there are positive feedbacks about the virtual learning environment, there are many concerns about this new method of teaching. Since information from one instructor can be transmitted to students anywhere in the world, the overall role of the teacher in the school is threatened. As schools become more involved in virtual learning, faculty will eventually be cut back. Teachers who have been instructing in the physical learning environments for most of their careers may not be computer savvy or familiar with online teaching and its effects on learning. A lot of times, they will focus more on how to use the technology rather than providing information and assignments for an active setting. Some also find it difficult to design texts and visuals online to make the course more exciting and interactive. They have noticed that more effort and changes are required because they have to figure out ways to continue the discussions online. Even though students are required to participate, some teachers noticed that they are unable to learn as much or as effectively as face-to-face instructions. Even though this new method is flexible, many teachers stated that trying to contact the students was too time consuming, tiresome, and difficult. Without a set schedule for class time, teachers would have to constantly check online to see if students have responded to their assignments or not.[17]

Studies and interviews have shown the positive and negative effects of online teaching and learning. This new method clearly cannot replace the role of physical learning environments but instead, they should be considered to enhance the teaching and learning process. Understanding the advantages and disadvantages helps teachers develop activities around it that is more effective for acquiring information for specific academic subjects. Places for education, whether in a virtual environment or physical setting, must be active spaces that enhance development, where individuals can work alone or in groups.

[17] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools*. Hoboken, N.J.: J. Wiley, 2010.

Technology has the ability to greatly improve the learning environment, but the types of equipment and devices change and grow so quickly that a careful evaluation of their effects must be made before integrating them. Incorporating technology without a good understanding can hinder the effectiveness of the teaching process and also affect the students' ability to learn.

03.3 DESIGN GUIDELINES FOR NEW SCHOOLS

The use of computers in schools has existed for over 20 years and can still be found in schools today. Each school typically has one room designated as a computer lab, which is only accessible during school hours. This setting is the result of technical limitations and does not support the desire for flexible learning environments in modern day schools. With the introduction of wireless internet and portable devices, however, access to online sources is no longer restricted to one space at specific times. Children are starting to use these tools at a very young age and are quickly improving their skills. During the design process, designers and educators need to consider many factors before determining how to integrate them into the school setting. Since students are able to obtain so many sources in a short period of time, schools must be cautious about setting their policies. Educators sometimes feel the need to ban the access to certain websites to prevent unwanted behavior, but they do not realize some of the benefits of allowing students to use them. Including the students in the policy making process can clarify what can be accessed and this encourages responsible use of the sources that is agreed upon by everyone.

Websites for videos, images, and social networking are typically banned on school property because educators find them distracting and sometimes inappropriate. Students, on the other hand, find them helpful in improving their school work. They are able to use sources that are relevant to their research or presentation, for example, and can develop their creativity skills. The use of instant messaging programs is also discouraged because it is assumed that students would focus more on chatting with their friends than focusing on the information being transmitted to them. Some schools, on the other hand, find that these programs are beneficial in extending communication outside of school grounds. Students and teachers can chat online during set after school hours to discuss questions or thoughts on the class work. Parents can also be more involved by using these programs. They can talk with teachers if they are concerned about the progress of their child or if they just want to be more connected with the school, curriculum, or the community. By allowing the use of these sources, relationships between the students, teachers, and parents are strengthened.

Determining where to locate the equipment for internet access requires a lot of thought. Technology is constantly and quickly changing, so with this in mind, the amount of equipment incorporated as well as their locations needs to be flexible. It is ideal to have a variety of devices evenly distributed across the campus and should be available for immediate and quick access, at standing-height stations, as well as for longer uses, at seated-height stations. Integrating secure, wireless internet gives the students and teachers the option to bring their own portable devices, which they can use during free time, recess, or lunch. From this, students can learn how to be more responsible for their own belongings.[18] Computer use in the classrooms has become more popular recently as well. When plans are being made for new classrooms in wealthy districts and private schools, it is already assumed that each student would eventually own a portable laptop or other handheld devices. Although this concept is ideal, designers should not place this assumption in all new schools. Wired connections are also becoming less important, but should not be eliminated in the planning process.[19]

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[18] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.
[19] Perkins, L. Bradford, and Raymond Bordwell. *Building Type Basics for Elementary and Secondary Schools*. 2nd ed. Hoboken, N.J.: John Wiley & Sons, 2010.

Providing options around the school for the users creates a flexible, convenient learning environment, but if possible, a computer or technology lab should still be provided to accommodate full classes for specific assignments or activities. Traditionally, computer labs were designed without windows because it was believed to be more energy efficient and glare was reduced. When these spaces are occupied for long periods of time, however, it is necessary to provide windows for daylight and views. This not only affects the health of the users, but it also impacts their productivity. In the past, computers were located along the perimeter of the room facing the walls. This type of setting does not encourage or allow for collaboration between the users. Being able to discuss and communicate while working on these devices creates an active learning environment so placing these tools in groups, facing one another would be ideal.

Along with providing laptops and desktop computers for easy access, schools should also provide printers, interactive white boards, and audio and visual handheld devices whenever possible. In the future, other tools that the schools find effective and efficient for teaching and learning should also be provided. Teachers can create more activities that promote group collaboration if students were provided with and are able to use these tools. Students who are able to share their findings and knowledge with their fellow classmates and teacher through these different mediums will develop their communication, presentation, cognitive, and psychosocial skills.[20]

With technology changing so fast, it is almost impossible to plan what equipment will be used years from now. Like the integration of films, radios, and televisions, the types of equipment available and efficient now might be considered outdated and ineffective in the future. It is even possible that the computer can be considered inefficient in the future. Many plan technology based on the number of equipment they want in the schools. For example, in today's schools, computers and computer labs are the most basic technology that is provided. Schools need to decide specifically what they want the students and teachers to be able to do with them and then determine the amount that should be integrated so that they could accomplish their goals. Planning long-term use might restrict schools to using old equipment that might not be able to perform tasks of the future. Technology should be included in teaching every academic subject and should not be taught in isolation. A separate class for typing lessons, for example, should not be in the school's curriculum but instead, it should be integrated into each subject area so that the students can enhance their typing skills as they acquire knowledge. Technology integration in schools needs to be effective and efficient as well as help the users work smarter and not harder.[21]

03.4 PERSONAL REFLECTION

> "When I was in elementary school, many traditional technologies, such as film and television, were used as tools for teaching. Like the classrooms of the past, we sat and listened while the film and television instructed. The first time I ever had access to a computer was in second grade. We had typing lessons a couple of times a week and played games for fun, but it was not used for projects or research. Internet was not invented at the moment so a lot of our assignments required looking through encyclopedias and books. Although we were able to complete our assignments, the process was slow and not efficient. Compared to the past, there are so many tools that are used in schools today for teaching, learning, and entertainment that I wish were

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[20] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.
[21] "National Center for Technology Planning." National Center for Technology Planning. http://www.nctp.com/html/john_see.cfm (accessed April 10, 2011).

invented in the past. If we had some of today's technologies when I was in elementary school, my experiences and outcomes of my assignments would have been completely different."

03.5 CONCLUSION

Technology used in the past, such as film, radio, and television, was temporarily effective in transmitting information and many believed that they would be the driving factors of teaching and school designs in the future. Over time, many problems had come about for each and they all failed to live up to their expectations. Although some of these tools are still used today, they create passive learning environments when many desire more active settings. The use of computers and internet, however, allows for more involvement of students, teachers, and even parents and is becoming more popular in all environments. They are crucial elements that need to be considered in designs of all building types and not just schools. There are many disadvantages to using technology, but knowing its effectiveness in the learning environment can create positive impacts for the users and the schools. Innovative, efficient technology will continue to develop and people will always be inventing new devices that are easy to learn and fast to operate. Students are starting to acquire technology skills at a very young age and it is important to incorporate them into the schools. It is difficult to predict the future and determine what the next big thing will be, but it is certain that technology will always be enhancing the skills of the teachers and students, creating active learning environments.

04 | FLEXIBLE FURNITURE

04.1 TRADITIONAL PROBLEMS

Furniture has always been designed and built with a purpose. In schools, they were once placed facing the front of the classroom where the teacher had complete control of the content that was being taught as well as the students. Activities varied little and furniture bolted to the floor was partially the reason. Everyone was provided with the same standard pieces and no thought was put on the physical, emotional, and social needs of the users. In today's schools, the use of the furniture has changed very little compared to the past. Students still sit facing the front of the room absorbing information while the teacher instructed. The types of furniture provided for the students are still standard in design.

Figure 04.01
In elementary school, children of the same age vary in ethnicity, gender, and size and grow at different rates. Oftentimes, providing appropriate furniture is overlooked, causing physical discomfort that reduces concentration, which affects cognitive growth. Chairs and tables provided are standard in design and many times are too low, too high, or too deep, impacting the posture, safety, and learning process of the children. Students who are uncomfortable focus more on finding comfort and easing the pain rather than learning. The amount of time spent in uncomfortable positions can lead to physical, emotional, and social problems that not only impact a child's abilities in school, but also their capabilities to complete tasks at home and in the future.[22] In schools today, there is a desire for flexible, child-centered spaces and activities that encourage group collaboration. With this new focus, the "one-size-fits-all" mentality for furniture selection needs to change. Providing flexible furniture will accommodate the mix of activities that support the new curriculum as well as the different needs of the users.

04.2 MODERN SOLUTIONS

More recently, user-centered designs in furniture have become popular. In schools, functional, comfortable, safe, and healthy furniture needs to be provided not only for the students, but also for the teachers. Sitting for long periods of time with furniture that does not support ergonomics creates static postures, which causes drowsiness and muscle fatigue. Ergonomics is based on scientific knowledge that takes human characteristics into consideration when designing. It has the potential to protect the health and well-being of the users, enhancing learning and teaching. Attractive and playful furniture can make fun learning environments.

The two major pieces of furniture that needs improvement in the classroom are the seat and desk. Both should be flexible and adaptable to the users and classroom activities. A flexible seat allows users to lean forward for reading, writing, and drawing as well as lean backward for listening and watching. Adjustable backs allow for more movements and positions to accommodate small and big students. Seats with an inch of foam will reduce pressure points on the back, buttocks, and legs. Circulation and comfort can also be achieved when the front edge of the seat is designed like a waterfall. They also should be height

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[22] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.

adjustable to the different heights of all the users. By offering a variety of options, it improves posture and prevents physical strain. Adjustable tables should also be considered depending on the task duration and posture activity level. Since the number of people in a group varies with each activity, providing trapezoidal or nonrectangular shaped tables can enable different spatial arrangements to support all forms of collaboration. They can be put together for group projects or separated for individual tasks.

Although the physical impact of furniture on the users is important to consider, their usability and portability is also critical. Products that are functional and support ergonomics but are difficult to figure out fail to be usable. Those that are heavy make moving and reconfiguring difficult. They discourage and prevent users from participating in group activities, which affects their collaboration skills. Students and teachers should be able to rearrange the rooms from lecture to small groups and back again quickly and easily. Being able to compress the furniture for storage will take up less floor space and provide more areas for other activities.[23]

In order to create more relaxing and sociable environments, soft furniture, such as lounge seating, sofas, standing-height tables, and coffee tables, can be included. Students found that sitting on the ground with soft seating was also comfortable. Providing these types of furniture can enhance the students' learning abilities. With technology playing a big role in today's schools, incorporating the right type of furniture for computer use is essential as well.[24]

04.3 DESIGN GUIDELINES FOR NEW SCHOOLS
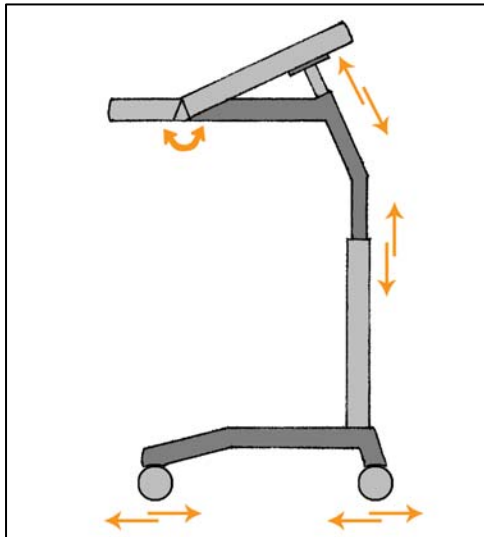
Figure 04.02
Tables that are lightweight, height adjustable, and reconfigurable

[23] Chism, Nancy Van Note, and Deborah J. Bickford. *The Importance of Physical Space in Creating Supportive Learning Environments.* San Francisco, Calif.: Jossey-Bass, 2002.
[24] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools.* Minneapolis, Minn.: DesignShare, 2005.
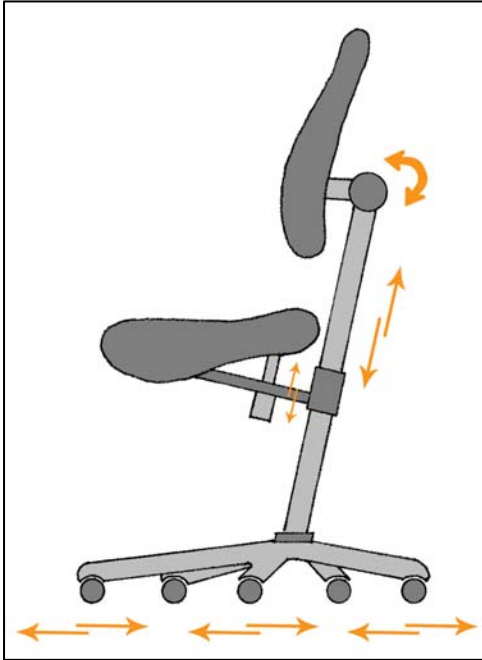
Figure 04.03
Ergonomic chairs that are lightweight, height, back, and seat adjustable, and moveable
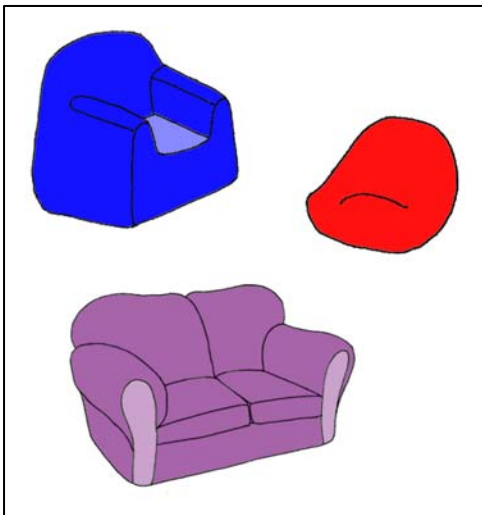
Figure 04.04
Soft seating (sofas, bean bags, pillows, etc.) for relaxing, reading, studying, informal discussions, and casual conversations

04.4 ANALYSIS OF PROPOSED/BUILT PROJECTS

Company: Shuttle
Website: http://www.shuttlefurniture.com/index.asp

Shuttle Furniture believes that they can shape and reshape schools in a new way with the understanding that schools are always changing. This company designs furniture that is durable and functional for both teachers and students. Their complete line of furniture is certified under the GREENGUARD Children and Schools Standards. They are committed to: "Designing and crafting innovative learning environments, while always using materials and processes that respect and protect the environment."[25]

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[25] "Shuttle Furniture." Shuttle Furniture. http://www.shuttlefurniture.com/ (accessed February 13, 2011).

Figure 04.05

Shuttle provides "Single-Student Desk" and "Built-for-Two-Student Desk" to support the new changes in modern day schools. These desks come in all different sizes, shapes, colors, and storage options, which the schools can customize. They can also select legs that are fixed, adjustable, or with wheels. These desks can be easily grouped together for collaboration or separated for individual use. Although the many designs can support the different activities and can be reconfigured, storing them is difficult because they cannot be folded or stacked to open up the floor space.

Figure 04.06

The "Multi-Purpose Table" comes in different sizes, shapes, and colors. Not only are the individual table designs customizable by the school, putting together pieces that are of the same shape creates different setups for groups or individual activities. Connectors are located on the edges of the tables to support the various configurations. Although these tables make rearranging the room easier than the standard furniture of traditional schools, they are large and difficult to store. They cannot be compacted or stacked to clear the floor space for floor assignments. The different colors mixed together, however, create fun and playful settings.
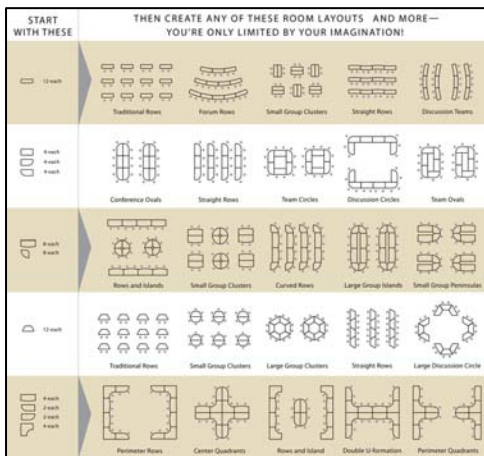
Figure 04.07

Shuttle Furniture provides schools with a variety of table designs. Each style can be reconfigured as many times as possible for different amounts of users and uses. They can stand alone and face the front during lectures for individual users. They can also be put together to form groups of four or six for activities that encourage collaboration. They can be located at the perimeter of the classroom to support class discussions as well. All designs come in different sizes and can accommodate individual and group work. With these options, the learning environment becomes an active setting, with constant changes.
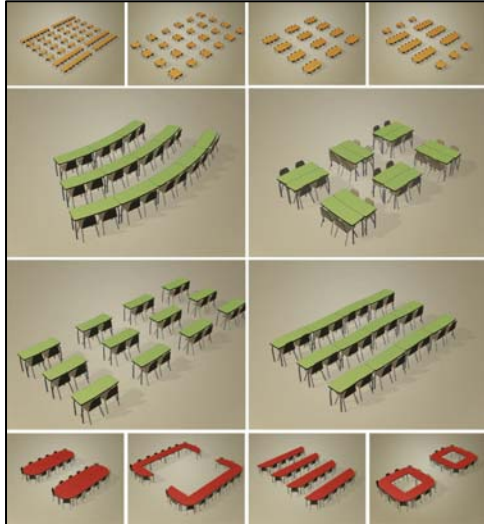
Figure 04.08

In a school, every classroom has their own teachers and students. Activities that occur within the classrooms vary throughout the day. Furniture that can be easily reconfigured and reshaped for the different activities is important for modern day schools because they create flexible and adaptable spaces. With furniture from Shuttle, in a short period of time, the room can accommodate individual as well as group activities. Instead of having the users adapt to the furniture, the furniture adapts to the users and their activities. The variety of furniture available from Shuttle is not only made for classrooms. They can also be used in other spaces of the school that want to function as flexible and adaptable spaces.

Company: Victorian Educational Furniture (VEF)
Website: http://www.vef.com.au/

VEF has been supplying desks, seats, and storage in the educational sector as well as corporate, government, and healthcare sectors for many years. Owned by Australians and operating from Springvale, VEF provides a diverse range of furniture for local and international users. Their products include modular, mobile, and reconfigurable solutions in the educational and commercial market.[26]

Figure 04.09

VEF's ergonomic "Podz Kinetic Pod" and "Kinetic Tablet" replaces standard tables of traditional schools. With wheels on both the central pod and individual tablets, users can easily move them around to accommodate the different academic and personal activities. The tablets can be pieced together with the central pod to support group collaboration or be moved to the corners to create more table space for each individual. Both the pod and tablet are adjustable to fit the height of each individual user. When these flexible furniture pieces are not in use, they can be folded up and placed along the walls.
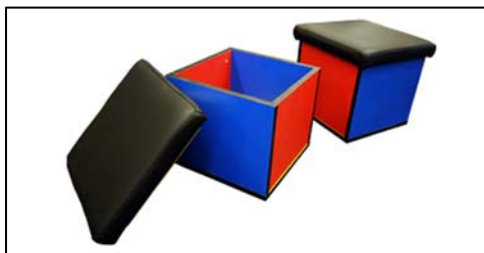
Figure 04.10

The "Cubo Mobile Storage & Chair" is designed to serve multiple purposes. Not only is this black, red, and blue object a soft and lightweight chair, it can also be used for storing toys, books, or schools supplies by removing the cushion cover. Adding this to schools create fun and relaxing settings.

[26] "Primary classroom furniture educational furniture." Ber furniture classroom furniture school furniture flexible modular innovative furniture Melbourne Sydney Brisbane. http://www.vef.com.au/cat_primary.php (accessed February 13, 2011).

Figure 04.11
The "Podz Ottoman Centric Ranges" and the "Podz Ottoman Signature Series" was designed to be fun and reconfigurable. The users can produce different types of settings by joining the individual pieces.   With their modular design, they can be combined to make a circle or triangle, for group activities, or be placed in rows, for individual users.

Figure 04.12
The "Freedom Multi-Purpose Coffee Table" with "Podz Ottoman" can be occupied for different functions. Aside from its typical use as a stand for food and drinks, the table can be occupied as additional seating or be placed over the ottoman as a workspace. The soft seating can be occupied for casual conversations or quiet assignments. Long term uses, however, may create discomfort because there is no back support. The wheels allow for quick and easy moving, but the size makes it difficult to store.

Figure 04.13
Colors of the soft "Podz Ottomans Small" can be mixed and matched and arranged around a round table to create a continuous, comfortable, sitting surface for the teachers and students. Although they do not have wheels on the bottom like other designs, which would make transporting easier, they are lightweight and small enough for young children to carry and move on their own. This gives them more freedom and more options in schools.

Figure 04.14
VEF's "Podz Pedestools" are mobile stools that can be grouped together for collaboration or separated for individual use. Combined with a table, they create casual, comfortable settings for the users. The lack of color in this design contrasts other VEF products and is less fun and enjoyable to use for the young children.   The lack of backrests might cause discomfort when they are occupied for long periods of time.

<u>Company</u>: Feelgood Designs
<u>Website</u>: http://www.feelgood-designs.com/

Feelgood Designs is a company that believes that good design can influence a child's development, learning, and quality of play. Their designs are contemporary and beautiful, stimulating the learning environments for children. All products are influenced by their research project about Italy as well as the

collaboration with designers, architects, and schools of Reggio Emilia. Custom designs are provided to support specific needs of the schools and users.[27]

Figure 04.15
Designed by Giuseppe Amore, the "Chaise Longue" is a soft piece of furniture that functions as two different types of furniture. In its original, closed position, it can be occupied like a bench for multiple people. Opening up the movable part creates a lounge chair for two users that can be used for reading, studying, or resting. Its soft material creates a comfortable setting but its size cannot accommodate large groups.

Figure 04.16
"Satellites" by Paulo Grasselli was designed to support various uses. Many pieces of these soft platforms can be linked together to create a continuous sitting surface for small or large groups. The raised element acts as an armrest or a task surface that can be used for reading or writing. When they are not in use, the separate pieces can be easily stacked together like a puzzle. This design makes cleaning and storing possible.

Figure 04.17
"Key Stone" are colorful chairs designed by Sebastian Bergne that come in two height positions. The large base, lower chair is made for young children while the small base, higher chair is designed for older students or adults. Incorporating these chairs in the learning environment creates informal settings for individual and group activities. Their bulky design, however, occupies a lot of space and makes them difficult to store.

Figure 04.18
Designed by Marco Zito, "Up & Down" provides soft seating of different heights for resting, reading, or studying. Its design accommodates the different physical features of each individual and it also allows users to choose the position that best supports their task. When used in the classroom, they create interesting and colorful landscape making the school environment a fun setting for learning.

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[27] "feelgood designs - Home." feelgood designs - Home. http://www.feelgood-designs.com/ (accessed February 27, 2011).

Figure 04.19

"Zed" by Marco Zito comes in two different sizes and colors. One design accommodates small, young children, while the other supports big, older children and adults. Each piece can be used separately as lounge chairs for individual activities or put together as group seating for multiple users. Teachers can gather a small amount of students for story time. With its odd design and big size, however, stacking and storing can be difficult.
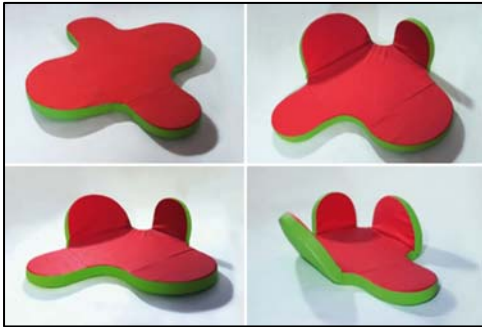
Figure 04.20

Designed by Tullio Zini, the "Openclose Flower" is a soft mat with flaps that can be folded up easily based on the preferences of the users. The pedals act as backrests for various activities like studying or reading. Folding up all the pedals creates a private space for group discussions or conversations. This addition to the classroom makes an interesting setting for the users, with the constant movement of the bright red and green colors.
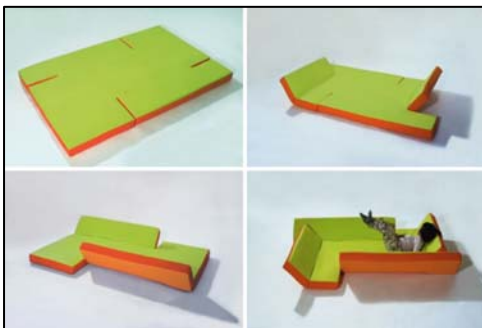
Figure 04.21

The soft "Openclose Mat" by Tullio Zini can be adjusted to support any sitting positions. Users can fold up the flaps to create backrests, similar to the design of a sofa. Folding up the edges define the usable space. The design is small for students and can only accommodate two users at most. Providing one mat for every two students can create fun and comfortable learning environments. They can also be easily stacked to open up the floor area.

Figure 04.22

ZPZ Partners' "Lagoon" creates a small, soft space in the classroom for individuals or small groups. Backrests are provided to support activities like reading or chatting. Although comfortable in design, this piece of furniture only accommodates small groups and will create a sense of crowding if four or more users occupy it. Adult supervision might be required because young students might perceive this soft furniture as a play structure by climbing on it.

Figure 04.23

"Y Bookshelf" by ZPZ Partners acts as a visual and physical space divider. The niche is a bookshelf and a seat is provided so that students can sit and read.

Figure 04.24

"Tier" by ZPZ Partners consists of soft, comfortable blocks that can be rearranged to create spaces for work or play. Groups as well as individuals can occupy the area to develop their cognitive and psychosocial skills. Its design enhances development, but the scale occupies a large portion of the classroom. The availability of space in the classroom should be considered when incorporating this piece of furniture.

Figure 04.25

Designed by ZPZ Partners, "Edges" combines multiple mats with raised edges to create soft, comfortable spaces. The muted color on the inside defines the usable space while the brighter exterior color defines the perimeter. These pieces can be reconfigured to create different settings for activities such as reading, studying, or chatting in the learning environment. Although flexible in design, users are unable to store them if they needed more space.

Company: VS International
Website: http://www.vs-furniture.com/56.0.html?&L=1&FL=10

VS International believes that providing durable, high quality, ergonomic furniture is essential in all environments, including schools and offices. They also take into account environmentally related considerations. Furniture provided is flexible and support lifelong learning in modern day environments. Their products are tested for safety and are designed to support the demands of day-to-day office and school life.[28]

Figure 04.26

"HOKKI" by VS was created for playful movement, activity, and high spirit. It is a stool that is available in three colors and sizes. Not only can it be sat on, it is also a fun toy that allows students to use their imagination. With its simple and lightweight design, it is moveable to support productivity in the classroom. The base also comes with soft padding that provides stability and prevents slipping.

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[28] "School." VS International, School Furniture and Office Furniture. www.vs-furniture.com/56.0.html?&L=1&FL=10 (accessed November 15, 2009).

Figure 04.27

"Ergo" is a height adjustable desk that supports the different physical characteristics of each user. A crank handle that is incorporated allows this to happen. It can be adjusted quickly to adapt to the work setting. The desk can be inclined for ergonomic support with a push of a button and is mobile with the optional wheels. Including the "PantoMove" height adjustable swivel chair and this desk improves posture, concentration, and productivity. The chair adjusts and supports movement of the body. The seat has an air cushion shell that is not only comfortable, but is also resistant to scratches and is fully recyclable. Schools that provide both of these furniture models can support all activities without having to get furniture of different sizes. There are various colors available so schools can customize their selections to create a fun learning environment.

Figure 04.28

The "RondoLift" is a height adjustable table for teachers. It allows them to work or instruct while standing or sitting. The table top is oval in design and includes a lockable drawer underneath for storing teaching tools and supplies. Provided with wheels, it can easily be moved to adjust to the different activity settings. A day at work for the teacher will be balanced out between sitting, standing, and moving. This table can also be provided for students as well to do group work which requires either standing or sitting. Movement in the learning environment will reduce physical strain to the body and enhances the learning process. Furniture in traditional classrooms restricted movement and hindered learning. The users should also be provided with the "PantoMove" height adjustable chair with this table. With these flexible furniture pieces that support various activities, the users are able to move more, creating active learning environments.

Figure 04.29

"Integra" is a table for two users that can be occupied as a student desk or computer workstation. A flat screen monitor, keyboard, and mouse are incorporated in an extendable, perforated-plate section. When this table is not occupied for reading or writing, users can adjust the height of the plate for computer use. Storage spaces can be locked and the top of the desk can be removed for rewiring or setting up cables. This table is multi-functional

and can serve a number of users for a variety of assignments. It would have been more appropriate if the tables had wheels on the legs because it would support movement and room configurations.[29]

Designer: Simon Dennehy
Website: http://www.perch.ie/

"Perch" is a furniture concept created by Irish designer Simon Dennehy. With many research about the effects of furniture on student productivity and health, it is essential that they are provided with tables and chairs that support their different physical features and needs. Currently, there are very few credible, existing solutions.

Figure 04.30
Schools require students to sit at their desks for long periods of time. Without the right furniture, they can experience discomfort, which affects their learning process. As they get older, many work settings require sitting for long periods of time as well. Having poor posture and body pain at a young age can affect productivity in adulthood. "Perch" addresses all these global problems and focuses on the relationship of the user's posture with the chair height and work surface. This design not only enhances the learning process, but it also improves posture and health.[30]
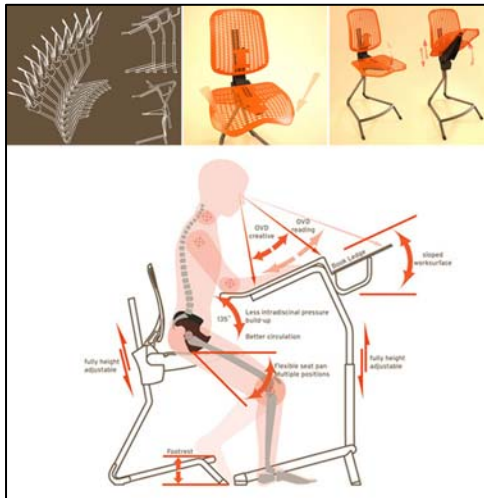
Figure 04.31
The table and chair of "Perch" were designed to be lightweight for movement and stackable for storing. The front wings of the seat are made to reduce pressure from under the legs, prevent physical strain, and increase blood flow. The ventilation slots on both the adjustable backrest and seat increases comfort and are visually pleasing for schools. The legs of the chair are designed to give room for leg movement. A footrest is also incorporated for user comfort. The table has a soft, rubber surface that is both easy to clean and prevents books from slipping. An elbow rest is also provided for writing or reading assignments. On the front edge of the table, a ledge is included for putting books, which opens up the rubber surface for other tasks.

With this new concept, flexibility in the learning environment can be achieved and user productivity and health can be improved.

04.5 PERSONAL REFLECTION

"In all environments, it is always difficult to find furniture that can accommodate my physical needs. I have always been and still am one of the shortest in comparison to my co-workers at work, my family members at home, and my fellow classmates at school.

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[29] "School." VS International, School Furniture and Office Furniture. www.vs-furniture.com/56.0.html?&L=1&FL=10 (accessed November 15, 2009).

[30] "Perch.ie | Ergonomic Furniture for Primary School Children." Perch.ie | Ergonomic Furniture for Primary School Children. http://www.perch.ie/ (accessed February 12, 2011).

In elementary school, all students used the same furniture. The heights of tables and chairs were standard and not adjustable. They were typically too high or too deep for my small body type. When I leaned back on my chair, my legs would dangle off the edge of the seat because I could not reach the floor. My arms, shoulders, and wrists would hurt because it would be difficult to complete tasks on my table. When I sat on the edge of my chair to reach my assignment on the table, I would feel pain in my back, neck, and legs because I could not lean on the backrest for support. The materials of the chairs were also hard and uncomfortable when occupied for long periods of time. I often attempt to find comfortable positions, but it was never possible.

Class assignments varied very little when I was in elementary school. Majority of the day, the students sat at their desks taking notes while the teacher taught in front of the class. Occasionally, we had group assignments where we were required to move our tables and chairs around. This was difficult for many because the tables, although provided students with their own storage space, were bulky and heavy. The legs did not have wheels to enable movement as well. If our class was in an upper floor, users downstairs would complain about noise disturbance coming from the moving furniture. We also did not have soft seating for quiet, relaxing tasks like reading or studying.

Now that there is more research on the effects of furniture on user health and productivity, I wished that my school and other schools were provided with lightweight, ergonomic, flexible furniture. In the long run, it would have helped with my comfort as well as the different class activities. Even now, when I have stopped growing, I find furniture to be an issue because standard pieces are found everywhere. Being provided with inappropriate furniture from elementary school till now, I definitely feel that my body and health have been affected. I still feel pain all over when I am using standard furniture and I am unable to find lightweight, ergonomic, flexible furniture anywhere. Changes need to be made in all environments, not just schools, in order to make a positive difference for the users."

04.6 CONCLUSION

New teaching methods and learning processes involve various activities that sometimes require students to work alone or in groups, which requires constant rearranging and moving of furniture. While good pieces can be comfortable and help build important skills, bad pieces can result in discomfort, dissatisfaction, and disorders. In order for new schools to produce long-term physical, emotional, and social benefits for the users, flexible furniture, that is adjustable, reconfigurable, compressible, and attractive, needs to be provided. To support the different physical needs of the users and the various activities, they need to incorporate ergonomics, usability, and functionality as well.

05 | TRANSFORMABLE CLASSROOMS

05.1 TRADITIONAL PROBLEMS

Children spend majority of their school day in the classrooms so it is crucial that these spaces are designed to influence and promote development. Unlike upper level learning environments, elementary schools are not designed for children to move from class to class to learn the different academic subjects. They obtain all information in one place for the whole school year with the exception of physical education, recess, and lunch, which requires them to leave the classroom. With this much time spent indoors, it is important that much thought is put into their design.

It has been agreed upon by many that there is a lack of innovation within the design of educational facilities, but there are various factors that limit designers from creating the appropriate learning environments. Some designs are driven by budget and schedule concerns while others develop solutions from research on the users and their needs. Everyone expects design professionals to have the skills and be trained to analyze research on how teachers teach and how students learn so they could use the information to design spaces that promote learning. Even with this understanding, however, they may not be able to translate the concepts into designs that support the users. Providing new ideas that work may be rejected because owners do not want to take risks on concepts that others are not familiar with and might not support. For this reason, reverting back to traditional classroom designs, which are better known but not successful in promoting learning, has been the safest solution for designers. Traditional classrooms, however, were inflexible and restrictive, which did not allow diverse activities to occur.

Many traditional classroom designs were considered unsuccessful, but some can still be found in schools today. There are mixed arguments about these designs. Some believe that they promote learning and continue to apply them in schools and others find them to inhibit learning. The L-shaped design was one of the first patterns created that allowed for a variety of activity settings. Different areas of the room were defined for specific activities and can be reconfigured to support other activities. Even with its flexibility, it has been criticized because it restricted the teacher's view of what was happening in the extensions. Some believed that they encouraged unwanted behavior and activities, which the teacher could not control. The open plan school, like the L-shaped design, was another idea that allowed for various activities. Students were encouraged to be active learners where they are able to wander around the spaces and choose what, where, and how they will learn. Teachers tried to structure their settings for learning activities to occur but students were unable to be fully engaged because they were distracted by other activities surrounding them. Most classrooms today are rectangular in plan, a familiar design to all, which allows the teacher to have full control of the space. The teachers are more comfortable in this setting because they can still instruct from the front of the classroom while the students take in the knowledge from their seats that are placed in rows and columns. This passive environment, however, creates obstacles in teaching, learning, and development.[31]

Educational specifications (EDSPECS) play a great role in classroom and school designs and restrict innovation and creativity. Designers rely heavily on EDPECS even before they start the design process. This physical document, developed by the Department of Education (DOE), provides data and information on how the physical plan of each space should be, including square footages, furniture sizes, etc. The DOE assumed that with this document, designers are able to provide spaces that meet the instructional

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[31] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools*. Hoboken, N.J.: J. Wiley, 2010.

objectives and the new trends in teaching and learning as well as support the advancement of technology. Simply assembling pieces together, however, result in cookie-cutter schools that are not site or community specific and do not support the needs of the children. This traditional way of designing is based on a linear process, where the function of a space is determined first and the space is then designed for that activity. Without considering the human experience and cognitive process, static spaces that restrict learning are created.[32] The idea of classrooms that are spatially transformable lets the teacher hold activities that promote individual, one-to-one, small group, and large group learning that support the different academic subjects.

05.2 MODERN SOLUTIONS

When designers research the history of school designs, understand the learning theories, and evaluate the effects of the learning environment on how people interact and learn, they should be able to apply these findings to designing spaces that promote learning and development. By taking the successful ideas and eliminating the unsuccessful elements from traditional classrooms as well as integrating modern day changes and technology, designers can create transformable classrooms to support the users. Teachers who are able to spatially manipulate the learning environment can develop lesson plans for each academic subject. With this flexible feature, they can prepare for changes that may occur in the future.

When students are in school, they learn the most in the classroom. Their interaction with their fellow classmates and nonhuman elements provide opportunities for learning and influences behavior. The activities created by the teacher should allow each individual to enter reflective and engaging spaces where they acquire formal skills, scientific knowledge, informal skills, everyday knowledge, and creative skills. The roles of teachers have evolved in modern day schools, so they act more as guides rather than controllers of the activities and the individuals in the front of the room. They need to generate activities that vary in student engagement and transform the classroom space to accommodate them. Activities and spaces should be for individuals, partners, small groups, or large groups.[33]

The overall design of elementary school classrooms should be diverse in design to enhance the gross motor skills of the children. An environment that does not support their process of development will have a negative impact on their health and can be damaging to their learning. Each individual classroom must be age appropriate for the users occupying them and must be inspiring and not overwhelming. Each child perceives space differently, which affects their understanding and reaction to them. As designers, applying their way of thinking is important in creating these spaces.[34] The impact of the classroom on the development of children is not only affected by size and the spatial configurations, but it is also affected by the use of materials, colors, effects of lighting, acoustics and noise, and temperature, humidity, and ventilation.

Size & Spatial Configuration
Studies have shown that smaller classrooms positively affect a child's academic achievement. They are able to feel more personal connections with the school, which improves learning and academic achievements.[35] While large spaces may decrease the sense of overcrowding, it might have the potential to overwhelm smaller, younger children. With a desire for active involvement from the students, studies have also shown that more participation in leadership roles and extracurricular activities occur more in

[32] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools.* Minneapolis, Minn.: DesignShare, 2005.
[33] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools.* Hoboken, N.J.: J. Wiley, 2010.
[34] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition.* New York: Fairchild.
[35] Frumkin, Howard. *Safe and Healthy School Environments.* Oxford : Oxford University Press, 2006.

smaller classes. They are more responsible, understandable, and exhibit greater self esteem. Children who develop these characteristics will less likely be involved in crime, vandalism, and misconduct. Although it is ideal to have small classrooms, this is sometimes hard to achieve. If designers unintentionally create spaces larger than appropriate, there are design features that can be used to change how the space is perceived. For example, large spaces can be segmented with sculptures and blank walls can be covered with murals or pictures to make the space feel smaller. Architectural elements, like the ceiling, can be sloped in certain areas of the room to increase the students' perception of space. When an activity requires the teacher to instruct in front of the class, like traditional schools, the ceiling in this area can slope higher as it reaches the front of the space. This reduces the teacher's visual distractions because they can focus on the students during instruction.[36]

The factors that affect the configuration of the classrooms are the fixed and non-fixed elements that help define the activity spaces. Fixed features may include corner areas, built-in cabinets with countertops and sinks, wall cabinets, overhead projectors, recessed ceiling projection screens, white boards, cubbies, and built-in seating. These elements are used to define learning zones and create specific activity settings. Here, students are able to develop interpersonal, intrapersonal, mathematic, kinesthetic, and spatial skills while working on specific problems. Non-fixed features of the classroom may be items that are brought by the teachers to promote specific tasks for the students. These may include smartboards, blocks, microscopes, laptop computers, PDAs, computer tablets, water tables, sand tables, chairs, desks, tables, and bookcases. These temporary elements can be arranged and rearranged to promote individual, one-to-one, small group, and large group activities.[37]

In order to create a transformable space, the plan of the classroom cannot resemble the tradition L-shaped, open, or rectangular plan, even though there are advantages amongst the mentioned disadvantages. Instead, these new classrooms should combine all these concepts into an irregular layout. This gives teachers more opportunities for applying different teaching methods because they are not restricted to a standard layout and one way of teaching. They can also determine what techniques to use that will make the teaching process more efficient and beneficial for developing the skills of the children. Areas of the classroom which are more open, like the traditional open plan schools, can be used to promote exploration and participation and allow for group work.[38] As seen in history, open spaces have the potential to be distracting when the students are divided into smaller groups and multiple activities are occurring at the same time. With the scale of the classroom, however, disruption can be lessened when moveable walls, screens, storage units, bookshelves, and other non-fixed elements are used. These spaces that are not fully defined by permanent walls are more fluid and can be easily changed on a day to day basis.[39] Areas in the classroom that resemble the L-shaped plan can accommodate small group or individual activities because the extra extension acts as a breakout space. The part of the classroom that reflects the typical rectangular classroom has three walls that can serve different functions. One wall can display student work, important school announcements or notices, and seasonal decorations. This surface would not be the primary display and should be located in the back on a movable partition to avoid distractions during class time. The two side walls will display information that has already been taught, which students can refer to for review. Lastly, the front wall should be used to acquire new knowledge. Acting as the focal point of the space, this surface will have the most attention compared to the others.

[36] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.
[37] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools*. Hoboken, N.J.: J. Wiley, 2010.
[38] Perkins, L. Bradford, and Raymond Bordwell. *Building Type Basics for Elementary and Secondary Schools*. 2nd ed. Hoboken, N.J.: John Wiley & Sons, 2010.
[39] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools*. Minneapolis, Minn.: DesignShare, 2005.

With flexible spaces like transformable classrooms, it is recommended to have less built-in furniture because it restricts change and movement. Smaller, lightweight pieces that are easily moveable and storable can accommodate the different activities and arrangements that support the varying teaching methods. Clustering furniture as opposed to rows and columns is recommended because it supports interaction and collaboration between the students. In less active spaces that are for independent studying or reading, teachers can provide small sofas, bean bag chairs, carpet squares, or loose pillows to promote comfort and relieves stress.[40] Since there are many non-fixed elements and everything is constantly changing, the room might be cluttered with too many things. When this happens, it can create the effect of crowding, which can cause stress and be overwhelming for the users. Shifting elements that are not applicable to the lesson plan can mitigate the feeling. Excessive supplies or books can also be distracting and should be stored when they are not in use. With the spaces always shifting to fit the academic subject, the users should occasionally change the displays to reflect the current projects. With the spaces changing as well as the temporary features, this creates a dynamic, active learning environment.[41]

Materials

The materials of classrooms need to be carefully selected not only to endure years of use but also to enhance learning and promote appropriate behavior. Oftentimes, materials that convey a stronger sense of factories are used because they are more durable and maintainable. There are many new products that can provide the same level of durability and maintainability that produce more comfortable settings, like those of homes.[42] Designers must consider the materials from a child's perspective instead of an adult. A child, for example, might interpret shiny floors as places for running and making squeaky noises while an adult sees them as spaces for quiet walking.

Colors

Using colors in learning environments can affect not only the students' level of attention but also their attitudes, behaviors, and learning comprehension. The school environment can be perceived as pleasing, exciting, and stimulating rather than plain and boring if colors are used correctly. Studies have shown that white or off-white colors decrease human efficiency and should be avoided. Areas of calm activities should have darker colors and spaces involving high energy should have brighter colors. Subdued colors on a black, purple, or deep yellow background color, for example, draws the least amount of attention and creates a calm environment. Cyan on a red or yellow background, or red or magenta on a cyan background, on the other hand, are stimulating and attracts more attention. To differentiate each individual's workspace, colors that contrast the overall environment should be used.[43]

Lighting

Windows incorporated in the learning environments allow daylight into the overall setting. Studies have shown that lighting, especially from natural sunlight, could affect a student's academic performance, physical development, and cognitive growth. This occurs with better quantity and quality of lighting. A well distribution of lighting allows for better vision which leads to completing tasks quicker. With good lighting, students are able to acquire knowledge 20% faster than in poor lighting. Uneven distribution of lighting may cause strong, dark shadows, making the spaces unusable. Lights hitting the walls, ceiling, and

[40] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.
[41] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.
[42] Perkins, L. Bradford, and Raymond Bordwell. *Building Type Basics for Elementary and Secondary Schools*. 2nd ed. Hoboken, N.J.: John Wiley & Sons, 2010.
[43] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.

desks should be balanced, which promote a feeling of spaciousness. Although uniformed lighting can have positive effects, monotonous lighting can be boring after long periods of time, which can make spaces feel dull or dim. The users should be able to control the lighting to fit the variety of activities that are to occur, including regular class work and high light demanding tasks. It is also ideal that the lighting can be dimmed or turned off. Having operable windows that control the amount of natural lighting entering the space can increase student performance by 7% while inappropriate glazing can cause glare, reducing learning rates by 21%. When tinting, awnings, blinds, louvers, and light shelves are incorporated on the windows, the users can manually balance the natural and artificial lighting.

Windows built into the partitions, sidelights on the door frame, and glazing within the doors allow natural light to filter into the overall space. Students are able to see the activities that are occurring throughout the facility. In this more open environment, fellow teachers and students can learn from one another academically as well as personally. High skylights or clerestory windows can provide daylight while windows at eye level can provide views to the outdoors. Including more glazing in all the structures creates an informal security system where the users are able to determine who belongs and does not belong inside the facility. Users are able to take notice of trespassers and accidents are also reduced when spaces are properly lit. By integrating daylighting with electric lighting and flexible controls, visual comfort can be maximized and connection with the environment can be maintained.[44]

Acoustics & Noise

In learning environments, sounds that have an unpleasant physiological or psychological effect on learning become noise. Unwanted noise can negatively affect learning, whether they were continuous or intermittent. They can occur from both external and internal elements and have the ability to harm a student's academic achievement. A combination of outside and inside noise not only affects communication between the teacher and students, but they also lead to the lack of motivation, attention, and memory. Students who are unable to focus in class may experience stress, which increases blood pressure and heart rates. The persistence of these symptoms can affect them as they get older. Incorporating sound reducing features not only lowers noise levels, but they also allow students to pay more attention the teachers and activities happening in the spaces. Less noise distractions result in higher test scores related to letter, number, and word recognition.[45]

Distracting external noise from elements like cars, planes, and lawn mowers can affect a student's ability to concentrate but can be reduced if double or triple paned windows are incorporated in areas of high noise levels. Including tall greenery and landscape can also absorb the noise and also act as visual stimulation. Other sources of disruption might be generated from lighting, mechanical systems, and heating and cooling systems.

Internal noise can be caused by computers, printers, copiers, mobile phones, pagers and the hardest factor to mitigate, human activity. People speaking, moving chairs and desks on hard floors, and tapping pencils and pens on desks are disruptive for all users and is difficult to control.[46] Integrating certain design features can help reduce the noise levels and this includes the configuration of the rooms (placement of walls), surface finishes (hard or soft), material density (solid or hollow), and air tightness of the materials (for sound transfer). Changing the room size, dimensions of walls, ceilings, floors, and

[44] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools*. Hoboken, N.J.: J. Wiley, 2010.
[45] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.
[46] Kopec, Dak. "Designing Public Schools." *ASID ICON*, Fall 2006.

windows, and materials of chairs, desks, flooring, wall coverings, and ceiling can also help lesson noise. Sound absorbent or soft materials on walls, cork, linoleum, or carpet on floors, and acoustic ceilings, for example, can be used to dampen the noise. Where there are hard floor surfaces, rubber pads can be used on the feet of chairs, tables, and desks.[47]

Temperature, Humidity, & Ventilation

Similar to acoustics and noise, temperature, humidity, and ventilation are non-visual elements that need to be considered when designing learning environments. When possible, natural ventilation should be maximized. It not only gives the users a better quality of air to breathe but it also provides a connection with the outdoors. The thermal condition of the classroom can have direct effects on the human body which affects the overall performance, learning, and productivity of the users. The appropriate temperature and humidity in these spaces vary and they all depend on external factors, like the season and climate, as well as internal elements, like materials, window glazing, size and volume of the spaces, number of occupants, activities occurring, and the heating and cooling system. In hotter climates, incorporating air conditioning can improve attitudes, performance, and behavior. It is ideal that controls are provided so users can monitor these factors that impact their comfort. Not being able to control the interior conditions can lead to discomfort of the skin, eyes, and other parts of the body, which affects learning and intellectual performance.[48]

05.3 DESIGN GUIDELINES FOR NEW SCHOOLS
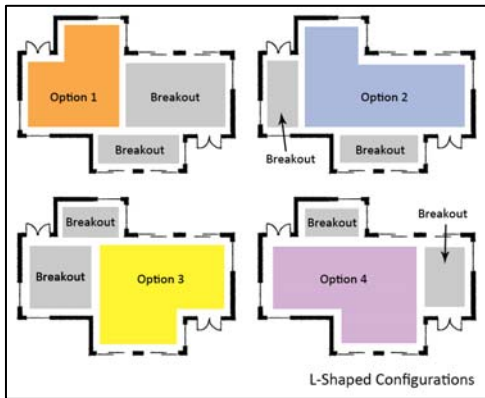
Figure 05.01

Irregular layout that accommodates various configurations (L-shaped, open, rectangular, and random) and breakout areas for individuals, small groups, and large groups
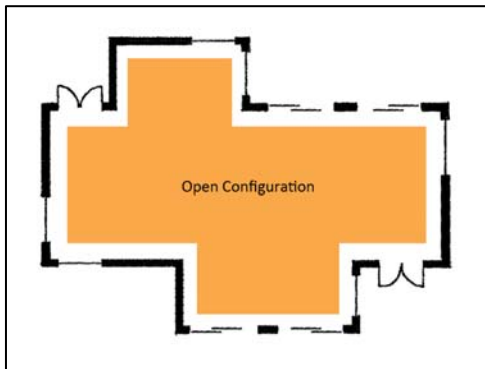
Figure 05.02

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[47] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.
[48] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.
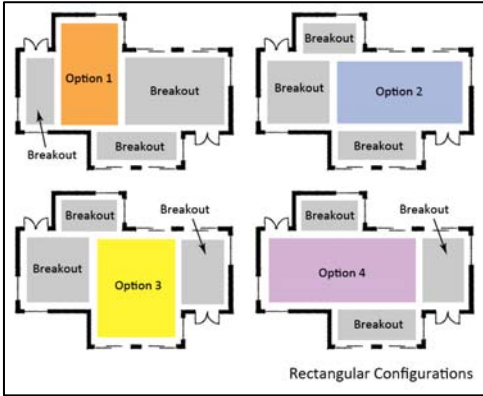
Figure 05.03

Figure 05.04
Moveable elements (walls, screens, storage units, bookshelves, etc.) for defining spaces temporarily
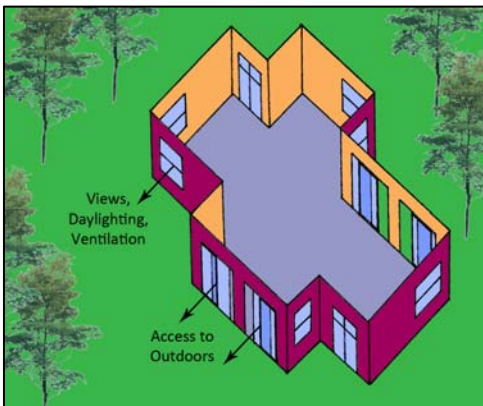
Figure 05.05
Windows and sliding glass doors for views, daylighting, ventilation, and access to the outdoors
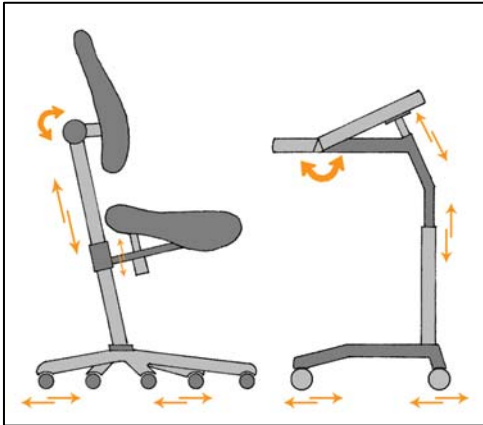
Figure 05.06
Flexible, ergonomic tables and chairs

05.4 ANALYSIS OF PROPOSED/BUILT PROJECTS

<u>School</u>: Hillel School of Tampa
<u>Location</u>: Tampa, Florida
<u>Architect</u>: Fielding Nair International

Figure 05.07
The renovation of this school transformed a traditional design into a modern day learning environment. Each classroom has a video projector and a smartboard. A variety of flexible furniture and soft seating is included for group work, individual activities, or quiet tasks. Sliding glass doors are used to separate two classrooms but can be opened to promote collaboration between the classes.

Figure 05.08
A typical classroom before renovation had very small windows that provided very little daylighting, fresh air, and no views. Not only were the users unable to connect with the outdoors, but they also had furniture that did not support ergonomics. The tables were also big and heavy, which made it difficult to move around. After renovation, larger windows were provided for views of the outdoor environment, natural lighting, and ventilation. One room connects directly to another through a sliding glass door. Teachers and students of both classes can work as a team with this new setup. Although the arrangement of the furniture is student-centered and promotes collaboration, their designs might be too big for the children to rearrange on their own. They are also placed too close together and do not leave enough space for movement and reconfiguration of the room.

Figure 05.09

In other renovated classrooms, round tables are provided that accommodate 6 or more users and encourage group work. The class on the other side of the sliding glass door can also occupy this room for class collaboration. Like the tables of the other classrooms, however, they are large, heavy, and placed too close together, which restricts movement.

Figure 05.10

Throughout the renovated building, new furniture has been incorporated for improving student and teacher comfort and productivity. In some classes, yoga balls are used as student chairs, which forces proper spine alignment. Being able to obtain proper posture improves spinal health, decreases back pain, and improves concentration. Other flexible seating that are height and back adjustable should be provided to support other uses. Having to sit on yoga balls for long periods of time might create some problems for tall and short students because the tables would be too high or too low for them. In other classrooms, soft seating is included to create comfortable reading settings. The students can find a comfortable position on these soft seating and cushions while they read or rest. Large windows provide adequate amount of natural lighting and ventilation as well as views of the outdoors.

School: Scotch Oakburn College, Middle School
Location: Tasmania, Australia
Architect: Fielding Nair International

Figure 05.11
The classrooms of this middle school provide children with a variety of furniture that can be rearranged to support the different activities. There are round and rectangular tables for reading and writing assignments for groups as well as sofas for laptop use. Bean bags are also included to create soft, comfortable environments for reading or studying. Each wall has large windows that let in a lot of natural lighting. They can be opened for natural ventilation as well. Students who need a break from their school work can look out into the natural environment for relaxation. The walls that separate the classrooms also have windows. This design allows the users of one class to see the activities occurring in another, which encourages them to learn more about their peers and their projects. The wall surfaces can also act as teaching surfaces, where new materials can be pinned, as well as student display spaces.

School: Von Humboldt Elementary School
Location: Chicago, Illinois
Architect: Landon Bone Baker Architects
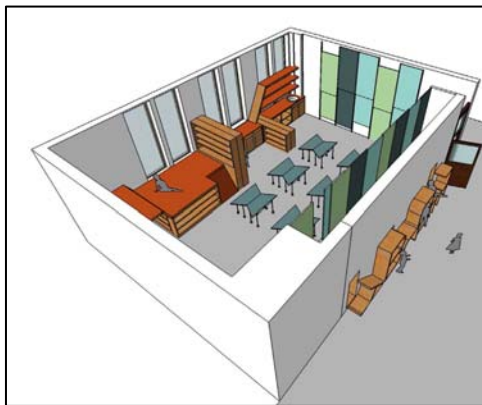
Figure 05.12
This design proposal focused on the upgrade of a first grade classroom, which was developed with the collaboration of the architect, 23 students, and the teacher. The original classroom had mismatched bookcases scattered around the room, which left no space to work or areas for personal storage. The room also lacked wall space for displaying student works and chalkboards for teaching. Technology, such as a TV or project screen, was also unavailable. Only an outdated computer was provided. The new classroom not only creates more storage and display spaces, but it also allows for flexibility. The design creates three distinct zones, which support the various activities. These zones include the storage zone, activity zone, and multi-purpose zone.
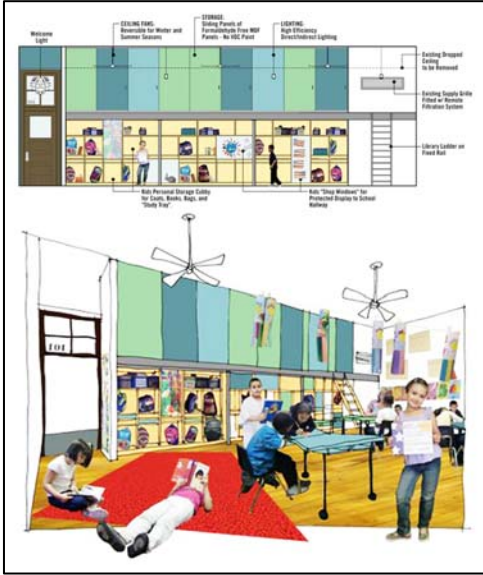
Figure 05.13

When users enter this room, they are welcomed by a modern light fixture hanging above the door. The storage zone is located next to the entrance, along the hallway. The original dropped ceiling was removed to create high cabinets for the teacher to store her supplies. They can be accessed from a ladder that is fixed to a rail. Beneath these cabinets are low, built-in cubbies for the children to store their belongings such as coats, books, or bags. Small windows are integrated into the cubbies so that projects and artworks can be displayed for the rest of the school users to see as they occupy the hallway space. Although fixed elements are known to restrict movement and flexibility, these storages spaces actually open up the floor space of a once cluttered room to support furniture reconfiguration for the different activities of the day.
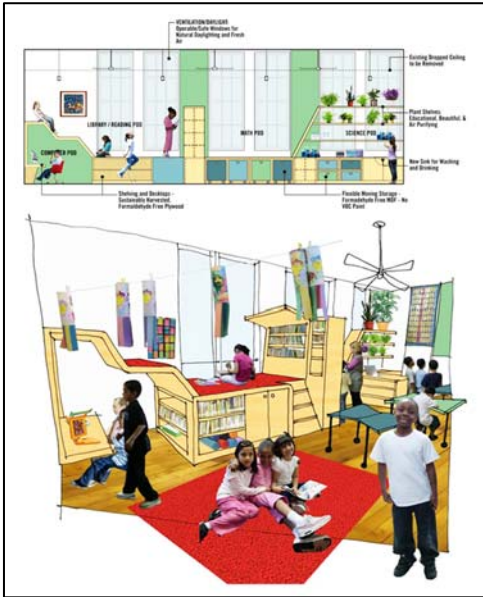
Figure 05.14

The activity zone is located along the window wall. The tall windows are operable and safe and allow users to connect with the outdoors, natural light, and fresh air. Along this wall are pods for computer, reading, math, and science lessons as well as shelves for growing plants. Here, the teacher can hold lessons on the different academic subjects. These activity spaces are defined by the built-in furniture which also includes areas for storage, books, and displays. The children can occupy these spaces for individual or small group assignments. A sink is incorporated below the science pod for washing and drinking. By placing all the activities along this wall, the floor space is open for furniture arrangements. The use of mats on the hardwood floors support floor activities and can be rolled up when they are not in use.

Figure 05.15

The central area of the new first grade classroom is the multi-purpose zone. This flexible space, filled with new, trapezoidal, height adjustable student desks on wheels, is designed to be reconfigurable and encourages movement. Each desk is occupied by two students and a portable tray is provided underneath for storing of books and supplies. Throughout the day, this zone transforms many times to form large or small groups to support the various activities. This space can also be cleared completely to create room for physical activities such as class plays, educational games, jump rope, or other exercises.[49] The school day begins at 8:15 am when the children store their belongings in their personal cubbies and then sit in small groups. During this time, the teacher discusses the activities for the day. At 9:30 am, the class is divided into two large groups for their 90-minute, uninterrupted reading assignments. The furniture in the room transforms again into smaller groups at 11:30 am for 1-hour of math lessons. After lunch, children gather in the reading pod for quiet, individual reading. At 1:30 pm, they rearrange the furniture again around the science pod for science lessons. Before they are dismissed from class at 2:15 pm, the furniture is brought back to their original positions for class the next day.
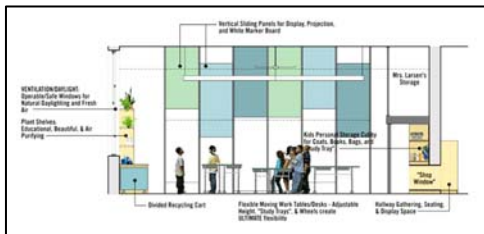
Figure 05.16

On the other 2 walls, there are vertical panels that can be used for displays, projection, and white marker boards. With their ability to slide up and down, these colorful panels create different and interesting learning environments for the users.

[49] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).

School: Future Leaders Institute Charter School
Location: New York, New York
Architect: Gensler

Figure 05.17
The goal of the designers was to change the traditional, old school building into modern learning spaces. They did so by reusing appropriate portions of the existing building and blurring defined spaces to create various learning environments that are centered on the learners. The original school was traditional in plan, with a double-loaded corridor and stairs at the ends of the hall. Although its design and size of the classrooms were appropriate in the past, they are no longer effective for learning. With the classrooms, the designers have created transformable spaces that accommodate small group learning rooms as well as multi-use assembly areas. The incorporation of movable elements allows all the learning spaces to overlap, creating flexible spaces for individual, small group, and large group activities. The impermanent features of the school produce blurred classrooms that contrast the traditional, rigid, defined classrooms of the past.[50]
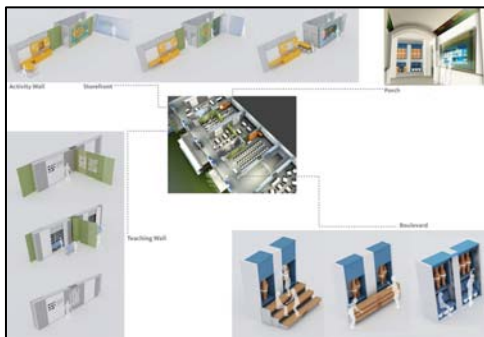
Figure 05.18
In this new design, there are activity walls and storefronts incorporated in several areas. The activity wall is moveable to create different sized learning environments. It has spaces for storage, sinks, and white boards for class lessons and assignments. The storefront is also moveable with a glass surface that can be written on for teaching. In other areas, multiple teaching walls are provided with technology integrated. There are tackable panels for posting papers and white boards for teaching. A hidden divider is in each of these walls that create different sized learning spaces for small or large groups. Users can also find hidden storage spaces here. There are several Porch spaces filled with technology such as interactive displays, LED banners for school announcements, stand up computer kiosks, and OLED technology that can be accessed by all users throughout the school day. The transformable spaces continue out to the Boulevard where bleachers are provided for group discussions and can be collapsed when they are not in use. In other areas, soft seating is integrated for quiet, individual work. Floor to ceiling glass in these areas allow natural light to brighten up the interior spaces.

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[50] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).

School: Antonio de Orena Elementary School
Location: Chihuahua, Mexico
Architect: Rocio Cristina Acosta & Diego Collazos Goret

Figure 05.19

In the process of improving the curriculum and with enrollment increase, the school wanted two new classrooms designed. The current classrooms of the school are over a century old. The small windows prevent daylighting as well as natural ventilation. Many classrooms are used for storage purposes, which reduces the amount of available space for teaching and learning. With inadequate storage space for teaching resources such as maps, drawings, posters, and recently, computers, crowding has become an issue. Movement and flexibility is restricted because of the lack of space. Some classes are also forced to move to the basements, which are poor, unsafe learning spaces for the children. With the collaboration of the architect, students, and teachers, a proposal was developed. This innovative design reflects traditional, local architecture and relates to the existing buildings of the school.[51] The integration of sliding panels creates an area that is transformable between the two classrooms. With this adaptable space, three possible configurations can be made. In the first option, there are two separate classrooms for 20 to 30 students and one shared library space. In the second option, opening up the library space creates bigger classrooms for 30 to 40 students. In the last option, the large, central space can accommodate 60 students and the two smaller classrooms can support 20 to 25 students. Located along the side and back edges of the classrooms are other learning spaces. There are areas for computer use, reading, crafting, lockers, and wood storage. Both classes share the bathrooms and sinks. Each classroom is also provided with a mobile chalkboard that can be moved around as the rooms transform themselves for the different amounts of users and changing activities.

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[51] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).

School: Ugandan Rural Classroom
Location: Uganda
Architect: Gifford LLC
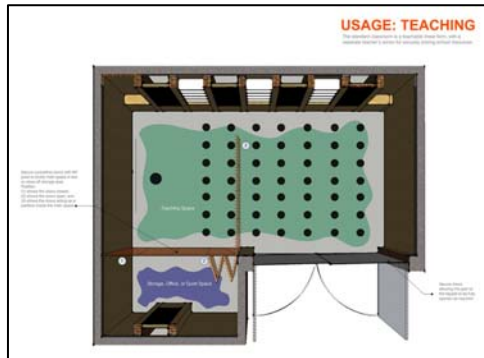
Figure 5.20

Although simple in form, the design of this new classroom features sustainability elements and supports modern day and future needs of the school. It not only creates various teaching spaces, but it also allows children to play and rest safely. The classroom features secure, foldable doors with a 90 degree pivot that divides the main classroom in half. They can also be closed off to secure the storage area that also acts as the teacher's office. It includes a window that provides daylighting when the space is occupied as an office. The surface of these flexible doors can be painted with blackboard paint that can be used for teaching or attaching student works and announcements. The main entrance to the classroom can be secured or fully opened when the outdoor spaces are being occupied.[52]
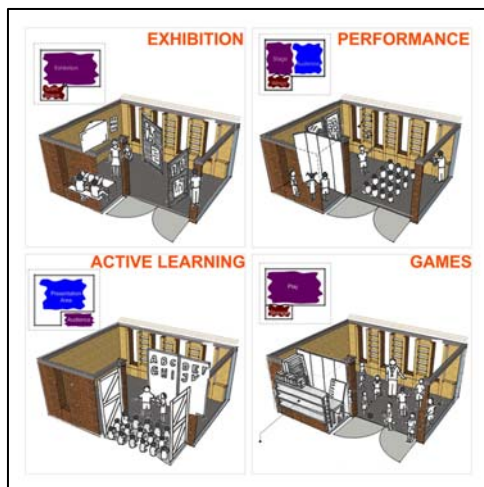
Figure 05.21

The simple L-shaped plan is not a new idea. The design is simple but can transform for a variety of uses. The classroom can be occupied as an exhibition with moveable screens for displays. These screens can be easily stored away when not in use. The small extension can be a desk area for quiet reading, working, or can be occupied as a reception area. An indoor performance space can also be created for the school and community. Half of the room acts as a stage while the other half is occupied by the audience. The foldable doors create an enclosed back stage area for the performers. Another function of the room is an active learning space. While sheltered under the roof, children can sit on the veranda as the presenters teach the students with screens as the backdrop. In this setup, the students get the opportunity of being in the outdoors with natural lighting and fresh air. During rainy season, the indoor classroom can be converted into a game room with the flexible furniture stored in the storage.

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[52] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).
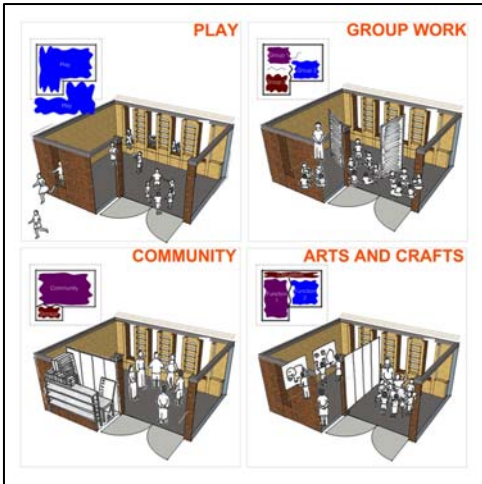
Figure 05.22

On days when the weather is nice during summertime, the whole indoor and outdoor spaces of the classroom can be used for play. The foldable doors can be folded away and the window shutters can be opened for daylighting and air flow. Children can also climb through them for fun or occupy them as seats. The classroom can also be transformed into multiple group work areas for different age groups. This can be done by using the foldable doors as well as two sets of movable screens, creating three separate work areas. When the classrooms are not occupied by the teachers and students, it can be converted into a community space. The school can secure their possessions in the storage while the community occupies the main space in the room. When the foldable doors divide the room in half, the school can create two distinct areas for arts and crafts. Different projects can be taught simultaneously. The foldable doors do not completely separate the room, but instead, create a small gap for circulation. The students can move back and forth, alternating between projects.

School: Waldorf Educational and Social Organization
Location: Bogota D.C., Colombia
Architect: Architectura Justa
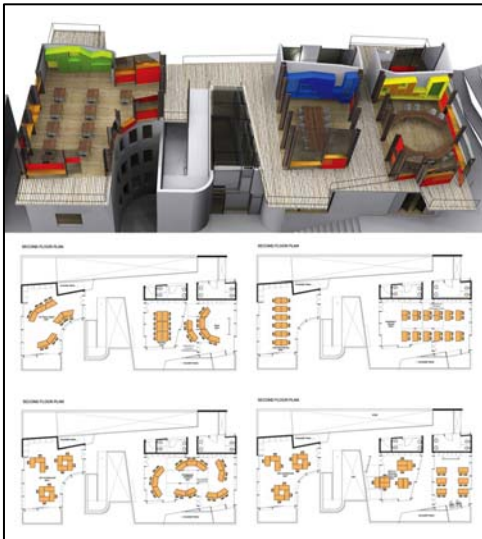
Figure 05.23

The designers partnered with the school to improve the spatial characteristics of the school and to enhance the quality of education. It was important that the classrooms are designed for the future with the integration of information technology. Flexible classrooms are created to adapt to the different teaching methods. Although this school is occupied by the community and open to the public for presentations, its spatial structure is introverted and enclosed. It is essential that the spaces are open, inviting, and exposed for the neighborhood and city to see the importance of education. The architecture responds to a wide range of uses within each school day. These dynamic physical learning environments accommodate the various activities like workshops, classes, and events. The use of overhead retractable doors allows two rooms to join together or lets the classrooms flow into the communal spaces.[53] The furniture provided supports individual work, small group projects, and large group collaborations.

[53] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).

School: J.H.S. 013 Jackie Robinson
Location: New York, New York
Architect: HLW International

1. ENTRY ZONE WITH BENCH
2. PROJECT DISPLAY
3. TEACHING WALL
4. GLASS PANELS
5. CENTRAL FORUM
6. ENCLAVES / TEAMING TABLES
7. LIBRARY / GARDEN
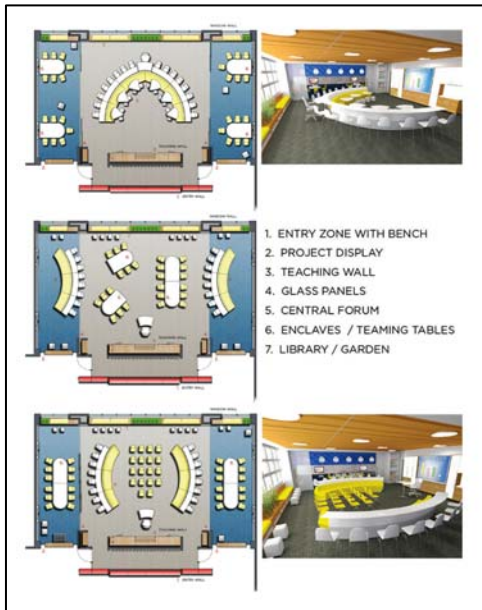
Figure 05.24

In hopes to create classrooms for the future, the designers interviewed the principal to gain a better understanding of the school's needs, goals, and ideals. From this, the designers have learned that the classrooms will be shared resource centers for multiple subjects and different teaching and learning methods. It is important to integrate computers for critical thinking and writing skills to develop. The students have also discussed their concerns about the closeness of the desk and they would rather work in groups of 4 to 6. They also feel that chalkboards are time consuming and difficult to read so the new classrooms should incorporate modern technologies. A small library will also be integrated to promote more reading. Storage spaces for coats and display cases for student projects will also be provided to create a sense of belonging for the students. Flexible furniture will also be integrated to promote rearranging of the rooms for the different activities. They also encourage interaction and accommodate the different methods of teaching and learning. Overall, the rooms need to be flexible for lectures, group work, and individual activities. By applying these comments to the design, classrooms for the future are created. The designers organized them into multiple zones of learning. These zones include the Entry Zone, Central Forum, Enclaves, and Library/Garden.

Figure 05.25

In the Entry Zone, a bench is included for gathering. This area also includes storage for the teacher, coat storage, a sink, a projection screen, a printer, a recycling center, and display. The users can recharge their laptops and other technologies here because a charging station is provided.

Figure 05.26

The Central Forum is an area for large presentations. Unique, curved seating focuses the attention to the presenter in the center. The soft seating provided creates a comfortable setting while the high counters with stools can be used for reading, writing, or technology use. A projector that is mounted on the ceiling connects to the presenter's station. The teacher's desk is not fixed and can be moved depending on the lessons and assignments.

Figure 05.27

Enclaves are areas for small group projects. This area has special acoustics on the ceiling and walls to lesson noise distractions during group collaborations. Users can use the interactive technology as well as the whiteboards for writing notes during their brainstorming process. The flexible furniture provided is lightweight and can be reconfigured to accommodate the different sized groups and various activities.

Figure 05.28

Located next to the window wall is the library and garden. The small library is set under the window seats and shelves in vertical storage towers are built-in for storing more books. This area can be occupied for quiet reading while the large windows let in natural sunlight and provide views of the natural environment. Small gardens are incorporated by the windows, which encourages students to be involved in the planting and growing process. This space can be divided into smaller spaces or opened up for large groups with the integration of sliding, translucent panels. These panels can also be written on for teaching and learning.[54]

School: The Project School
Location: Indianapolis, Indiana
Designers: Chunsheh Teo, Kelli Polzin, Brooke Funkhouser, Amy Berndt
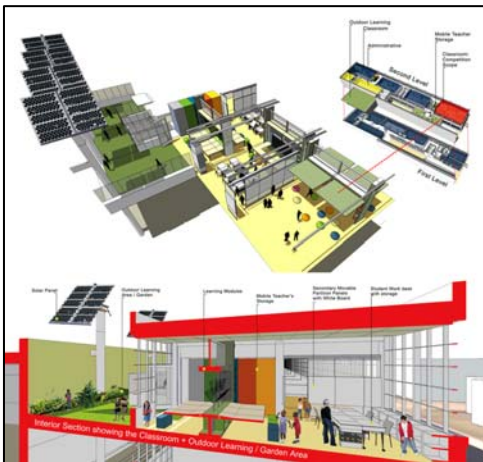
Figure 05.29

This school is currently occupying a historic building that was once a factory made of cast iron beams, brick walls, and large windows. It is essential that the new design preserves the character of the building because it played an important role in the history of Indiana. With large, high spaces and the odd spacing of the columns, the school found it difficult to create individual classrooms. The lack of acoustics also created problems for the users. After collaborating with the school, the designer developed a design that creates both large and small spaces for modern teaching and learning. Mobile, impermanent elements are incorporated into the design for flexibility.

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[54] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).

Figure 05.30

The integration of moveable modules encourages interaction between the classes and can be used to divide the spaces into separate areas for more private activities. These flexible spaces are designed so that they can be duplicated throughout the school in the future. They can be arranged so that the students can use technology, relax, or work on art projects. They can also transform to reflect a typical classroom, traditional classroom, or classrooms for activities. The interior spaces of the new design are constantly changing to support the activities.
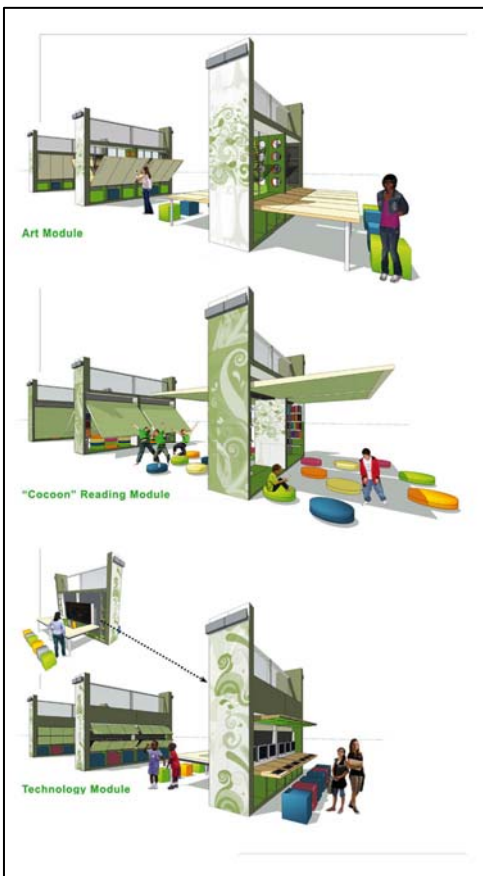
Figure 05.31

The mobile, self-contained educational modules are included to serve as partitions as well as learning centers. These modules are used for teaching art, technology, science, etc. They can be suspended and slid along the overhead beams to divide or connect the classroom spaces. These modules can also be floor mounted or on wheels. The Art Module has a vertical tack surface that unfolds to become a table. There are self-contained seating blocks and storage for the users. Translucent panels are incorporated above the units to allow light to enter the spaces. The "Cocoon" Reading Module has hinged walls that open up like a canopy to make spaces scaled to the size of the students. Cushions are stored in these modules to create relaxing spaces for reading or studying. There is also storage for books and magazines. The Technology Module has stored seating blocks for using the computer station on one side. On the other side, a smartboard is integrated and group learning can occur with the unfolding table.[55] The school can provide different modules for the many academic subjects. Because they are all moveable, the learning environment is active and constantly changing.

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[55] "Find current projects: Education Facility - Primary School | Open Architecture Network." Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. http://openarchitecturenetwork.org/projects/results/taxonomy%3A79 (accessed March 17, 2011).

Figure 05.32

The users are able to experience a variety of spaces with the integration of the mobile learning modules. These colorful and themed modules are fun and promote creativity. The schools can have them customized to fit their needs. Some students can occupy one area of the room for quiet reading or studying while others can have individual lessons from the teacher on the translucent writing panels. In the classroom space, children are provided with customizable tables on wheels. Each table is designed with a locking system and can be opened for storing belongings and supplies. They can be put together for group assignments or separated for individual work. Their large design, however, makes it difficult to stack and store if they wanted to occupy the open floor.

05.5 PERSONAL REFLECTION

"The spatial organization of my classes in elementary school varied little. Majority of them reflected traditional classrooms, except for kindergarten, with furniture laid out in rows and columns. The students sat facing forward in a rectangular classroom where the teacher instructed from the front, having full control of the setting. The method of teaching also varied little. It was a linear process where the teacher spoke and the students listened. The classrooms were passive learning environments with no hands-on experiences for the students. We sometimes worked in groups, which required us to rearrange the furniture of the room, but the desks and chairs provided were not flexible. We also did not have relaxing areas in the room with soft seating for quiet reading or individual studying. We were also unable to stack and store the furniture to use the floor space for activities. The classroom was slightly different in kindergarten. Instead of listening to the teacher instruct at the desk, we sat on the floor. We also used the floor during nap time, where we unrolled our sleeping mats and placed them in an open area. I was first introduced to a computer and typing lessons in second grade, so technology and internet did not play a big role in education compared to today's schools.

If I had the opportunity to make changes to my elementary school classes, I would want the teachers to create more assignments that encouraged the participation of the students. We would also do more group work to enhance our cognitive and psychosocial skills. With these changes, the learning environment would be more active than passive. The students would be more involved and the learning process would be more rewarding as the students acquire and master certain skills. The role of the teacher would also be different compared to traditional schools. They would not have control over the students, but instead, would act as guides as the students learned through participation and collaboration. I would also provide flexible furniture and soft seating that would accommodate the individual, small group, or large group activities. With technology evolving so quickly and playing bigger roles in schools, I would also

integrate them into the classrooms so that the users are able to occupy them for teaching and learning."

05.6 CONCLUSION

Although there were many disadvantages to traditional classrooms, some of these designs can still be found in schools today. These designs are continued partially because many were able to notice the positive features amongst the negatives. The design alone of L-shaped, open, and rectangular plans do not create flexible spaces for modern day teaching and learning methods. Combining all three into an irregular classroom layout can create transformable classrooms that allow activities for individuals, partners, small groups, and large groups. Even though these settings can be reconfigured to fit the activities and can accommodate future changes, designers must also consider other factors that might affect the development process of children. This includes the overall class size, how the spaces are configured, what materials and colors are used, the effects of lighting, acoustics and noise, and temperature, humidity, and ventilation.

06 | MULTI-FUNCTIONAL HALLWAYS

06.1 TRADITIONAL PROBLEMS

Figure 06.01

Hallways in traditional school designs were typically long, narrow, and double-loaded with classrooms. With some school sites being smaller than others, in a way, these hallways were a waste of space because they were not always in use. On average, double-loaded corridors account for 1/3 of a school's total floor area. With design budgets and a rising cost as well as scarcity of land in some areas, new schools cannot afford to pay for wasted spaces that only move teachers and students from one room to the next. A solution to this problem would be multi-functional, where they can serve as circulation spaces as well as provide for academic and personal purposes.[56]

06.2 MODERN SOLUTIONS

Multi-functional hallways were developed primarily to act as social and learning arteries for informal meetings and casual conversations. Similar to shopping malls, activities on both sides are needed in order to draw interest for people to stop along the way. The straight hallways of traditional schools were inflexible and only big enough to act as transition spaces between classrooms. Transforming them into meandering pathways that are filled with tables and chairs creates unique areas for positive social interaction and learning that not only vary in size and shape, but can also be occupied by groups or individual users.[57]

Including cave spaces along the path not only allow students to develop their social skills, but they also provide areas for quiet studying, reflection, and reading. These nooks and crannies can also include sculptures, exhibits, or student works. Incorporating daylighting and views of the outside also makes the space not read like a traditional corridor. Those using the space can take a break from their work and look outside into nature for relaxation.

Although the new hallway can serve multiple functions, a designer must be cautious when designing them. Including too many turns, bends, and private niches might create areas that promote bullying. Noise must also be taken into consideration when designing. When hallways are noisy, students tend to transmit the same noise intensity into the classrooms, which disrupts teaching. Because these hallways will serve as secondary learning spaces, the acoustics need to match classrooms that are in full use.[58]

The idea of a multi-functional hallway should not be restricted to only indoor spaces. Outdoor corridors with similar design features can provide for various activities as well, especially in climates that allow people to be outside all year round. Designers that want to include these outdoor spaces must think about issues such as noise and lighting as well as vandalism and theft of loose furniture. These problems, however, should not discourage interesting spaces to be made. Incorporating both indoor and outdoor

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[56] "Redesigning Education: Rethinking the School Corridor | Fast Company." FastCompany.com - Where ideas and people meet | Fast Company. http://www.fastcompany.com/1598539/re-designing-education-trung-le (accessed February 5, 2011).
[57] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools*. Minneapolis, Minn.: DesignShare, 2005.
[58] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.

multi-functional hallways maximizes the site space, creates areas for gathering, reflecting, studying, and socializing, and generates different experiences.

06.3 DESIGN GUIDELINES FOR NEW SCHOOLS
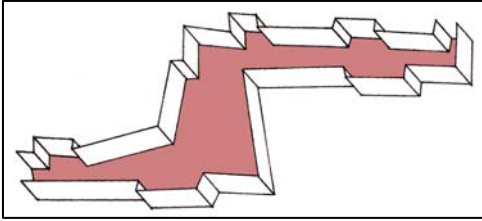
Figure 06.02
Meandering pathways of various shapes and sizes
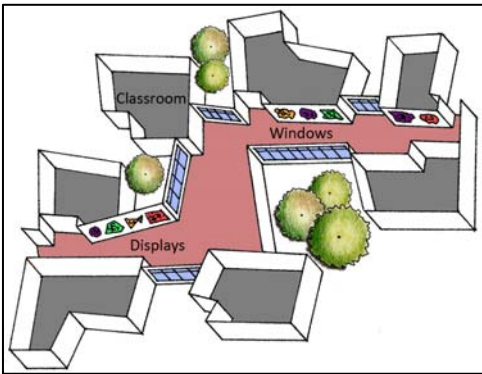
Figure 06.03
A mix of classrooms, student displays, and windows for views, natural lighting, and air flow
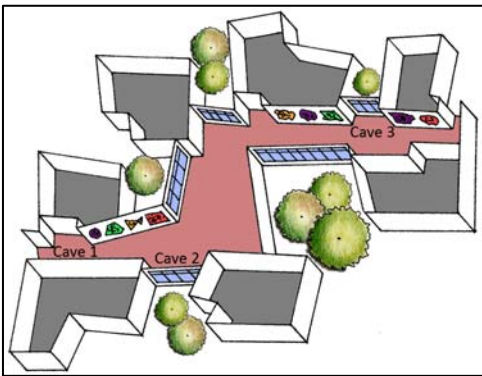
Figure 06.04
Cave spaces with soft seating and views of the natural environment
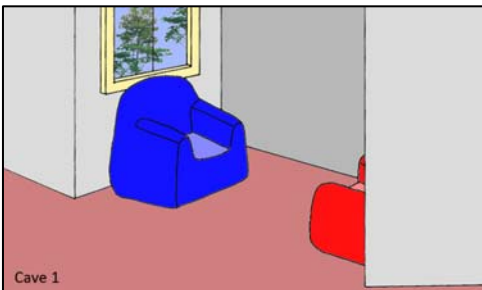
Figure 06.05
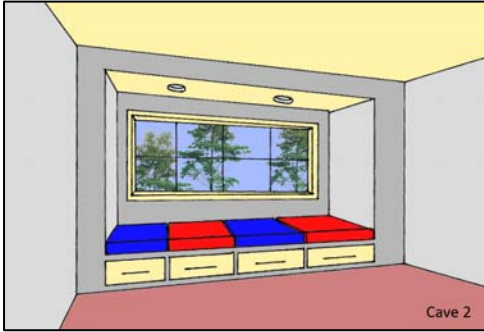
Figure 06.06
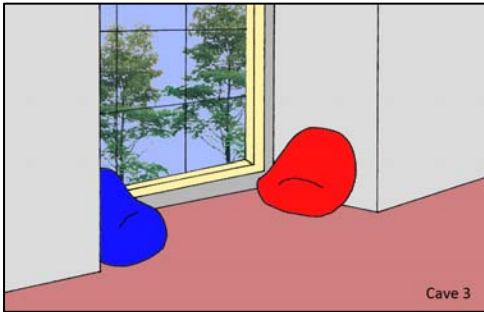
Figure 06.07
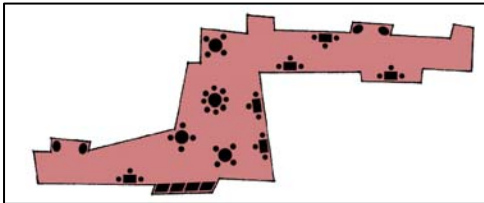
Figure 06.08
A variety of flexible furniture to accommodate individual and group activities
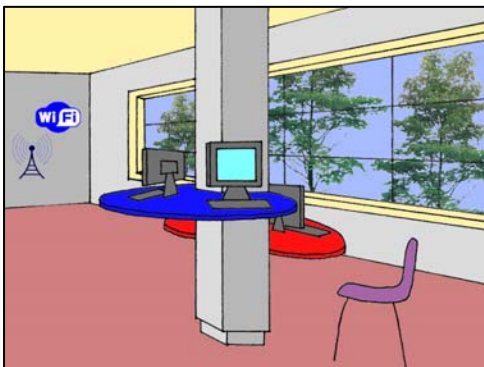
Figure 06.09
Access to secure, wireless internet and technology (desktops, laptops, portable devices, etc.) for short or long periods of time

06.4 ANALYSIS OF PROPOSED/BUILT PROJECTS

School: Forest Avenue Elementary School
Location: Middletown, Rhode Island
Architect: Fielding Nair International

Figure 06.10

Prior to renovation, the corridor space of the elementary school reflected traditional school designs. Classrooms were placed along a long, dark corridor with no views of the outside, natural lighting, or multi-purpose spaces. All instructions were held in the classrooms and the hallway space did not allow for activities that promoted collaboration. With only the summer to renovate and a small budget, the teachers participated intensively in the design process to voice their desires on how they would eventually teach in the new space. They wanted areas that would allow multiple classes to work in teams instead of being kept in separate, enclosed rooms. The renovation process began with the demolition of the existing classroom walls that created the traditional, straight corridor.[59]

Figure 06.11

From the renovation, a multi-functional hallway space was created where children of all ages can come together and collaborate on group activities. Opening up the space also creates a large common area where parents and community meetings can be held before and after school. With glazing on the perimeter of the school as well as the new classroom walls, natural lighting and ventilation are able to flow through the spaces. The use of different floor materials and colors help differentiate the large, common area from the small, group spaces. Carpet in the large space helps absorb the noise of users moving around, but the use of colored tiles in the small group spaces are unable to reduce noise levels.

Figure 06.12

Contrasting the original classroom walls that had high windows, eye level glazing is included on the new walls of the classrooms which allow occupants to see activities occurring in all the spaces. With these windows, daylighting and natural ventilation can flow through the large common area, pass the multi-purpose hallway, and into the adjacent classrooms. Users are able to connect with the natural environment because more views of the outside are available. The large common space allows boys to run, jump, and be physically expressive, while the small tables allow girls to talk, share secrets, and be verbally expressive. Flexible furniture should be provided to accommodate the different needs of the users. Although more group activities can

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[59] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

occur in this new design, the space has the potential to be cluttered with books and other things that are used for the different activities. The shelves provided are used to store unused things but not having enough storage space would result in placing unwanted items in inappropriate areas. Unwanted objects that are placed under the table will make the space unusable and items on the open floor may cause users to trip, fall, and injure themselves. The exposed metal columns are also dangerous for those who are not paying attention while they are moving around. It would be best if they were covered with soft materials to prevent injuries. With the flexibility of the space and the small furniture provided, children can move them around to support their individual, partner, small group, or large group activities. All the movement of tables and chairs on the tile floor, however, would be sources of noise disturbance. Providing rubber pads to be placed on the legs of the tables and chairs can help dampen the sound.

School: Hillel School of Tampa
Location: Tampa, Florida
Architect: Fielding Nair International

Figure 06.13
Realizing that their old buildings no longer accommodated the needs of the teachers and students to support their new vision, this Jewish Day School decided it was time to renovate. It was difficult to get funds during the difficult economy, but Prakash Nair, president of Fielding Nair International and parent of the school, decided to volunteer his firm's design services to create a more progressive, student centered learning environment. Renovation took six weeks and many changes were made, mainly the removal of the traditional, double-loaded corridors. The original hallways were lined with lockers and a couple desks were provided for the users. Overall, the space had very little teaching and learning value, occupying 1/3 of the school's floor area. Many existing walls were demolished and large windows and glass doors were used to open up all the learning spaces.[60]

Figure 06.14
A space that was once used for storing personal belongings and transporting users from one space to another is now being used as a multi-functional space. Providing soft seating lets students relax, study, and converse while tables and chairs of different heights can be used by students of varying body types. Activities can occur on the floor or tables by individuals as well as groups. The use of colors on both the walls and carpet make the spaces more fun and enjoyable to be in and the incorporation of large sliding glass doors creates an open environment where all users can learn from one another. Although display boards are provided for posting school

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[60] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

notices and information, some wall spaces should have been used for showing student work. Windows which allow natural light and ventilation to enter would have made the space more comfortable because users can have a direct connection with nature. Cave spaces along this hallway would have been appropriate as well for more private and quiet activities.

Figure 06.15
In traditional schools, children were restricted to one space at one set time to use computers for doing school work or to access the internet. The multi-functional hallways in modern day schools, however, differ from traditional computer labs because they enable all users to easily access technologies whenever and wherever they choose. Modern technologies, like laptops and iPads, are small, lightweight, and portable, which can be used in the multi-functional hallway or in other areas on school campus.[61] These devices can be accessed quickly for a short period of time as users circulate through the space, or for longer time periods with the provided flexible furniture. There are enough work stations for teachers and students to work in groups, in pairs, or alone. With access to these technologies, the multi-functional hallway becomes a place for active teaching and learning for all users.

School: Galilee Catholic Learning Community
Location: Aldinga Beach, Australia
Architect: Russell & Yelland Architects

Figure 06.16
Student work displays at various heights and a cave space with soft features is incorporated in this multi-functional hallway. The holes punched out from the wall also act as windows when student projects are not exhibited, creating an interesting experience for indoor and outdoor users. The pillows and blue colored paint on the walls produce a comfortable setting for quiet activities while the large window allows natural sunlight to enter. Users can get a visual break by looking out into the nature whenever they choose. The drawers under the cave space can be used to store toys, books, and soft pillows when they are not in use. This lets users customize the space to fit their needs and activities. Softer material instead of wood should be used on the surface of the cave space because this might promote unwanted behavior like stomping and jumping from young students.

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[61] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

School: Wooranna Park Primary School
Location: Melbourne, Australia
Architect: Mary Featherston Design

Figure 06.17

When students are not in class or out playing during recess, they could choose to stay indoors and have alone time in the provided cave spaces. Soft seating in this space helps create a comfortable, quiet setting where students can read the books that are provided on the book shelves, to develop their cognitive skills, or converse with their fellow classmates, to develop their psychosocial skills. Exhibiting student works in a display case allows visitors to see what types of projects the students have been working on. A clear display can be viewable from the users of the cave space as well as the people circulating on the other side. It is not necessary to show completed works because unfinished projects show progress and development. Occasionally changing these displays can create a dynamic, active space.[62] Although this setting is well lit from electrical lighting, providing windows would have enhanced the experience. It would allow natural lighting to enter and the students can relax their eyes from reading by looking at the natural environment outside.

Figure 06.18

As people walk through the school, not only are they able to see student art work posted on the structural columns and projects in glass displays, but they are also able to rest in the semi-circle lounge space provided. Here, users can find comfort on the soft seating that accommodates groups as well as individuals. The adjacent windows allow natural light to fill the space and users are also able to give themselves a visual break by looking at nature outside. Providing only one small round table in this area creates several issues, mainly caused by its size and height. Its design forces users to be in uncomfortable positions for long periods of time. Task completion, whether it is reading or writing, becomes a strain to their backs and necks, which affects their comfort and overall health. When all the seating is occupied at the same time, not all users are able to use the table and this could impact their productivity. Including a smartboard and a projector in this area lets teachers hold class discussions and lessons or can be used by the students during their free time.

Figure 06.19

In another multi-functional hallway of this school, an area for children to play, read, and study is incorporated. The open space on the carpet floor lets them explore with building blocks while the structure that resembles a red fire truck allows them to be creative and play "make believe". These two spaces help develop and enhance their

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[62] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.

imagination skills. Boys would enjoy playing in this area because they are able to be physically active. The front surface of the truck was designed with a magnetic board, where students can learn how to read and spell by using the provided magnetic alphabet pieces. A bookshelf and linear soft seating forms a semi-enclosed private space that promotes quiet studying and reading. Girls would enjoy talking in this space because they can be verbally expressive, but still maintain their privacy. The overall design of this multi-functional hallway takes into account the scale of the children where no feature is too big or too small. The ceiling height is low enough for them to not feel overwhelmed, but might be too low for adults to occupy the space. Not a lot of electrical lighting is needed here because natural sunlight brightens the area from both sides of this space.

Figure 06.20
When traditional corridors are avoided in new school designs, it opens up many creative opportunities. Some modern schools have cave spaces that are completely exposed on one side, while others, like this, are semi-enclosed. Serving the same purpose, this area gives students a more private setting for reading, conversing, or studying while other children are working on the computer stations next to them. The cave space on the upper level gives children more options and privacy, but it also promotes unwanted behavior because teachers are unable to see the activities occurring. The use of colors differentiates one area from another and it also makes a more vibrant and exciting setting for the students. Less electrical lighting can be used because natural lighting fills all the spaces.

School: Arcola Community Elementary School
Location: Saskatchewan, Canada
Architect: Fielding Nair International

Figure 06.21
As one of the six new schools in Saskatchewan, Canada designed by Fielding Nair International, there is a strong desire for an innovative facility that supports current teaching and learning methods. The community attended workshops and meetings and completed surveys to discuss what concepts should be reflected in the design. This collaborative process brought designers, educators, students, and the community together, which strengthened the design of the overall school.[63] One main design feature that influences modern ideas is the elimination of double-loaded corridors and the integration

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[63] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

of multi-functional hallways. With classrooms surrounding this space, it can be accessed by all users at any time of the day. Areas for small group and large group gatherings are separated by nonpermanent elements such as planters and bookshelves. These temporary features are used not only to define the spaces, but also to create a sense of privacy for the users. Teachers can hold lessons and activities in the enclosed classrooms or in the open, multi-functional hallway.

Figure 06.22
A large gathering area was integrated into the multi-functional hallway, which can be occupied for all school meetings, student performances, and community conferences. Here, users can find many non-fixed elements such as lightweight, foldable chairs, soft seating, and a stage with wheels. These furniture pieces can be rearranged to fit the activities or be stored away to open up the floor space. When this area is not used for large group gatherings, students can choose their own furniture and place them where they want to accommodate their needs. Those who want privacy can sit close to the edge while others who like being in the open can locate themselves in the center. Groups can also cluster furniture pieces together if they wished to. The school can also include student works on transportable, foldable display boards or display cases on wheels. Exhibiting student projects make a more personalized setting and they can also be used to divide the large space into smaller spaces. The double height feature of this area is appropriate because users on the second floor are able to see the large group activities that occur below. Shading should be provided on the windows to block out unwanted sun during these activities.

Figure 06.23
The proposed design consists of two levels. The first floor is occupied by younger children while the second floor was created for older students. In the multi-functional hallways of both levels, users can find spaces that support individual and group activities as well as access to technologies. To accommodate the varying physical features of the users, flexible furniture is also provided in some areas. Higher seats are supplied for adults while lower ones are used by the shorter children. Although some are light and portable, which makes them easy to transport, others might be too big and heavy to be moved around. To create a stronger connection between the users and nature, large windows and plants are incorporated, bringing nature in. Having carpet instead of wood floors would be more appropriate for absorbing unwanted noise from the movement of the users. Lowering the ceiling in some areas on the first floor will decrease the overwhelming feeling for the young children and will fit to their scale.

School: San Felice Nursery and Preschool
Location: Reggio Emilia, Italy
Architect: ZPZ Partners

Figure 06.24
As a nursery and preschool, the design features of this building are appropriate and applicable for elementary school designs. The plan provides many opportunities for students to develop their skills. Knowing that children from every grade level differ physically, cognitively, socially, and emotionally, separate areas for each age group are provided in the multi-functional hallway to accommodate their varying needs. Outside of every classroom is an area for small group gatherings and general play. Although the hallway is very open, all the separate areas for each age group are defined and differentiated by the slightly dropped and raised ceilings. Children are able to move freely throughout, but they are also aware of where they belong. A central, elongated space is also provided to allow collaboration and interaction between all the age groups. This is where the shared kitchen is located. This significant area showcases the importance of dining as a family in the Italian culture. The multi-functional hallway creates a harmony between public, social spaces and private, quiet spaces.[64]

Figure 06.25
Providing spaces for physical and imaginative play is important for children because they start to acquire knowledge at a very young age. In the multi-functional hallway, students are able perform activities on their own or in groups to develop their skills. There are areas for physical climbing, soft corners for individual reflection, and art/wet spaces for messy school projects. The use of colors and different shapes on the walls make the spaces fun, exciting, and stimulating. Providing bright lights is essential for young children to find their way around the spaces, but it is also important to incorporate natural lighting. The multi-functional hallway slightly resembles traditional schools with double-loaded corridors because only a few areas have large windows for daylighting and views of nature. With spaces that promote physical activity, it is not fitting to have wood floors. Children jumping, running, and playing indoors will create a lot of noise and might cause a disturbance to classes in session. Including carpet and sound absorbing materials on the walls would help in dampening the unwanted noise.

[64] Dudek, Mark, Dorothea Baumann, and Margot Stringer. *Schools and Kindergartens: A Design Manual*. Basel: Birkhäuser, 2007.

Figure 06.26

Throughout the hallway, children are able to find small and cozy double height spaces that not only create a vertical connection between the two floors, but they also resemble self-contained family apartments that the children are familiar with. While the ground floor is used for public activities, spaces on the second floor are more quiet and private. The designers also used this design feature to differentiate the large group areas from the small gathering spaces in the hallway. In some places, oval and rectangular rooflights are incorporated into the ceilings to act as visual cues for wayfinding and to provide natural lighting. The young children reference these design features when finding their way around. In these tall areas, floor to ceiling windows are included where students are able to connect visually and physically to the outside. In all of these public spaces, carpet should be used or rubber pads should be added to the furniture legs to reduce noise distractions when movement occurs.[65]

School: Scotch Oakburn College, Middle School
Location: Tasmania, Australia
Architect: Fielding Nair International

Figure 06.27

In this meandering pathway, students as well as teachers are able to hold formal and informal meetings. It can be occupied by individuals, partners, small groups, and large groups. Tables and seats are provided, which allow the users to converse or work quietly. The soft seating creates a comfortable environment, but the tables are too short and cannot be adjusted to the height of the users. The piano included in this space can be used for music lessons, but it might create unnecessary noise, which will be a source of disturbance to the adjacent classes that are in session as well as users of the hallway. With this space of high activity and movement, the use of carpet on the floor is appropriate for absorbing the noise.

Figure 06.28

This multi-functional hallway is large enough for full classes to be held but is too open for any type of privacy. The space under the staircase, however, is a little more quiet and private. Soft seating is provided for casual discussions and group work but the tables are not adjustable.

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[65] Dudek, Mark, Dorothea Baumann, and Margot Stringer. *Schools and Kindergartens: A Design Manual*. Basel: Birkhäuser, 2007.

Including more flexible furniture gives users more seating options that can accommodate their varying activities. Along with soft seating, tables and chairs that support ergonomics and are height adjustable would be appropriate. In this setting, users are able to use their laptops and access wireless internet for their school projects or for personal use.

Figure 06.29
The floor to ceiling window in this multi-functional pathway not only allows natural lighting to enter the space, but it also lets users look outside for relaxation. In this space, tables as well as seats of varying heights are provided to accommodate the users with different physical features. It would be more appropriate if seats with backs were provided to prevent strain to their body.

School: Canning Vale High School
Location: Perth, Australia
Architect: Hassel, VITETTA

Figure 06.30
The designers of this school wanted to make a playful setting for children to learn in. They did so by using a mix of forms and colors to create a fun learning environment. Although the exterior of the school and many interior spaces achieved this, the cave spaces incorporated are not too successful. The blank, white walls with a few small, colored windows are not fun or exciting but instead are boring and dull. The curved design and the lack of windows create a very private space, but it may also promote unwanted behavior like bullying. To avoid this type of behavior, the designers should have painted the walls with a light color and included bigger windows. Incorporating these design features will enhance safety and the user experience greatly. The soft seating provided supports independent study, small group meetings, and allows students to learn how to use technology with wireless internet access.

School: Millennium High School
Location: New York City, New York
Architect: HLW International
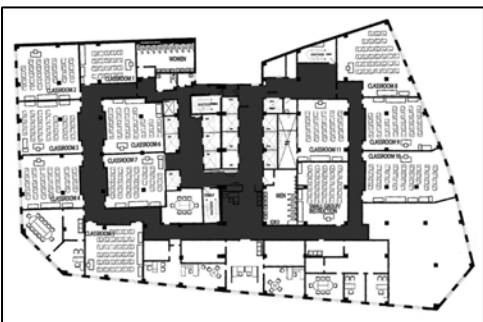
Figure 06.31
During the design process of this school, a proposal plan was created. Like many schools of the past, the intended use of the corridor was to transport users from one space to another. By looking at the proposed plan, it is obvious that the corridor is inflexible because it did not support the modern teaching and learning methods. This design was eventually abandoned and not constructed because it represented the traditional, double-loaded corridor.

Figure 06.32

The architects and planners noticed the issues of integrating traditional design ideas to a new school and later made a revised plan. In the new design, the corridor space varied in shape and size and was multi-functional. The multi-purpose space consists of an open knowledge center, meeting area, and technology lab, bleacher stairs for all school meetings, lockers for personal storage, meeting alcoves for small groups or individuals, and gallery walls to display student works.[66] Not only did this design create interesting hallway space, it also shaped the design of the classrooms, making them all unique in their own way. The users are able to have different experiences as they circulated from the hallways to the classrooms and back out to the hallways again.

Figure 06.33

Although the users and designs of high schools are completely different compared to elementary schools, the features of multi-functional hallways are still applicable. In this area of the pathway, students find a variety of seating options and arrangements. Round tables for four students each are provided, which allows groups to work together. Because elementary students vary in height and weight, more flexible seats should be provided. This way, the users are able to adjust the heights of their seats to support their body type and activities. Students who want to work alone can also find individual seating areas in this hallway. Soft seating is also included, which creates a more relaxing and comfortable setting. The integration of technology is becoming more important in the school setting so providing secure wireless access as well as power outlets for the users is essential. This allows students to work on school work or personal projects wherever and whenever they choose to. Although the checkered floor tiles are easy to clean when they are dirty, providing carpet can reduce the noise from users talking and walking through the space. Instead of having a blank wall with a checkered pattern, displaying student work can create a more personalized learning environment. Parents and community users who walk through the hallway would get a better understanding of the school through the works of the children. Opening up the blank wall with windows can relax the users and provide views of the outside environment.

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[66] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition.* Minneapolis, Minn.: DesignShare, 2009.

School: West Hialeah Elementary School
Location: Hialeah Gardens, Florida
Architect: MC Harry and Associates, Inc.

Figure 06.34
The idea of multi-functional hallways should not be restricted to indoor spaces only. In places that allow people to be outside all year round, designers should apply similar design features. Spaces for individual, partner, small group, and large group activities should be included as well as flexible furniture and access to technology and wireless internet. Like interiors, the exterior spaces need to accommodate the different needs of the users. Being outside connects the users to nature and natural lighting, which enhances development, but unwanted noise and unexpected weather may reduce levels of productivity. Designers and educators must think about how to prevent vandalism and theft of the loose furniture as well.

06.5 PERSONAL REFLECTION

"Born and raised in Honolulu, Hawaii, where the weather is typically nice all year round, majority of the elementary schools are two floors and have exterior hallways instead of interior. Aside from having a roof for shelter, they are all long, straight, and lined with classrooms, which reflect traditional corridors that were mainly used for circulation. Although students are found sitting on the floor outside their classroom talking stories, working on homework, or playing games, the design of these spaces do not support these activities. Teachers rarely bring their students out into the hallways to hold lessons or academic activities, even though connection to the natural environment is important. Although the weather is comfortable and children are active in these spaces before, during, and after school, tables and chairs are also not provided to support their physical needs to accomplish their tasks.

Knowing that students occupy the exterior hallways and use them for various activities, creating spaces that serve more than circulation should be on the minds of designers when designing new schools in Hawaii. Personally, if cave spaces and flexible furniture were provided when I was in elementary school, I would have occupied them every day because I was one of the many students that actually worked on homework when class was not in session. As a girl, the hallway space was also a place for me to hold conversations with my friends, developing my psychosocial skills. Sitting on the floor every day, however, was not good for my physical health because I would find pain in

my legs, knees, back, and neck from being in the same position for too long. By improving the design of the hallways, students would be able to develop their physical, cognitive, and psychosocial skills."

06.6 CONCLUSION

Many schools today still have hallways that are used only for transporting people from one space to another. Wanting to provide children with a variety of places for different activities to develop their skills require more space. With small and expensive sites and the lack of land in some places, however, continuing to include double-loaded corridors in new school designs does not support this goal. Transforming the traditional corridors to multi-functional hallways, on the other hand, will make good use of all the available space and give more options for the users. What was originally a space that was stark, unimpressive, and used for utilitarian purposes can now function as areas for learning and socializing.

07 | OUTDOOR LEARNING SPACES

07.1 TRADITIONAL PROBLEMS

A common criticism of traditional school designs was the lack of site space, which resulted in multi-storey buildings with no landscaping. Students were kept in the classrooms with no views or experiences of the outside. Windows were sometimes placed high to reduce the amount of distractions or even disregarded completely. It is natural for human beings to be drawn to nature, but schools around the nation want to remove physical education and recess. They assume that more time spent indoors would produce better test scores. From this, designers have devoted much of their creativity on classroom designs, putting very little thought on the exterior spaces. To solve these problems, outdoor learning spaces should be incorporated into new schools. Not only are they new places for learning, but they also expose students to the natural environment for relaxation and stress reduction.

07.2 MODERN SOLUTIONS

When research started to prove that the natural environment has positive effects on not only the development of the children, but also on the teachers, designers provided more windows to create visual connections between the inside and outside. Being able to view 50 feet outside the window allows tired eyes to find relief. Having a visual break from long hours of reading notebooks, textbooks, and computers can keep young children healthy. Similar to the past, the views of the outside might cause distractions, but this should not be the reason for excluding views. Studies have shown that children with views of nature achieved better results in tests related to attention than those who had views of man-made elements like buildings. Visual connections with the outdoors are important, but they do not replace the physical experiences of being in the natural environment. With outdoor learning spaces, not only do they allow students and teachers to be in stimulating and creative places, but they also allow different activities to be held that support the curriculum. The activities that cannot be experienced indoors can be done outdoors such as large and messy projects, gardening, observing the climate, nature walks, and animal care, to name a few. Paved areas with enough seating for the whole class as well as for small groups can be provided for the different activities.[67]

The amount of recommended exterior learning spaces for each school varies depending on the activities that take place as well as the site constraints. Social skills and behavior are affected when either too much or too little space is provided. Too much space might reduce attention spans, require more supervision, and result in random behavior and too little space might lead to aggressive or destructive behavior, fewer friendly communications, and less individual learning and play. Designers must create inventive solutions to provide access to these exterior spaces.[68] Outdoor learning environments should not be restricted to classrooms on the first floor. Although it may require more creativity, small sites with multi-storey buildings can also include these spaces. Building terraces directly outside of the classroom on the upper floors not only create different experiences from a higher elevation, but they also provide shelter and shade for the outdoor learning spaces below. Although these spaces can provide alternative experiences to the conventional indoor classroom and serve numerous purposes, many factors of the natural environment can negatively affect the activities or information being taught, which inhibits the experiences and learning process. This includes the weather, lighting, and noise.

[67] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools*. Minneapolis, Minn.: DesignShare, 2005.
[68] Perkins, L. Bradford. *Elementary and Secondary Schools*. New York: J. Wiley & Sons, 2001.

Maintaining optimal temperature and humidity can create environments that promote learning, but this depends on the season and climate. It is ideal to be able to use the exterior learning spaces all year long but many places experience winters that are freezing cold and summers that are boiling hot. Where this occurs, having these spaces directly next to the classrooms with shelters can be the solution. The spaces can still be used for short periods of time and traveling long distances in the changing weather would not be necessary. Depending on the season and time of day, lighting can also affect the teaching and learning process. Based on research, student attendance and concentration levels are increased with better quality and quantity of lighting. In the classrooms, artificial lighting can be controlled with light switches and dimmers. In outdoor learning spaces, however, the non-visual element of natural sunlight is the only source. Good lighting can improve health and learning but bad lighting may increase the frequency of headaches and stress. Although the addition of electrical lighting can be costly, it should still be considered if they support the activities that take place in these spaces.[69] Probably the hardest element to manage is noise. External noise including planes, trains, automobiles, and lawn mowers are difficult to control and could affect a student's ability to concentrate. When noise impacts student-teacher communication, it could lead to the lack of motivation, attention, and memory, which harms a student's academic achievement. Noise can also cause stress, increasing blood pressure and heart rates, which could still persist as they get older. Their experiences during their adult life could potentially be affected as well if they are constantly exposed to noise as a child.[70]

07.3 DESIGN GUIDELINES FOR NEW SCHOOLS
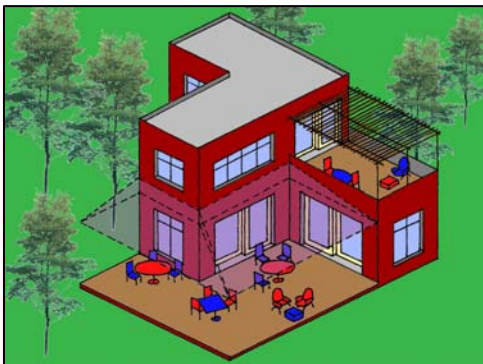
Figure 07.01
Sheltered, paved spaces for class, group, and individual activities located directly outside of the classroom on the ground and upper floors

Figure 07.02
Breakout spaces for school and personal use and natural areas (nature trails, gardens, fish ponds, animal care spaces, weather observation tower, etc.)

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[69] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.
[70] Kopec, Dak. "Designing Public Schools." *ASID ICON*, Fall 2006.

07.4 ANALYSIS OF PROPOSED/BUILT PROJECTS

School: Djidi Djidi Aboriginal School
Location: Picton, Australia
Architect: Edgar Idle Wade Architects

Figure 07.03

Outdoor learning spaces come in many forms. Some require the users to walk long distances while others are located adjacent to the classroom. Here, four classes share an outdoor, central, covered space. Each class can alternate and occupy it to complete class activities or multiple classes can share this area at the same time, which allows the students to collaborate and be more familiar with other children in the school. The v-shaped plan opens up the space to the natural environment and the slanted roof shelters the users from unexpected weather conditions like rain. Every two connected classrooms also share a covered veranda, where smaller group activities can be held. These can be occupied for more private, quieter tasks.

School: Medlock Primary School
Location: Manchester, United Kingdom
Architect: Walker Simpson Architect

Figure 07.04

Although outdoor learning spaces and the connection to the natural environment seem only applicable and most effective in single storey schools, other floors of multi-level schools should not be neglected of this feature. This school linked three separate classes on the second floor together by providing them an exterior learning space that can be shared, which supports academic and personal uses. The sliding glass doors create visual connections to nature and can be opened to allow the users access to the terrace for messy projects or other outdoor tasks. Activities that occur here can be seen and learned from by the students of the adjacent classrooms. With this terrace, students are encouraged to collaborate and interact with one another, enhancing their cognitive and psychosocial skills. This space not only serves as a place for acquiring knowledge, but it also functions as a shelter for the outdoor learning space on the lower level. The only element missing in this design is a cover for the students on the second floor, which would be useful in protecting them from unpredictable weather conditions.

School: Hillel School of Tampa
Location: Tampa, Florida
Architect: Fielding Nair International

Figure 07.05

Prior to renovation, this school was not designed to enhance the skills of the students. Many spaces were enclosed with only a few windows, mainly for ventilation. It was designed this way because educators believed that learning can only occur indoors. They assumed that views of the outdoors would cause distractions, similar to the traditional way of thinking. From recent research, however, it has shown that connection with the outdoors is necessary for child development. The spaces that were once separated from the outdoor environment are now visually and physically integrated with the natural surroundings. Sliding glass doors that occupy majority of the wall space are incorporated to create natural views for the users indoors as well as access to the outdoor learning space. They also allow more daylighting and natural ventilation to enter the interior space. With one teacher and a teacher's assistant, teaching and learning can happen in both spaces. When the weather is pleasant, small group assignments can be completed. Age appropriate and flexible furniture, however, should replace the wooden pieces provided because they will enhance productivity.

Figure 07.06

Many outdoor spaces in this school were not used for learning before the renovation. There were some landscape elements such as grass, trees, and bushes, but students were unable to see them from the classrooms because the windows were too high. Daylighting was also limited because of the small windows. The classrooms on the left were completely disconnected and had no direct connection to the library on the right. The outdoor area in between them was not used in any way so it was considered wasted space. After the renovation, not only are the classes designed with larger windows for views, but sliding doors are also incorporated to allow access to the new exterior learning space. A paved pathway was created to physically link the two buildings together and a wooden trellis was built to provide shade for the occupants of the space.[71] Many of the natural elements were saved during

[71] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

the renovation and users of both buildings are able to be visually and physically connected to the outdoors. A space that was once wasted is now being used to enhance the skills of the children. Academic or personal activities can now occur in this space.

Figure 07.07

Before the renovation, many buildings in this school had no connection to the outdoors, visually or physically. After it was redesigned and renovated, all the exterior spaces are used as places for learning. Larger windows and sliding glass doors are added to create the visual and physical connection between the users and nature. All the areas that were once unused can now be occupied any time of the day for academic or personal activities.

Figure 07.08

This school had many opportunities to connect its users to the natural environment, but they did not take advantage of them. One side of the school faced a beautiful playground, but the original small windows were too high, which let in very little daylight and provided no views. The designers decided to redesign so that the natural surroundings can be better integrated with the buildings and its users. They did so by providing bigger windows and sliding glass doors. An exterior learning deck was provided for students to collaborate on group work, talk stories, or use their computers. Also added to this outdoor space is a big chess set where children can learn how to play during their free time or recess. The renovation created new spaces for learning and children are able to develop their cognitive and psychosocial skills. The one element missing from this renovation is a shelter for the deck.

School: Hachoresh School
Location: Zichron Yaacov, Israel
Architect: Shimon and Gideon Powsner, Tel Aviv

Figure 07.09

Located in a place filled with nature, the designers wanted to take advantage of the outdoors by creating many outdoor learning and gathering spaces. Following the topography of the site, all of these spaces have their own panoramic view of the sea. In the center of the school is an amphitheatre and communal court for large gatherings, performances, and presentations or activities that involve the whole school. Surrounding this central space are the classrooms, which are divided by age. Each classroom has their own private outdoor courts that are accessible by sliding glass doors. Users can work on class activities while being connected with nature. The young children also have an extra courtyard space for learning. This outdoor area provides shelter during sunny and rainy days and creates a secure and safe feeling for the young students because it is enclosed by the other classrooms. Flexible furniture should be provided for the users so they can perform specific tasks to enhance their skills and development.

School: Goa International School
Location: Goa, India
Architect: Fielding Nair International, Dennis Coelho
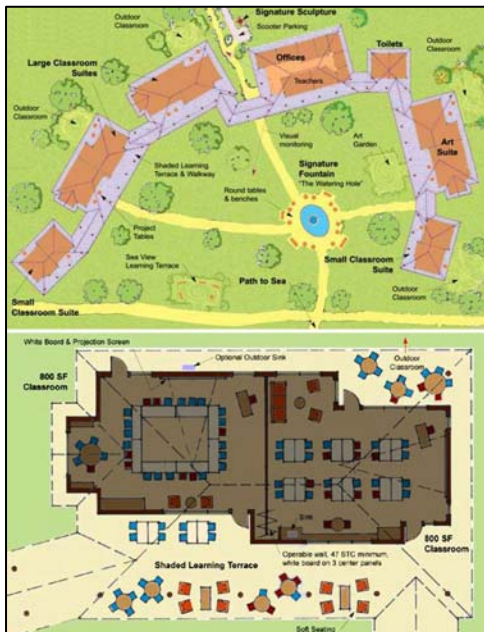
Figure 07.10

With 50 acres of land, this school wanted the design and curriculum to focus on the natural environment. The designer decided to preserve the local plant life and natural bodies of water and use them for educational purposes. From these, students can learn about ecology and biology.[72] Every building on the site serves a specific purpose and they are all connected by shaded walkways. Multiple outdoor learning spaces are created for each building and they all vary in size to support the different activities. Furniture for individuals and small groups are provided as well as soft seating for relaxation. Although many of these spaces are man-made and can be accessed directly from the classrooms, users are able to experience and learn more about nature in the natural, outdoor classrooms, which are located next to each building and are made with native materials found from the site.

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[72] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

School: Meadowdale Middle School
Location: Lynnwood, Washington
Architect: Fielding Nair International

Figure 07.11
The concept diagram for this middle school illustrates a strong connection between the indoors and outdoors. Opportunities for teaching and learning can occur directly outside of the classroom as well as further out into the site. Windows are located all along the perimeter of the school so that visual connections with nature can be made. Every classroom has access to at least one exterior learning space which creates a physical connection between the children and the natural environment. Each outdoor learning space is different in shape, size, and design and they support all activity types. The largest feature in this concept is the chess terrace which is not only a game for fun, but also a game for building skills. In the natural, learning spaces further out into the site, information about nature can be taught and learned. While walking along the discovery trail that surrounds the school, students will find small, shaded areas for breaks, a vegetable garden for growing their own vegetables, and a weather station for collecting data about the climate. Also along the trail is a bird habitat, an eco fish pond, and a reflective garden for quiet reflecting and studying. The design for this school creates places for learning both indoors and outdoors for all the teachers and students.

School: Scotch Oakburn College, Middle School
Location: Tasmania, Australia
Architect: Fielding Nair International

Figure 07.12
The designers of this middle school did not want to combine all the classrooms into one building. Instead, they created three separate classrooms located on two levels with outdoor learning spaces on both levels. Each outdoor terrace on the first floor has an area that is completely exposed to the natural environment as well as a space that is protected from unexpected weather such as rain. They are designed this way so that the students and teachers can be visually and physically connected with the outdoors and not have to worry about the weather. The three separate outdoor learning spaces face the center of the site to encourage collaboration between the classrooms. A variety of furniture is provided to support all forms of group and individual activities. On the second floor, each classroom has access to an outdoor environmental studio, fish pond, vegetable garden, and backyard learning space. Here, all classes can work together and collaborate on assignments related to nature. Also on the second floor, each classroom is designed with a glass porch,

which can be used for quiet and private work. Teachers and students can still be visually connected to nature because of all the windows surrounding the space. Next to these porches are exterior learning spaces. Each one is made up of two smaller spaces with planters and a water feature dividing them. Both areas can be accessed and occupied from the classroom or the glass porch. Although not on the ground floor, which has direct access to nature, the designers provided planters on the edges so that users can be physically connected with nature. These planters also provide privacy against the other outdoor learning terraces. These exterior learning spaces are flexible and can accommodate all types of activities.

Figure 07.13
The amphitheatre of this middle school is a large exterior learning space that can be occupied not only by the students and teachers for teaching and learning, but also the community when school is not in session. The size of this space is large enough to fit all the middle school classes, where they can come together for meetings, performances, or presentations. This space can also be occupied for informal activities such as reading, studying, or working on homework. Although users have a close relationship with nature, the size of each step is a little too high, where young children might fall and injure themselves if they accidently trip. With no shelter for protection and shade, users might also be uncomfortable when it gets too sunny and hot, or wet and cold when it rains. Safety is also a concern when the rocks get wet because children running might slip and hurt themselves.

School: Sinarmas World Academy
Location: Tangerang, Indonesia
Architect: Fielding Nair International, PT Metro Idea Architects

Figure 07.14

Located away from the classrooms, this structure encourages outdoor teaching and learning. Teachers are able to bring their students out into the natural environment to hold lessons, class activities, or group projects. The materials used to construct this structure blends in with the surrounding, natural setting. Being closer with nature can enhance productivity and can be a source of relaxation. Unlike other outdoor learning spaces that are exposed to the climate and weather, this structure provides shade from the sun and protection from the rain. Sitting on the hard surface for a long period of time without a back rest, however, can be harmful to the health of the young children. When users decide to occupy this space, they should bring their own temporary soft seating to make it more comfortable. Aside from being an area for educational purposes, this space can be used for personal activities including casual conversations or quiet, individual studying.

Figure 07.15

While some schools include man-made exterior terraces that are accessible from the classrooms for teaching and learning, others incorporate natural elements, such as vegetable gardens, fish ponds, nature trails, etc. all over campus for the users to learn about nature. For some students, the learning process in school is sometimes boring and it is affected by the teaching process. Outdoor learning spaces do not strictly have to be educational only. They can be fun at the same time too. In this school, a playable musical sculpture was incorporated into the field, which allows students to have music lessons, making the activity both fun and educational. Maintaining and inspecting the materials as well as protecting it from vandalism are important issues that must be considered by the school when a structure like this is constructed.

School: Leysin American School Almaty
Location: Kazakhstan
Architect: Fielding Nair International, MHTN Architects

Figure 07.16
Outdoor learning spaces are not always achievable in all schools, which are sometimes the result of site constraints or budget. Designers need to be more creative in these situations. In this school, the designer decided to create the feeling of outdoor learning spaces by bringing natural, outdoor elements indoors. Plants, trees, and water features are brought into the school building to create that feeling. Not only do users get to be visually and physically connected to nature, but they are also sheltered from unexpected weather conditions. The design of the roof also allows for daylighting, which makes the space feel more like a natural setting. Maintaining all the natural elements might be difficult because many require being outdoors to survive. Although the space can be used for lessons on nature or to teach other academic subjects, the scale of it might be overwhelming for young children. It would be age appropriate if the large space was divided into smaller spaces to accommodate their different needs.

School: Morriss Center High School
Location: Bridgehampton, New York
Architect: Helpern Architects, Fielding Nair International

Figure 07.17
Not all outdoor learning spaces need to be designed and constructed by professional designers. This high school allowed the students to work together to create a structure that can be used for teaching, learning, social gatherings, and community meetings. The design and construction process of this tepee helped the students develop their physical, cognitive, and psychosocial skills. Completing an assignment of this size gives them a feeling of accomplishment and a sense of belonging because they were able to contribute to the school. Stacks of hay are placed under the structure to match the natural materials of the tepee and are used as furniture. Sitting on hay for a long period of time might put a strain on the users' backs and neck because no support is provided. Although surrounded by nature and sitting in a structure built with natural materials, users are also not protected from the sun or rain. It would be appropriate if a cover or shelter was provided.

07.5 PERSONAL REFLECTION

"Attending elementary school in Honolulu, Hawaii, teachers did not take advantage of the outdoor spaces and use them as places for learning. All academic subjects were taught indoors and the only time students were outside with the natural environment was during recess or physical education. Large windows were not even incorporated into the classroom designs to allow the students to be visually connected with nature. My -school was made up of separate, two-storey buildings laid out in rows and in between each were grassy areas with a couple of trees. These spaces were perfect opportunities for outdoor learning, but were not used for that reason. They were sometimes occupied during recess, where children would play catch or run around, but aside from that, they were just open spaces.

If I had the opportunity to renovate or redesign my school, I would make use of the grassy areas for educational and fun purposes. These spaces in between the buildings would be places for children to learn about nature where they could witness the process of growing their own plants, for example. Those that visit the school will learn more about the students because their natural projects would be out for display. Also in these spaces, there would be flexible furniture provided under trellises to accommodate different activities. Classes or group projects could be held and the occupants can be physically connected with nature.

Another change I would make about my school would be incorporating learning terraces for all the classrooms, whether they are on the first or second floor. Since we had exterior hallways, they could have been occupied as spaces for learning, but crowding might occur because all classes had access to them. In order to achieve privacy, each classroom would have its own outdoor learning space that can be accessed from indoors. Larger windows would also be provided so that users who were inside can be visually connected with the natural environment. Providing outdoor learning spaces would be a different experience for the students and teachers and they would not have to be stuck indoors for majority of the day. It also would help them relax and relieve stress."

07.6 CONCLUSION

Outdoor learning spaces is an innovative idea for new approaches to learning and experiencing, whether they are covered, in open air, next to the classrooms, or away from the classrooms. Contrasting the traditional classrooms, these outdoor spaces support many uses and activities, which may vary in size and shape. They can be occupied during school time for educational purposes or before and after school for meetings, gatherings, performances, or play. Providing these spaces in new school designs will create new opportunities and enhance the developmental process of the children.

08 | SMALL EATING AREAS

08.1 TRADITIONAL PROBLEMS

Figure 08.01

In modern day schools, when children are not in the classrooms, they are either in the playground for recess, on the field for physical education, or in the cafeteria for lunch. Traditionally, one large hall that accommodated all students at one time would be used for dining. These large cafeterias can still be found in many elementary schools today. They are typically full of long tables with hard, backless seats. During school time, the tables are set up in rows and are folded up quickly and placed along the walls once the students are finished with lunch. These large halls are accessible from anywhere on campus because multiple doors are provided around the perimeter of the building. Window design varied depending on the location. Some are placed high, which does not allow users to view outside. Materials and colors used are normally boring and selected to endure constant use and abuse.

These cafeterias are designed this way because it allowed for quick and easy cleaning. Similar to the traditional classroom, where the teacher had control over the students, cafeterias allowed the school to manage the eating process because it was assumed that students are not responsible and cannot control their eating. When the cafeteria is not occupied for school dining, the space is usually empty. One end of the large room would sometimes have a stage for presentations, performances, and meetings. Although the users and space can be easily maintained, it does not help the students enhance their skills during this critical developmental stage in their lives.[73]

The traditional cafeterias are not designed for the comfort and safety of the students. With such a large space full of children, one issue that affects the users is crowding. When this occurs, children experience fatigue and stress, which result in poor mental and physical health. Aggressive behavior to their peers as well as withdrawing socially may happen as well. When a cafeteria is overcrowded, noise also becomes an issue. Although the people in these spaces may not be talking or walking loudly, the combination of everyone communicating and moving at the same time can contribute to the noise. The materials typically used are able to endure constant usage, but are not able to absorb sound. The long tables also increase noise levels because they seat 20 students each, making hearing impossible. As a result, it causes them to raise their voices. Although this large space can accommodate many people at one time, it should not be continued for new school designs. Instead, smaller spaces should be incorporated, which makes the setting more intimate, flexible, and child-focused.[74]

08.2 MODERN SOLUTIONS

Although a centralized kitchen is needed to supply food for all the users, providing smaller service cafés and eating areas can create more personal spaces. Round or rectangular tables with comfortable seating for 4 to 6 students should be included, where groups can socialize during lunch time without having to yell or scream across the room. Lightweight, flexible furniture is easily and quickly stacked for cleaning, which

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[73] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.

[74] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.

the students can complete on their own to create a sense of ownership of the spaces. Each eating area can have its own theme for decoration, which makes the spaces more fun to be in.[75]

Technology is playing a big role in learning environments, so desktops or laptops can also be provided which allow students to improve their computer skills as well as access the internet for research. Including computers may be costly, however, so at a minimum, these spaces need to be designed and planned with wireless capabilities.[76]

With this space being available before, during, and after school, it can allow students, faculty, and the community to work independently and collaboratively for all activities. Because this space will be occupied for multiple purposes, it needs to be welcoming and exciting. Providing more windows for viewing of the natural landscape enhances the user's experience. Outdoor terraces can also be incorporated so that indoor-outdoor connections can be made for the users.[77]

08.3 DESIGN GUIDELINES FOR NEW SCHOOLS
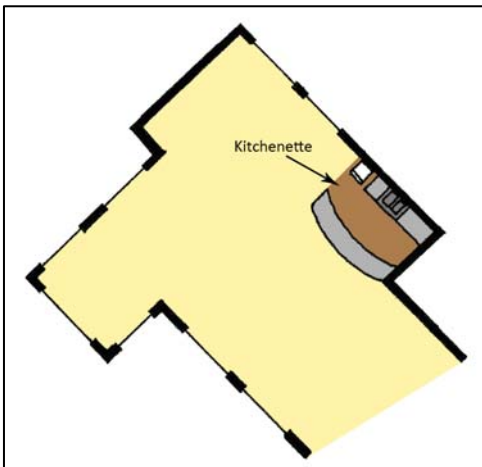
Figure 08.02
Spaces of different sizes and shapes with kitchenettes
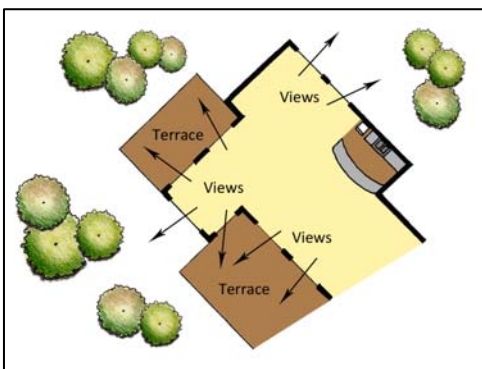
Figure 08.03
Views of nature and/or covered, outdoor terraces

[75] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools.* Minneapolis, Minn.: DesignShare, 2005.
[76] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools.* Hoboken, N.J.: J. Wiley, 2010.
[77] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools.* Minneapolis, Minn.: DesignShare, 2005.

Figure 08.04
Custom colors, themes, and decorations for each area

Figure 08.05
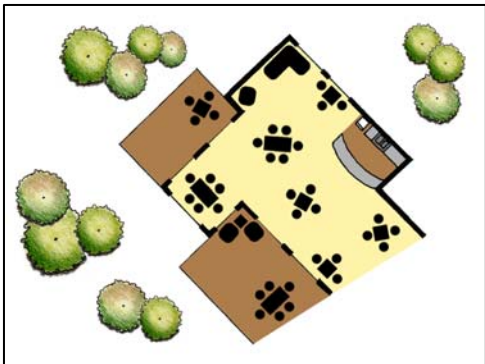
Figure 08.06
A mix of flexible furniture that seats 4 to 6 users and soft seating
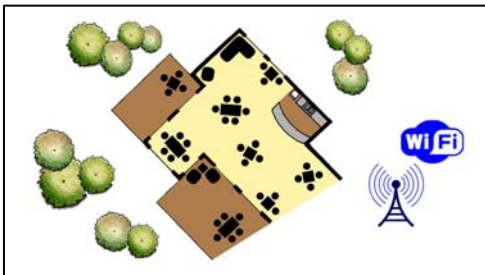
Figure 08.07
Access to secure, wireless internet at a minimum

08.4 ANALYSIS OF PROPOSED/BUILT PROJECTS

School: George Town Primary School
Location: Cayman Islands
Architect: CS&P Architects Inc., BDCL Architects
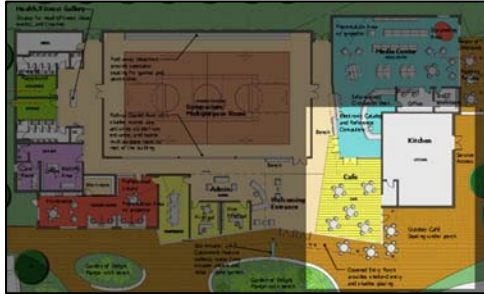
Figure 08.08

In this primary school, three separate buildings were integrated into the existing landscape. The administration/gym occupied one building while grades 1 to 3 and 4 to 6 were in their own two-storey buildings. Contrasting traditional schools, which had one large cafeteria that took up a big portion of the site, each separate building of this school has its own café, or small eating space. The central kitchen is located in this building where the main food is prepared for the whole school and distributed out to the other buildings. Adjacent to the central kitchen is an indoor café area with round tables for 4 users. Those eating in this space are able to converse in small groups and are not forced to yell across the room, like traditional cafeterias. A visual link to nature is possible in this space because windows are provided. When the weather is comfortable and nice, users can be physically connected with the natural surroundings because a covered, outdoor eating terrace is also incorporated. The indoor and outdoor space is not only designed for eating, but they can also be occupied before, during, and after school for various activities. During school time, teachers and students use these spaces and when class is not in session, the community can hold small meetings and discussions in them as well.

Figure 08.09

The building for grades 1 to 3 consists of two levels. On the first floor, a small kitchen is provided for distribution of food delivered from the central kitchen. Like the café space in the administration/gym building, the café area in this building consists of round tables for small group gatherings. Users who are indoors can access an outdoor terrace that is shaded by the trees of the site. The natural environment can be viewed from the indoor space through the large windows. On the second floor, a larger interior café and exterior eating terrace is provided. With areas for dining on both floors, the children can choose where they want to eat and not feel as if they are being watched or controlled by the school, like traditional cafeterias. They do not have to worry about noise and crowding because the design of these spaces promotes quiet, small-group conversations. The scale is also age appropriate for the young users of this building.

First Floor

Second Floor

Figure 08.10

In the building for grades 4 to 6, the same design elements are incorporated into the eating areas. On the first floor, users will find an indoor café space, with a kitchen, as well as an outdoor terrace. On the second floor, there is a larger café area and outdoor eating terrace. All spaces serve multiple purposes and give users either a visual or physical connection with nature. When they are not occupied for eating, they can be used for group assignments, community meetings, or individual activities. Located in the same building as the classrooms, teachers can use these spaces for instruction and class presentations can also be held, which can be seen by the other occupants of the building. When it is lunch time, users of all three structures are not restricted to their own building. Providing more options lets the students move around and bond with other people. They can learn more about the other users of the school and this will develop their communication and psychosocial skills.

School: Metsola Primary School (Metsolan Ala-Asteen Koulu)
Location: Helsinki, Finland
Architect: Arkkitehtitoimisto B&P Manner

Figure 08.11

For elementary schools, it is important that spaces are designed from a child's perspective. They must be age appropriate and scaled to their comfort. Schools have been trying to make their spaces feel more like homes rather than institutions because they reduce anxiety about school and reassure both the children and the parents.[78] In this school, a cafeteria is not provided for the users because they are large and unwelcoming. Instead, small café spaces are integrated along the meandering halls. They are not too big or overwhelming and they fit

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[78] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.

no more than 20 students. Here, the younger children are in a familiar home-like setting where they can eat or collaborate on assignments with their classmates. Small, round tables are provided to promote conversations and interaction.

School: Sinarmas World Academy
Location: Tangerang, Indonesia
Architect: Fielding Nair International, PT Metro Idea Architects

Figure 08.12
In a large scale school with students from pre-kindergarten to grade 12, it is sometimes difficult to design age appropriate spaces because the physical, cognitive, and psychosocial needs and skills of all the students are drastically different. With a big site, the designers of this academy decided to combine students of similar skills into their own buildings.   Children from pre-kindergarten, kindergarten, grades 1 to 3, and grades 4 to 6 are in separate buildings located on the south end of the site while buildings for grades 7 to 9 and 10 to 12 are placed on the north end of the site. With a desire to create spaces to support the developmental needs of each age group, small learning communities of various sizes are provided.[79] In traditional schools, where lunch was held at a certain time, all users had to eat together in one large cafeteria. Noise and crowding was a major issue in these designs. For this school, however, every building has its own kitchen and small eating areas or cafés. This is the main café space and it is designed to be playful and fun to welcome all users. Artwork on the walls, modern light fixtures, and large windows for views and daylighting make the space lively and stimulating. Furniture pieces provided for small group gatherings create a more intimate and personal setting. Teachers and students can eat and talk together at the same time, creating closer relationships outside of the classroom. Students will no longer feel as if they are being controlled or watched by the teachers because of these new interactions. This main café is not the only place for the occupants to eat because many other small eating areas are incorporated around the school.

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[79] "Fielding Nair International – School Architects and Change Agents for Education." Fielding Nair International – School Architects and Change Agents for Education. http://www.fieldingnair.com/ (accessed March 27, 2011).

Figure 08.13

As one of the youngest groups in the school, it is important that the kindergarten students are provided with spaces that fit their needs because the skills they are expected to know are still new to them and are not fully developed. The small eating area for these children serves multiple purposes and is located in the center of the building, surrounded by classrooms and other spaces. A small kitchen is included to serve the meals and student displays, that exhibit projects completed by each class, surround this area. Although access to this space is easy, users are unable to get natural lighting or views of the landscaped gardens outside. For young children, it is important that all places are welcoming and fun. The walls are decorated and painted to create an exciting environment. As children occupy this space, they can also learn about colors from the lightweight chairs that are provided. The hexagon design of the table promotes group work and projects that encourage collaboration can be seen from the second floor. In this area, school projects or other educational elements are also displayed from the ceiling, where visitors and other users can learn about the activities that occur in the school.

Figure 08.14

For grades 1 to 3 and 4 to 6, not only are they located in separate buildings, they also have their own eating space. Both are designed with colors and have their own unique theme. The users of both cafés can create their own bond and relationship with these space because no two eating areas are designed the same. They can also clean their own areas when they are finished eating or working, which creates a sense of ownership. When they leave their own cafés to eat at another, not only do they get to experience the outdoors and natural landscape of the site, they are also able to see other students and teachers on campus. Here, they can develop their emotional and social skills because they can learn about people they have not seen before. Children of this age find it important to build friendships and these small eating areas allow them to do so.

Figure 08.15

Since the skills of these older children are more developed than pre-kindergarten and kindergarten students, more options for eating should be provided for them to accommodate their needs. The triple height space designed for grades 1 to 3 might be too big and could be overwhelming for the children. Noise might become an issue as well if the space is filled with people. Even if the users are not talking loudly, the combination of everyone speaking and moving at the same time will contribute to the noise. The echo of unwanted sounds might travel to the upper floors and could be a disturbance to classes that are in session. In this space, there are a variety of seating types that can support small group or large group gatherings. The chairs and tables, however, are not flexible to support the different physical needs of the users. The openness of the space does not provide much privacy as well, especially for students who prefer being in more quiet spaces to eat, where they can communicate without having to speak loudly. Including a work station for computer and internet use is important because when this space is not occupied for eating, students, teachers, or the community can use them for school or personal work. Although located in the same space as the café, the computer work station gives users privacy because it is in a semi-enclosed box. Users are not completely separated from the eating area, but are able to work alone if they choose to. Its design, however, is inflexible because it is a permanent feature. It might have been more appropriate if a temporary, transportable work station was incorporated.

Figure 08.16

The eating area for grades 4 to 6 is similar to the space for grades 1 to 3. This double height room is appropriate for the older children and helps reduce the feeling of crowding. Although the round tables with 4 chairs promote small group gatherings, their placement may create the feeling of crowding. They are positioned too closely together and users are unable to achieve privacy. The chairs are also not flexible and cannot be adjusted to accommodate the different needs of the users. Including a mix of rectangular and circular tables that seat 4 to 6 people not only accommodates the different group sizes during lunch time, but they can also support the group activities that occur before, during, and after school. Those that wish to converse, do work, or eat in a more private and relaxed setting can move to the areas with soft seating. Even though this space for dining allows a lot of natural light to enter, users are only able to visually be connected with nature through the windows. Opening up the room to an outdoor eating terrace would produce an indoor-outdoor space as well as allow the users to be physically linked to the natural environment.

Figure 08.17

With such a large campus, a traditional cafeteria would not support the developmental needs of all the students because they are all so different. The designer of this school understood the issues and provided the teachers and students with many options to choose from. Not only are separate cafés provided in each building, there are other small gathering spaces around campus that can be occupied during lunch time. Many of them include soft seating for various group sizes, different types of tables, and large windows for views and daylighting. They can also be used for meetings or relaxation. Those that do not wish to eat in the cafés, because the spaces are still too large for privacy, can dine in these smaller eating areas. With so many places to eat, it is difficult to keep all the areas clean. This was a concern in traditional schools and as a result, large cafeterias were designed. Here, students need to be educated about being responsible for these spaces. Knowing that they are required to clean them when they are done strengthens their sense of belonging in the school. Children tend to take pride in their schools when they are more involved.

School: Scotch Oakburn College, Middle School
Location: Tasmania, Australia
Architect: Fielding Nair International

Figure 08.18

This middle school gives users many options to choose from when it is time for lunch. The designer has incorporated an outdoor eating terrace that is accessible from the indoor café. It is located next to the lawn so that users can be closer to nature. Contrasting other outdoor eating areas that use trees for shading, this space provides large umbrellas for unexpected weather. Based on the preference of the users, they can be opened or closed for shading from the sun or protection from rain. The design features of the outdoor eating terrace resemble many coffee shops. Students and teachers not only use this space for eating, but they can also occupy it for casual meetings, group activities, or individual study. On the second floor, a similar outdoor eating terrace is provided. In this space, tables with umbrellas are not necessary because the roof of the building will protect users from unpredictable weather conditions.

School: Cristo Rey Jesuit High School
Location: Minneapolis, Minnesota
Architect: Fielding Nair International

Figure 08.19

Café spaces and small eating areas can already be found in some high schools and should be applied to elementary school designs. Colors on the walls differentiate one space from another and they create enjoyable environments, which contrasts the dull and boring colors of traditional cafeterias. The small kitchen, defined by the green walls, provide food while areas around, colored red, are places for users to eat. The furniture pieces included vary in height where students can choose to sit or stand while dining. Not being able to adjust them, however, may affect their productivity when this space is occupied for other activities. The carpet on the floor lessens the noise from people walking and moving furniture, but may be difficult to clean if users accidently spill food or drinks. This is a flexible space and when it is not occupied for eating, casual conversations, individual study, or community gatherings can occur. The school can open up the space before, during, and after school for all users and they are able to obtain food from the kitchen provided whenever they choose to. They are not restricted to a specific time period to eat, like traditional schools. The lack of windows in this space makes it a little less comfortable because occupants are unable to be physically or visually connected with the natural environment.

Figure 08.20

Other areas of the school are designed to serve multiple functions and can be occupied during lunch time for eating. These spaces are just as colorful as the other eating areas. Instead of using the same design elements, a new theme of decorations should have been applied to create a different experience for the students. As a space that can be occupied for eating as well as other school or personal activities, a variety of furniture types are provided to support the different tasks. There is a combination of tall tables with tall chairs, short tables with short chairs, and soft seating. Most of the furniture pieces are lightweight and can be rearranged to support the various activities. The level of comfort may vary because the design of the seats is not flexible. Users are unable to adjust the seats to support their tasks and being in uncomfortable positions for a long period of time can be harmful to their health. At the end of this space is a large window that lets in natural lighting and allows for views of the natural environment. Having the soft seating next to this window makes the space more relaxing and comfortable, where users can relieve stress. This small eating space, although flexible for dining and other activities, can be a visual and noise disturbance to the surrounding classes. The large windows of the classrooms allow students inside to see what is going on outside and they could easily get distracted. Including window shades or curtains might be helpful in reducing the visual distractions. It would also be appropriate if the school provided computer work stations that can be used any time of the day, which has access to internet for personal or school work. If that is not possible, at a minimum, there should be wireless internet where occupants can use their own portable devices.

Figure 08.21

Other eating areas around the school allow users to gather in small groups. In one space, a rectangular table and a few soft seating are provided for quiet, private dining. Although soft seating is supposed to be more comfortable, their large size does not allow the users to sit back and relax. The design of the table also causes students to be in uncomfortable positions because they need to either hold their plate of food on their lap or lean forward to their plates on the table. Both types of furniture combined affects the backs and necks of the occupants. The seats should be less deep and the table needs to be higher to prevent the body from straining. When people use this space for other activities, they are also affected by these furniture pieces, whether they are reading, writing, studying, or working on group projects. In another area, round tables with regular chairs are included. Users can obtain privacy here because they can simply move the furniture closer to the cave space where the coat hangers are located. In both spaces, the designers used the same color theme as the other eating areas in the school. They should have incorporated different decorations so that users can experience different settings.

School: Scotch Oakburn College
Location: Tasmania, Australia
Architect: Fielding Nair International, Hassell, Patrick Architects, Philip Lighton Architects
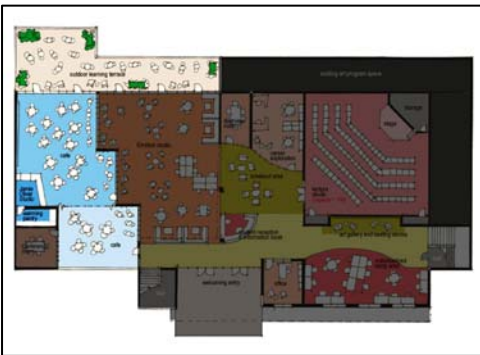
Figure 08.22

In many colleges, small areas for eating are already incorporated to contrast traditional cafeterias. Even though the schools are larger and filled with more people, compared to elementary schools, these places for dining encourage students to gather in smaller groups where they can be more personal and intimate. Many of these café spaces have small kitchens where food can be prepared or reheated and furniture that seat 4 to 6 users are typically included. In this building, the eating area is divided into three separate spaces that serve multiple purposes. The southern eating area is rectangular in plan that is accessible from the adjacent hall and conference room. Users of this space are visually connected with the outdoors, through the windows. In the central café, classes occupy this space like a learning studio. A folding door separates this area from the south café. When it is not used for learning, the doors can be opened and both the teachers and students can have their lunches here. The northern eating area is an outdoor eating and learning terrace. A variety of furniture is provided to promote group work as well as individual study. Planters are incorporated into the space to provide shading and to physically connect the users with the natural environment.

Company: VS International
Website: http://www.vs-furniture.com/56.0.html?&L=1&FL=10

Figure 08.23

VS International has been designing business and school furniture for over a century. Their designs not only create better working and learning environments, but they are also ergonomically fit and flexible for all user types and activities. Their furniture pieces for the new eating spaces are colorful and lightweight, which creates a fun setting and can be easily cleaned, stacked, and stored when they are not in use. In the first setting, children are sitting around a circular table in a group in a fruit themed eating space. The combination of colors from the wall and furniture makes the space fun and enjoyable. When this space is not occupied for lunch, it can be used for other activities. In the second setting, the square tables and colorful chairs are quickly stacked so the floors can be cleaned. They are lightweight so that the students can participate in the cleaning process. The cartoon design on the wall is another fun theme for the children. When these spaces are not occupied for eating, they can serve other purposes as well.

08.5 PERSONAL REFLECTION

"When I was in elementary school, teachers ate their lunches in the teacher's lounge while the students ate in a large, traditional cafeteria. It had a big kitchen for food preparation, a stage for performances or speakers, a few double doors for access, and many wooden jalousie windows, which could easily be opened and closed to control air flow. The school provided long tables with hard, backless seats because they could easily be folded up and placed on the side for quick cleaning. The walls were plain white and all other building materials were selected to endure constant use and abuse.

My memory of lunch time from kindergarten to fifth grade is very clear and I remember it being unpleasant every day, even though it was supposed to be a time where we are able to relax. The not so enjoyable experience started before the ringing of the lunch bell. Every teacher gathered their students and lined them up boy-girl, boy-girl. When the bell finally rang, the teacher led us to the cafeteria and we were not allowed to talk the whole time we were walking. When we finally arrived at the cafeteria, we paid for our lunches, took our plate of food, and sat in our designated class table. As we ate our food, we were watched and controlled by lunch monitors. When they saw students attempting to talk, they yelled at them and they were forced to put their heads down on the table. Adding to the punishment, those who did talk were not allowed to play outside after lunch. Instead, they had to stay indoors to wipe down the tables and to sweep the floors. This process of being controlled and not having any freedom did not enhance our skills at all.

Thinking back, I would change everything about the lunch time experience. The design of the cafeteria would be different and how the people occupied the space would not be the same as well. Instead of a large cafeteria, smaller spaces, indoors and outdoors, that are themed or colorfully decorated would be incorporated to give children more freedom. Flexible furniture that seated 4 to 6 users would be provided to promote interaction. In this new type of design, students can choose where they wanted to eat and can talk if they wished to, making the eating process fun and relaxing. Teachers would not be secluded in their own lounge but would eat with the students as well. That way, they can learn more about them outside of the classroom and lunch monitors would not be needed because if any child ever misbehaved, the teachers could stop the unwanted actions. Incorporating these changes would help develop the social and emotional skills of the students.   Incorporating larger windows and integrating technology into these environments would be helpful as well, whether the spaces were occupied for lunch or for activities that occurred before and after school."

08.6 CONCLUSION

Large cafeterias should no longer be used as places for dining because they are damaging to the health and safety of the students. Designs were plain, boring, and did not enhance the physical, cognitive, or psychosocial skills of the children. When they are not in use, this space is sometimes occupied for other purposes, but many times, the space is wasted. Students need smaller eating areas with comfortable seating for socializing during lunch time or for group work and individual study before and after school. With this new design idea, faculty as well as the community can use this space also.

09 | CHALLENGING PLAYGROUNDS

09.1 TRADITIONAL PROBLEMS
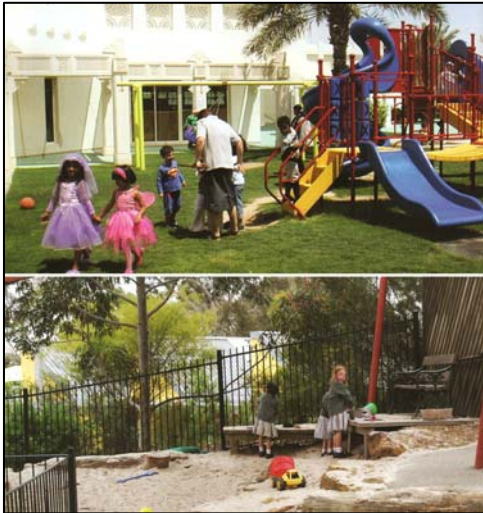
Figure 09.01

Playgrounds have taken many forms over the past 150 years. They influence not only a child's physical skills, but also their psychosocial and intellectual development when they interact with their peers. They are places where children learn how to balance, coordinate, and develop other basic, physical skills.   When a child uses the equipment provided, they must be inspired in new and exciting ways. In fear of lawsuits, however, designs have become boring and sterile, where there are only fixed, plastic structures and large areas of greenery.   These designs are not only uninspiring, but they are also not influential.[80]   Playing in these playgrounds does not enhance their skills one bit.

Many physical skills can be acquired during recess in the playgrounds. In recent years, however, schools around the world want to reduce or eliminate completely the amount of time spent in recess in order to provide more classroom time. This is caused by safety and budget concerns as well as the increased use of electronic media. A survey conducted in 2008 of 1,000 American adults showed that majority agree on the importance of recess and physical activity in a child's everyday life.[81]

Figure 09.02

IMPORTANCE OF RECESS & PHYSICAL ACTIVITY	
Survey	Percentage (Agree)
Children are not getting enough physical play on a regular basis.	80% (men) 74% (women)
Schools are responsible for providing a healthy amount of physical activity during the school day.	89%
Children do not receive enough time for recess at school as it is.	33%
Having breaks with physical activity helps children stay focused and learn in the classroom.	91%
Breaks with physical activity are good exercise for the kids.	88%
Recess is an important part of a child's life.	85%
Recess is a break in the day for teachers too.	69%
Recess plays a large role in readying children's social development.	91%
Recess plays an extremely large part in children's ability to make friends and interact with other kids.	36% (men) 43% (women)
Recess should not be reduced or eliminated in schools.	69%

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[80] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.
[81] "Studies and Research | KaBOOM!." We help communities build playgrounds | KaBOOM!. http://kaboom.org/help_save_play/play_research/studies_and_research/ (accessed February 20, 2011).

The concern with safety is a big reason why boring designs are found in many schools around the world today. Statistics have shown that in the United States, more than 200,000 children are treated in emergency rooms every year for injuries obtained in playgrounds. At least 17 result in death from those injuries. The only time children are able to express themselves and play freely is during recess, but the removal of challenging playgrounds have given them nothing to develop their skills. Bringing back challenging playgrounds is necessary because many life-long habits and skills that affect health and development cannot be obtained in the classrooms.

09.2 MODERN SOLUTIONS

Child psychologists believe that playgrounds that are creatively designed are crucial for child development. Nutrition experts believe that playgrounds, which encourage exercise, decrease the chances of obesity. The most important factors in creating safe playgrounds are surfacing material, design and spacing, and equipment inspection and maintenance.

Playgrounds are recreational areas that should not only be safe environments for active play, learning, and exploration, but like classrooms, they should also stimulate all senses. Surface materials need improvement because many injuries are caused by falling. Concrete, asphalt, grass, soil, and packed-earth surfaces are unsafe and unacceptable because weather can reduce their cushioning effect on a child's fall. Although loose materials like wood chips, mulch, sand, and pea gravel are used to create safer play environments, shredded rubber is becoming a popular surfacing material. Made from scrap tires, this material provides twice as much cushioning than the other materials.[82]

The types of equipment and their location also play an important role in safety and development. It is important that age appropriate signage is marked on the equipment to show what areas the children should be able to play in. Elementary students should include rope or chain climbers on angles, climbing pieces, horizontal bars, and cooperative pieces such as tire swings, slides, and sliding poles. These spaces not only enhance physical skills, but they should also allow for positive emotional development. When children are able to explore new ideas and use their imagination, they enhance their cognitive skills. Socially, their skills will develop as well because they can either play alone or with their peers. Being able to explore spaces and interact with others is the appropriate environment to be in. Areas for tricycles, loose parts, or dramatic play parts should be designated and away from fixed equipment. Children can develop intellectually when play areas provide games that involve problem solving and manipulating items. These types of spaces can include nature trails, large composite structures, playhouses, sand boxes, sand diggers, water-wheels, loose parts, and construction materials.[83]

Along with the playground equipment, landscape should also be incorporated to promote healthy social, physical, and cognitive development. Mixing landscape and hardscape can promote creativity and allows for various activities. Providing open and shaded areas encourage imagination and interaction.[84] They can be used by children who are intimidated or feel overcrowded by the manufactured playground structures. Landscape also separates different play areas and can be places for running. By providing varying topographic elements with shrubs and trees, children are encouraged to play chasing games or

[82] "The Great Playground Debate | SparkAction." SparkAction | For children. For youth. For change.. http://sparkaction.org/content/great-playground-debate (accessed February 20, 2011).
[83] "NPPS // S.A.F.E. - Age." NPPS // National Program for Playground Safety. http://www.playgroundsafety.org/safe/age.htm (accessed February 20, 2011).
[84] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.

hide-and-seek. This increases stimuli not only in the horizontal playing field, but also the vertical. A wider range of playing environments can meet the individual needs of the children.[85]

With both play equipment and landscape designs, safety is still the most important factor to consider. Although recess is the break time for both students and teachers, adults should be supervising the play areas. By taking precautions, adults can prevent accidents. They can make sure that the children are age appropriate for the equipment and that unsafe behavior is not engaged. Younger children should not play on equipment designed for older children because the proportions do not match, which could lead to injury. This also applies to older children on smaller equipment. Aid for injured children can immediately be directed with adults on the playing areas.

Maintenance and inspection also plays an important role in child safety in playgrounds. No equipment should be broken, including cracked or splintered wood equipment or rusted metal equipment. The surface material must cover all appropriate areas and should be maintained regularly. Weather might affect the quality of the playground, but the materials of the equipment should be durable and not fall apart. Contamination and vandalism during after hours when the playgrounds are not in use might be dangerous for the children and should be checked regularly.[86]

09.3 DESIGN GUIDELINES FOR NEW SCHOOLS
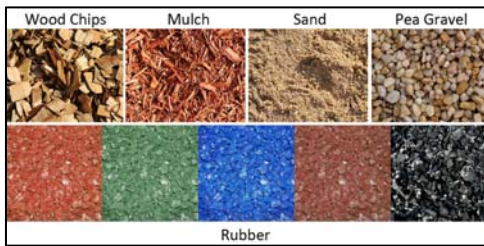
Figure 09.03
Soft materials (wood chips, mulch, sand, pea gravel, or preferably shredded rubber) for the surfaces

Figure 09.04
Fixed, age appropriate play structures for swinging, sliding, and climbing

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[85] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.
[86] "Playground Safety ." KidsHealth - the Web's most visited site about children's health. http://kidshealth.org/parent/firstaid_safe/outdoor/playground.html# (accessed February 20, 2011).

Figure 09.05

Hardscape, landscape, and topographic elements along with trees and shrubs for running, jumping, ball playing, and imaginative play

09.4 ANALYSIS OF PROPOSED/BUILT PROJECTS

Company: Rubberecycle

Website: http://www.rubberecycle.com/playground_rubber_mulch.asp

Figure 09.06

Providing proper surface materials is important in creating safer playgrounds. Many accidents are caused by children falling off the equipment and without the appropriate surface to decrease the impact, injuries will continue to occur. Many schools use wood chips, mulch, sand, and pea gravel for their surfaces, but shredded rubber is becoming more popular because it provides more cushioning. Playsafer Rubber Mulch by Rubberecycle is one of many products that can be included to make playgrounds safe. They are available in a variety of vibrant colors and schools can create fun and exciting playgrounds by mixing and matching colors.[87]

Company: Massey & Harris Engineering Ltd.

Website: http://www.masseyandharris.com/

Greco Ltd. was created in 1938 and was one of the first companies to manufacture playground and sports equipment. Massey and Harris Contracts Ltd. took over the company soon after and became Massey and Harris Engineering Ltd. It has been a privately owned independent manufacturer of British Products for over 70 years. Products from this company stimulate children of all ages, from toddler to teenager, which challenges the mind and body, and develops coordination, self confidence, and fitness. Their company's vision is: "To provide high quality innovative design, production, installation, and maintenance of

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[87] "Playsafer Rubber Mulch." Rubberecycle. www.rubberecycle.com/playground_rubber_mulch.asp (accessed February 20, 2011).

playground solutions that will provide creative stimulus for Active Play across all age ranges and environments."[88]
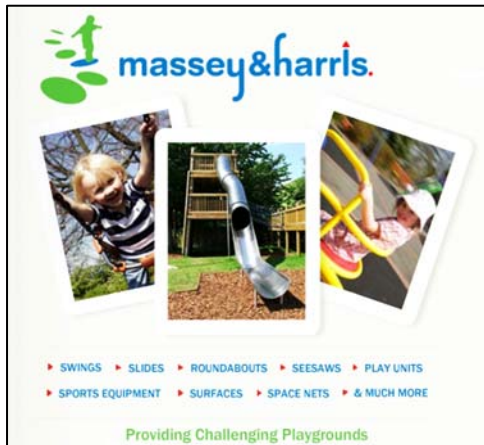
Figure 09.07
Massey & Harris Engineering Ltd. offers a variety of challenging playground equipment including swings, slides, roundabouts, seesaws, play units, sports equipment, surfaces, space nets, and much more.

Figure 09.08
Swings are great places for children to socialize and practice their swinging skills. There are many different designs available in stainless steel, which require very little maintenance. [1] Net Swings are made for children 4 to 14 years old and they encourage group play. The large seat allows for multiple users and the side barriers provided not only stop children from running into the path of the moving swing, but they also act as extra stability. [2] The 5-Way Cluster Swings are large pieces of play equipment that allow multiple users to have fun at the same time. Being the most popular equipment in parks and schools, this piece is a great social solution for playgrounds. [3] Cantilever Swings are appealing for the outdoors. Reclaimed tires can be used for the seat or a nest seat is another option. [4] Double Bay Swings come with four seats that are simple to assemble and install. Different seating types can be provided including flat, cradle, pod, or bumper.

Figure 09.09
Slides are great social play units that are made with either steel or timber towers/platform. They can be customized to fit existing units and are engineered for easy installation. [1] The Double Width Trough Slide is freestanding and is for children ages 4 and up, depending on the height of the slide. Steel steps or scramble nets can be incorporated as access to the top. Parents and teachers are able to access the slide as well and care for the children from the large platform provided. [2] Spiral Slides have steps that allow access to the top of the tower and has a cover to protect users from the weather. [3 and 4] Tunnel Slides come in different shapes, sizes, and configurations to fit the characteristics of the site and stainless steel security fixings are incorporated for safety.

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[88] "massey&harris | UK based Playground Manufacturer, Outdoor Playground Equipment, Swings, Slides, Seesaws." massey&harris | UK based Playground Manufacturer, Outdoor Playground Equipment, Swings, Slides, Seesaws. http://www.masseyandharris.com/ (accessed February 20, 2011).

Figure 09.10

Roundabouts are strong and durable rotating platforms. They reflect traditional roundabouts in an innovative way and encourage both group and individual play. [1 and 3] The 3 and 6 seat roundabouts allow children to sit as they spin and the handrails can be held as they stand and spin. [2] High Spinners are for older children to develop their upper body strength during play. The wheel is made with stainless steel and the heights can be customized to fit the users. [4] Giant Spinning Disks are new additions to the school playground for students ages 8 and older. Set at a specific angle, they are designed to challenge the balancing, coordination, timing, and running skills of the students. [5] Junior Roundabouts include one small central seat with lots of deck space for standing and pushing. [6] Wheelchair Accessible Roundabouts are also available, sitting flush to the floor. They are easily accessible by wheelchair and seats are provided for sitting.

Figure 09.11

[1 and 3] Springers are for young children ages 2 to 5. They can sit together in a group or separately. With a spring base, they stimulate young children to rock themselves back and forth as they play with their friends. With a soft surface underneath, it reduces injuries if the children accidently fall off. [2] Gullwing Seesaws are designed for children ages 5 and up. The raised wings are made for sitting and two users are able to rock and talk together, developing their physical and social skills. [4] Stand-On Seesaws allow students to stand as they rock back and forth. This design encourages collaborative play for up to two users. Handholds allow for firm grip and they suit most age ranges and abilities.

Figure 09.12

[1 and 4] Boats and Trains are fun additions to the playground. They can be climbed on, to develop physical skills, and children can have "make believe" activities, which enhances their imagination skills. [2] Medway Rotators are for children 8 years or older. This unit spins, twirls, and rises as it rotates, creating a challenging and exciting play environment. [3] Sand Diggers have 2 levers for moving sand or pea gravel around. When the children rotate a full 360 degrees as they dig, it develops their coordination skills.

Figure 09.13

[1 and 2] Space Nets and Spinning Cone Climbers create challenging experiences for children in the playground that encourage group play and develop climbing skills.

Figure 09.14

[1 and 2] Steel Trim Trails offer many alternatives for social and physical development. They are fitness trails that fit any location. Individual trail items can be placed alone or one after another to form a course. Individual trail items include Geometric shapes, [3] Step Pods, [4] Balance Beams, Rotating Balance Beams, Leaning Ladder, Bungee Bridge, Pod Run, Wobbly Walkway, Tunnels, and Vortex.

Figure 09.15

[1] Timber Trim Trails, like Steel Trim Trails, are activity and fitness trails. They can be individual, stand alone pieces that form an island or run one after another to form a course. Many styles are available to challenge the skills of children of all ages and abilities. The course can be any shape and size depending on the scale of the site. Individual trail items include [2] Suspension Bridge, [3] Stepping Logs, [4] Slalom, [5] Twister, [6] Balance Beams, Suspended Plank, Stepping Stilts, Swinging Steps, and Parallel Ropes.

Figure 09.16

With the issue of safety, this company also provides a variety of surfacing materials, including Safagrass Mats, Bark and Sand, Wetpour Rubber Surfacing, and Rubber Tiles. They are available in a variety of bright colors. Schools can customize their play surfaces and create vibrant and fun settings for the children.

Figure 09.17

Other products available include [1] Mushroom Top Seats, which make bright and colorful settings for interactive play and communication, [2] Play Houses for group play that have roofs for protection, [3] Single Sided Play Panels that stimulate imagination, and [4] Storytellers Chair and Bench for outdoor story telling or casual, group conversations.

Company: Creative Outdoors
Website: http://www.creativeout.co.uk/

Creative Outdoors specializes in playground designs for day care nurseries, primary schools, sure start centers, and commercial settings. Working closely with the clients and users, children get the most fun, play, and learning opportunities. They start with the initial site visit, create a brief CAD design, construct

the project, and take care of maintenance. They project manage the whole process from the beginning to end. They believe that: "The best way to make children good is to make them happy."[89]

Figure 09.18

A design by Creative Outdoors incorporated sand play, a giant stage with a changing area, a house, slides, role play areas, dens, mark making, sun canopies, wet weather group areas, a storytelling area, a range of surfacing, and a pet corner to accommodate two rabbits. These spaces promote physical play, which children can run, jump, climb, and slide, and have imaginative play. Some areas also include seating in semi-enclosed spaces, which allows children to develop their psychosocial skills as they interact and communicate. These play areas are accessible during dry or wet weather. When there is rain, there are also controls that keep children off the wet grass.

Figure 09.19

When children are outdoors, they are provided with weather play, physical challenge, mark making, and sand play equipment. The whole playground is separated by age so that children can play safely. Young children are able to climb the giant sandpit without having to worry about the older children. Water is integrated underground so that teachers can quickly fill the water trays for water play.

Figure 09.20

In this design, Creative Outdoors decided to keep characteristics of the site and integrate it with the playground. The surrounding area is filled with natural elements and they wanted to retain that character in the design of the playground. This design encourages children to use their imagination and to play in a setting inspired by jungles.   Multiple areas are incorporated for group gatherings, which help children develop their social and emotional skills. There are also tunnels for crawling, ropes for climbing, and beams for balancing, which promote physical activity.   These spaces allow schools to hold physical competitions that are original, stimulating, and fun. Carvings inspired by the jungle are also incorporated into the playground setting.

[89] "Playground Designs | Playground Designer | Bespoke Playgrounds for Schools and Day Care Nurseries." Playground Designs | Playground Designer | Bespoke Playgrounds for Schools and Day Care Nurseries. http://www.creativeout.co.uk/ (accessed February 20, 2011).

Company: Recreation Creations Inc.
Website: http://www.rec-creations.com/

Recreation Creations, Inc. creates imaginative designs and fun school play equipment. Designs are durable, dependable, safe, and environmentally friendly. This company believes that: "Education and interaction skills should continue outside of the classroom. We actively provide educational programs which highlight the need to recycle."[90]
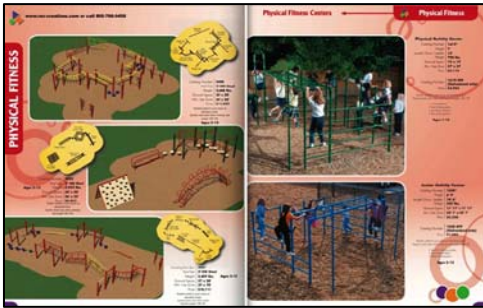
Figure 09.21
Recreation Creations, Inc. provides a variety of play equipment for developing physical skills. Multiple pieces of play equipment can be linked together to create challenging physical fitness centers. Children can learn to balance, climb, swing, and do pull-ups while they participate in group challenges during physical education class. During recess, all students can enjoy these play equipment as they talk stories and develop their psychosocial skills. This company provides play equipment for children of all ages. Schools can find age appropriate equipment for their users to develop their skills.

Figure 09.22
With sites that vary in size and shape, schools should not have boring, static playgrounds that are unoriginal and are not specific to their users' needs. This company has created many individual components that can be pieced together to form custom play equipment. Schools, designers, and the manufacturer can work together to select the appropriate components that stimulate the young children. Not only will the final design be site specific, but they will also provide a variety of play equipment for the children to enjoy. Each school can select different components and they will stand out amongst other designs because all the pieces were customized to their liking. These components include slides, climbers, and horizontal ladders where each develops specific physical skills.

[90] "Playground Equipment | Play Ground Equipment Manufacturer | Commercial Playground Equipment |School Playground Equipment | Park Equipment." Playground Equipment | Play Ground Equipment Manufacturer | Commercial Playground Equipment |School Playground Equipment | Park Equipment. http://www.rec-creations.com/index.php (accessed February 20, 2011).

Figure 09.23

Schools can also choose from a wide selection of panels to add to their playground equipment. These panels are attached to the edges of the play structures and are used for safety as well as developing physical, cognitive, and psychosocial skills. There are music, math, bubble, chalk board, clock, and driving panels, to name a new. Bridges and pods are also components that can be integrated with the structures to create challenging experiences for the children. They can learn to hop, walk, or keep their balance as they move from one side of the structure to the other. These pods can be placed in a straight line or curved to challenge the users. Each pod is different in height so the users are challenged with each step. These components give children a sense of accomplishment as they complete the physical activities.

Figure 09.24

For the young children in elementary schools, they can learn basic climbing skills from the freestanding structures that are designed like vehicles. Fire trucks of different sizes are popular equipment that can be included in playgrounds. These play equipment are not only for physical development, but they are also made for children to use their imagination. Spider nets and walls and rocky mountain climbers are other freestanding structures that can be provided in the playgrounds for older children. They are more challenging in developing their physical skills. They not only develop their climbing skills, but they also enhance their hand-eye coordination skills. By incorporating both easy and complex play structures, children can acquire and master skills during their many years of attending elementary school.

Designer: Richard Dattner
Website: http://tclf.org/landscapes/189/all

Figure 09.25

Along with manufactured play equipment, it is important that schools provide landscape and hardscape in playgrounds. Not only do they develop the physical skills of the users, nature-inspired or natural playgrounds also let students use their imagination as they interact with one another. Materials like concrete, granite blocks, and raw timber can be sculpted to resemble landforms and they blend in with the natural surroundings. Children can run, climb, hide, and jump freely in these spaces to increase stimuli in both the horizontal and vertical playing field. Combining manufactured play equipment and these natural settings give children more play options to support their individual needs.

Company: Landscape Structures, Inc.
Website: http://www.playlsi.com/

Founded in 1971 by Barb and Steve King, Landscape Structures, Inc. is one of the leading commercial playground equipment manufacturers in the world. With its headquarters in Delano, Minnesota, this company has designed, manufactured, and installed over 50,000 playgrounds worldwide. Innovation goes into every playground design, which encourages children of all abilities to get outside and play. Products that are designed support healthy, physically active outdoor play. They believe that their job is: "To promote exciting commercial play structures that promote stealth health – exercise disguised as fun!"[91]

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[91] "Landscape Structures." Landscape Structures. www.playlsi.com/ (accessed February 20, 2011).
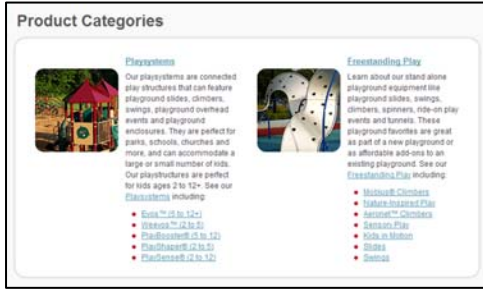
Figure 09.26

Schools that want custom playgrounds to fit their site characteristics and provide for the needs of the students can select from a wide range of playground equipment from Landscape Structures, Inc. Their products support children ages 2 to 12 as well as adults. Schools can choose between Playsystems, Freestanding Play structures, or a combination of both in their playgrounds, all designed by Landscape Structures, Inc. Playsystems are made up of individual play structures connected together, including slides, climbers, swings, playground overhead events, and playground enclosures. They vary in size to support a small or large number of kids. This company has designed their own individual play structures to accommodate children in elementary school, or age 5 to 12, and this includes Evos and PlayBooster. Freestanding Play structures are stand alone play equipment that can be used as add-ons to existing or new playgrounds. They include slides, swings, climbers, spinners, ride-on play events, and tunnels. Schools can find custom Freestanding Play structures designed by Landscape Structures, Inc. which includes Mobius Climbers, Nature-Inspired Play, Aeronet Climbers, Sensory Play, Slides, and Swings.
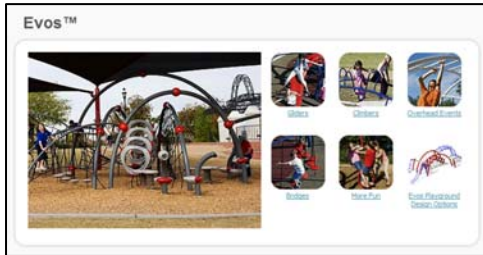
Figure 09.27

Evos are made for children ages 5 to 12 and develop the physical and psychosocial skills of the users. Endless configurations can be made with Gliders, Climbers, Overhead Events, and Bridges. Children can explore their imagination with the springy climbing cable and build their upper-body and core strength.
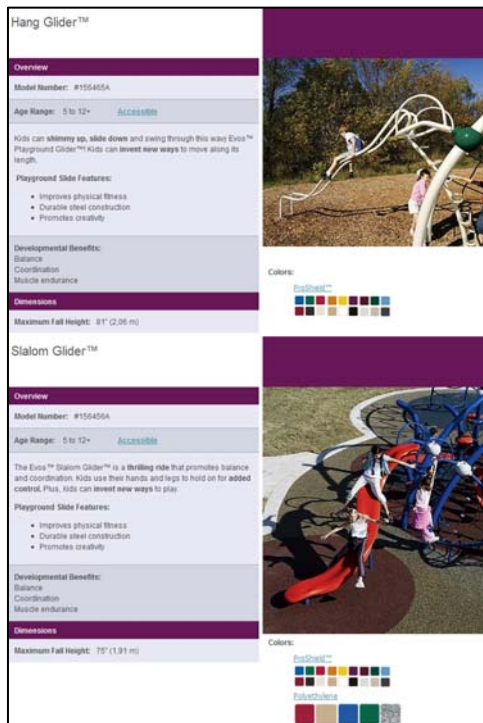
Figure 09.28

Since Evos are made with a variety of individual pieces, schools can select components that are challenging that can be put together. One of the many options they can choose from is Gliders. They make getting up and down the Playsystems fast, fun, and unique. Schools can choose between the Hang Glider and the Slalom Glider. Although they both have the same use and benefits, the designs are completely different and schools can select one that best fits their site and users. Providing more than one design option, schools will end up with customized playgrounds. Landscape Structures, Inc. includes all the information needed for the designers and educators when they are designing new playgrounds. With each component, schools can see if they are age appropriate, what features they come with, and how they benefit the development of the children. Some components are made for young children while others are designed for older students. They also provide a color palette of all the available colors.

Figure 09.29

Custom Evos can be made with Climbers that come in many designs and colors. This company has a variety of products in this category including the [1] Hemisphere Climber, [2] RingTangle Climber, [3] Helix Net Climber, [4] O-Zone Climber, [5] Balance Winder Climber, [6] Web Link Climber, and [7] Crescent Climber. These structures make moving up and down challenging and fun. All designs build total-body strength, balance, motor planning, and coordination skills. Their innovative designs also enhance problem solving skills and challenge kids both mentally and physically.

Figure 09.30

Overhead Events for Evos are challenging structures for children ages 5 to 12. These overhead climbing ladders come in different colors and designs that help build upper-body strength, balance, and coordination skills. Children can move across them from swinging with their arms from the bottom as well as crawling across from the top. Schools can select [1] ArcOver Ladder, [2] Overhead Trekker Ladder, [3] Overhead Explorer Parallel Bar, or [4] Bow Ladder to be added to their Evo Playsystems. It is important that the surface on the ground is soft to lessen the severity of injuries in case the children do fall.

Figure 09.31

Bridges for Evos are challenging and promote collaborative play and are available in a variety of colors. As children move from one pod to another, they learn how to balance, coordinate, cooperate, and communicate with others. Schools can choose between the [1] PodStomper Bridge and the [2] Swiggle Stix Bridge for their Evo Playsystems.
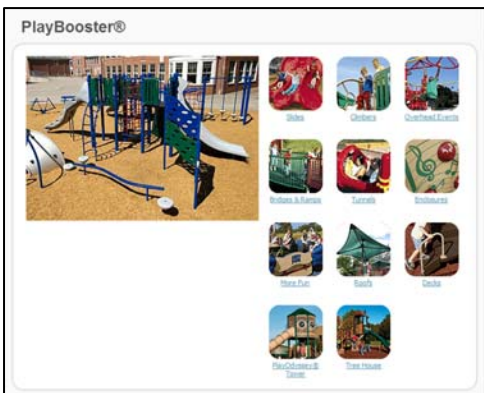
Figure 09.32

Along with Evos, schools can provide their students with PlayBoosters, which are also Playsystems that combine challenging ground level components and overhead activities. Not only are they safe and meet ADA requirements, but they also provide whole-body strength and aerobic workout for the users. Schools can create their custom PlayBoosters by selecting from the many products of Landscape Structures, Inc. including Slides, Climbers, Overhead Events, Bridges & Ramps, and Tunnels.

Figure 09.33

Landscape Structures, Inc. offers a wide variety of high and low components that can be put together to create PlayBoosters. Slides are one of the most basic playground structures that kids enjoy and the designs from this company are creative, challenging, and fun. From this company, schools can select simple, straight designs or twisty, complex designs. There are many options schools can choose from such as [1] Cloudburst Slide, [2] Gemini Slidewinder2, [3] TurboTwister Tunnel Slide, and [4] Rollerslide, to name a few. The structures with multiple slides not only accommodate multiple users, but they also encourage communication and competitions. Children can enjoy racing one another and at the same time, they will develop their balancing, coordination, and psychosocial skills.

Figure 09.34

Climbers for PlayBoosters are low and high components. They are safe, exciting, and provide opportunities for interactive, active, and multisensory fun for elementary school students. This company has designed many Climbers that schools can select when putting together their customized PlayBoosters. All designs are different and some are inspired by elements found in nature. Nature-inspired structures create a good balance with the other man-made play equipment in the playgrounds. Many of these Climbers enhance total-body strength, develop climbing, balancing, and agility skills, and encourage creative and cooperative play. These designs include [1] Discovery Tree Climb, [2] Funnel Climber, [3] Log Steppers, [4] Cascade Climbers, [5] Mushroom Steppers, [6] Cliff Climber, [7] Escalator Climber, [8] Starburst Climber, and [9] The Peak Rock Climber.

Figure 09.35

Like Evos, PlayBoosters can be customized with Overhead Events, [1] Triple Ring Fling Overhead Event, Bridges & Ramps, [2] Pod Bridge, and Tunnels, [3] View Tubes and [4] Wire Crawl Tunnel. They can be occupied by students of all ages. While some are physically challenging for older kids, others are relaxing for younger children where they can talk stories with their peers. They are all fun additions to playgrounds which develop physical and psychosocial skills of the users. Schools have the option of combining different components of various colors to create fun and exciting playgrounds.

Figure 09.36

Mobius Climbers are unique playground structures that are interactive and strategic for children between the ages of 2 and 12. These structures come in different shapes and sizes to fit the varying sizes of the school sites and the different age groups of elementary school students. The [1] 3-Panel Mobius Climber is designed for young children to build confidence as they first learn how to climb while the [2] 12-Panel Mobius Climber is more complex to accommodate the older, larger, more experienced kids. These Mobius Climbers develop gross motor skills, upper-body strength, hand-eye coordination, and balance. Their unique design creates interesting landscape forms amongst the other pay structures.

Figure 09.37

Aeronet Climbers are challenging, bouncy, interactive climbing structures that provide sensory fun for children ages 5 to 12. These stand alone designs are unique additions to playgrounds. Children can build their upper-body strength as well as their eye-hand coordination skills as they move from one side to the other or from bottom to top. They can also develop their skills in balancing, coordination, and depth perception. Cables of these designs are scratch resistant, color stable, durable, and vandal resistant. There are a few options schools can choose from including [1] Eclipse Net Climber and [2] Lunar Burst Net Climber.[92]

[92] "Landscape Structures." Landscape Structures. www.playlsi.com/ (accessed February 20, 2011).

09.5 PERSONAL REFLECTION

"As a child, recess was a fun time of the school day. Like many students, I looked forward to it because we were free to play whatever we wanted and we could relax from all the class assignments. The playground of my elementary school was a large grassy field filled with challenging structures. The center was open and was usually occupied for running or throwing/kicking balls. On one end of the playground, we had a baseball diamond for kickball or softball. Adjacent to this space were 3 tetherball poles for individual or collaborative play. On the other end of the playground, we had basketball courts that were surrounded by challenging play structures. The school provided a wide range of equipment including a balance beam, pull-up bars with three different heights, large rings for swinging or climbing through, two square jungle gyms for climbing, a tall rocket-shaped jungle gym with three poles in the center for climbing and sliding, and one tall slide. Sometimes, we ran around the whole playground and played 'catch' as well as used our imaginations and played 'house.' One person would play the 'mother' role, another would play the 'father' role, and so on.

Although the design of my school's playground is appropriate for developing physical and psychosocial skills, all structures have been removed from the site except for the basketball courts and the baseball diamond. Instead of providing children with challenging play equipment, much of the open green space was used to make additional parking for administration and visitors. Children attending my elementary school now only have one plastic structure to play with, which is uninspiring and boring. Thinking back on my experiences, I am glad that there were so many challenging play structures when I attended elementary school. It is a little sad to know that children are no longer having fun during recess because I really enjoyed that time of the day. If I had the chance to renovate the playground, I would provide the students with challenging structures that manufacturers have designed more recently. Even though they will require more supervision, there are long term benefits for the children."

09.6 CONCLUSION

Playgrounds in the past used to be exciting and inspirational. Children were challenged physically and also learned how to interact and cooperate with their peers. With many reports of injuries caused by these fun playgrounds, schools have resorted to boring designs. Although children are safer, they are no longer stimulated by these spaces and their skills are affected. Bringing back challenging playgrounds that are appropriate for the different age groups can help children develop physical and psychosocial skills and can make recess exciting and fun again.

10 | OTHER CONSIDERATIONS

10.1 OVERALL SCHOOL DESIGN

The ideal size as well as occupancy of elementary schools has been debated for many years. Today, schools that are too large seem to be an issue because they are not sensitive to the needs of each individual child. When designing, it is important to understand the impact of these spaces from a child's point of view, rather than an adult's. First impression of the exterior of the buildings can greatly influence a child's behavior and thoughts about school. Because of their smaller stature and limited perspective, children perceive the world larger than adults. The amount of space students occupy in comparison to the site size needs to be considered for optimal academic and behavioral outcomes.

Figure 10.01
Large structures with big features, like doors and columns, create an institutional image and can cause children to feel overwhelmed and uncomfortable. Smaller structures that are proportional to the size of the children, on the other hand, resemble residential homes and create a more welcoming feeling. Incorporating bright colors as well as building accessories, such as awnings, window treatments, and signage can achieve this feeling too.   Playful landscapes and images on the sidewalks and entries are inviting and exciting for young children.[93]

Many studies have been made on the size of schools in relationship to the academic performances and achievements of children in elementary schools. About half of the studies showed no difference between small and large schools. The other half, however, indicated that students from smaller schools receive better grades, test scores, honor roll membership, subject area achievement, and higher-order thinking skills assessments than those in bigger schools. It also showed that smaller schools positively affect attendance rates and school safety. Students who attend these schools seem to participate more, which results in positive attitudes and social behavior. This is so because smaller schools provide children with more opportunities to develop and improve personal relationships with their fellow classmates and teachers. Many old, larger schools have found the benefits of smaller schools and are retrofitting their learning environments. Although new, small schools are desired, it is important that they are able to evolve and grow in case of population increase in the future.[94]

10.2 CHARACTERISTICS OF THE SITE

The number of possible building configurations of a school is almost limitless, but there are many factors that influence the spatial organizations of the buildings. The design of schools is determined by the program requirements as well as the site, which needs to provide different and safe experiences for developing the skills of the children. The location of buildings, natural elements, and spaces for vehicles are some factors of the site that need to be considered.

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[93] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.
[94] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools*. Hoboken, N.J.: J. Wiley, 2010.

Elementary schools should be divided by age and grade level because of the children's differences in physical and emotional development. A third grader, for example, would have different physical height, coordination abilities, emotional capacity, and social skills as a sixth grader. Because of this, it is recommended that schools be arranged where first/second, third/fourth, and fifth/sixth graders are clustered into similar areas on the campus.[95] Some schools are located on small sites in single structures, like traditional schools, where students do not leave the buildings except for recess or physical education. Others, however, are designed with separate buildings, allowing children to move from one structure to another throughout the day. Although single structures have limited access points and are easier to secure, separate buildings can create indoor-outdoor experiences for the users to enhance their growth.

Security and safety of the school occupants is one of the most important factors to consider when designing new schools. While walls and fences are the obvious choices for preventing accidents, limiting access, and providing security, landscape features can serve as effective barriers, which make the site more inviting and welcoming. Conflicts between vehicular and pedestrian circulation is difficult to solve in developing school sites. This is determined by the amount of students taking the bus to school, getting dropped off, biking, or walking, which is influenced by each grade level, location, and demographics. Most traffic on and off site for vehicular and pedestrian circulation happen at the beginning and end of the school day, so routes of children walking to and from school should be separate from vehicular traffic.[96]

10.3 COMMUNITY CONNECTION

120-student Small Learning Communities (SLCs) or neighborhoods of two SLCs   Incubator shops / learning studios

Figure 10.02

In present day schools, cafeterias are used when classes are not in session, occupied by the community early in the morning or late in the evening. With resources and land continuing to be limited, the community will be more involved with the facilities of the schools. The spaces will be occupied for adult education programs, music, dance, and theatre. Joint use of facilities will make schools the heart of the community. Being connected to organizations, businesses, industries, and recreational amenities outside of the campus also creates extended learning opportunities for the users.[97] Providing a better connection between the school and the community can allow all occupants to have a greater sense of ownership of the facilities. This encourages collaboration and cooperation and unifies the entire community. Scheduling of activities may not be difficult in small school districts, but it may be an issue in a more complex, urban environment. Designers need to solve the issues that might occur in shared facilities.[98]

[95] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.
[96] Perkins, L. Bradford. *Elementary and Secondary Schools*. New York: J. Wiley & Sons, 2001.
[97] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.
[98] Lippman, Peter C.. *Evidence-Based Design of Elementary and Secondary Schools* . Hoboken, N.J.: J. Wiley, 2010.

Figure 10.03

When schools are opened to the community, it is important to separate the combined facilities from the spaces specifically for the students because this will keep the student areas secure and improve efficiency and energy consumption of the buildings. With activities occurring throughout the day, designers need to consider the security and safety of the teachers and students during the day as well as the people of the community at night. This influences the design of night lighting, entrances, and pedestrian/vehicular circulation. Areas that might promote unwanted behavior should be prevented.[99]

10.4 MAIN ENTRANCE
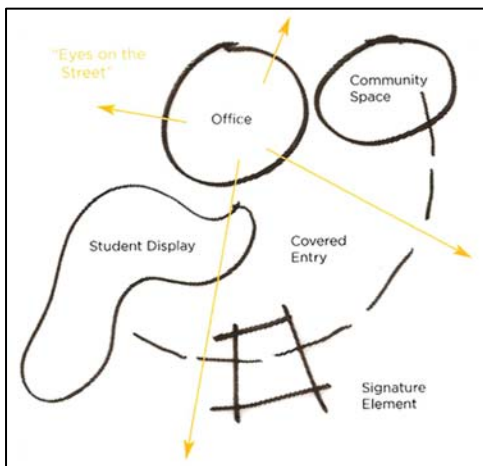
Figure 10.04

Producing a great first impression through the design of the main entrance is just as important as the design of the buildings themselves. Having an inviting, friendly, and secure entrance gives the community as well as the other users a sense of belonging and security. Although many schools have multiple entrances, the main entrance can be defined with a cover. It can be a fabric canopy or a cantilevered structure, which helps the teachers, parents, and students transition easily between the street and the school. This covered entry creates a ceremonial quality to the school as well.

Figure 10.05

A unique signature in the entry area, permanent or temporary, can be used to define the community as a whole. The signature can be a sculpture, art piece, or fountain that differentiates the school from other schools. It could also be incorporated into the architecture, like a historical piece important to the users, the school, or the community, to create a special identity in the area. Including a community space by the entrance is recommended because it is more welcoming and enhances the security of the school. It also functions as a multi-purpose space where parents and the community can gather or hold meetings. The administrative offices should also be located near the entrance, which helps improve security on the public side as well as increase supervision on the student side of the school. Incorporating more transparent materials at the entrance creates a feeling of openness, increases natural daylight in the buildings, and allows for better supervision of those entering and exiting the school.

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[99] Brubaker, C. William. *Planning and Designing Schools*. New York: McGraw-Hill, 1998.

Tackable surface for student work

Rear projection display for interactive display of student media projects

Horizontal surface for 3-D project display
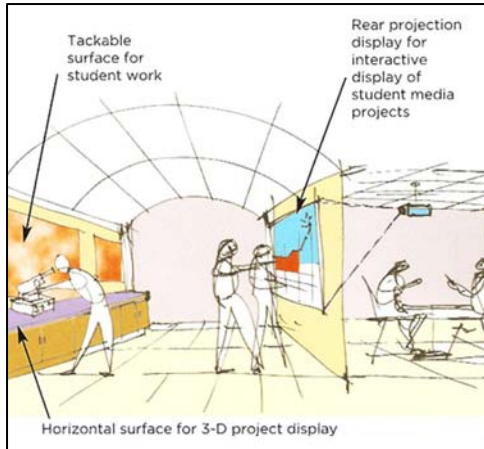
Figure 10.06
Another way of making an inviting entrance is by providing a student display space. It helps create a powerful statement about the school's learning mission and visitors can get a sense of what the school is all about. Changing the showcase occasionally can make a vibrant, dynamic space. An unconventional way of making an ever changing display is by incorporating a garden with student creations.[100] Displays of living elements like plants and animals can also be included because the presence of life, other than human, can create a sense of "aliveness" to the environment.

views and vistas

student display

Residentially-scaled elements greet students and parents on arrival

informal seating

clear views into school to foreshadow learning activity within

floor siting encouraged with comfortable floor coverings

Well defined zones for gathering and play
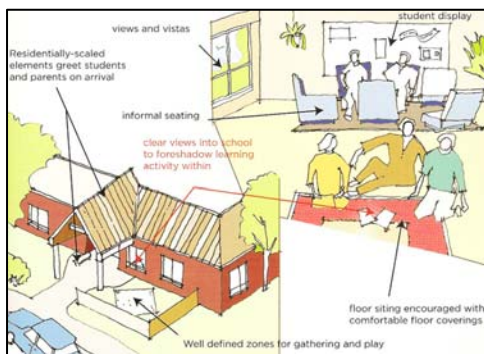
Figure 10.07
Not only should the entrance of the school be carefully designed, but the entranceway of a classroom also needs to be considered. The purpose is to give students a glimpse of the activities that will occur within. The scale should reflect those found in residential environments and large, institutional features should be avoided. Making them appear familiar, friendly, and inviting can reassure the interior spaces as being safe and fun.[101]

10.5 CROWDING

It has been argued that 100 to 200 students in an elementary school is optimal, but crowding can still become an issue. When the school and class size go beyond the buildings' intended capacity, they affect the performance and well being of those occupying them. Crowding can be measured based on the number of people in a space (e.g. 15 students per classroom) and by the number of space available for each person (e.g. 10 square feet per student). The feeling of crowding can occur depending on the experience of the individual. This is when they feel that they are unable to control their interactions with other people and are unable to accomplish certain activities

When a student gets overstimulated, they can also feel overcrowded. Having to pay attention in class for a long period of time, focusing on the lesson material, bulletin board displays, visuals on the walls, and other students can affect the learning process. When a child is unable to concentrate because of overstimulation, it can lead to attention overload or cognitive fatigue. Fatigue causes stress and in turn, affects the mental and physical health of the students. This could then lead to high blood pressure or heart disease. Students who are in this physical and mental state might be aggressive to their peers, behave inappropriately in class, or withdraw socially from participating in class. As a result, children are no longer able to pay attention to the material that is being taught. In order to restore attention, a child might tune out everything for psychological privacy and start daydreaming in class. Private spaces in

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[100] Nair, Prakash, and Randall Fielding. *The Language of School Design: Design Patterns for 21st Century Schools, Revised Edition*. Minneapolis, Minn.: DesignShare, 2009.
[101] Kopec, Dak. (In Press). *Environmental Psychology for Design, Second Edition*. New York: Fairchild.

classrooms that allow for alone time or views out into nature can reduce cognitive fatigue. Being able to do outdoor activities or attend a small trip outside of the classroom can also help restore attention.[102]

10.6 WAYFINDING

When enrollment increases, wayfinding can become an issue. Wayfinding refers to the way people orient themselves in any environment, eventually finding their destination. The ability to wayfind depends on many factors including visual cues, memories, knowledge of the place, and the ability to reason. Being able to move through the spaces and locating the destination without stress is successful wayfinding.

Each individual's ability to maneuver through the spaces varies, but there are certain images and clues that are perceived similarly by groups who share similar backgrounds, activities, or routines. By incorporating wayfinding strategies that vary in size, form, color, or style, it can make moving through the spaces easier. *The Image of the City* by Kevin Lynch was a study based on components of the environment that help with orientation on the street level and they can be applied in the smaller scale of learning environments as well:

1. Paths: channels of movement
2. Edges: boundaries that break or contain or run parallel to the forms
3. Districts: areas of recognizable identity
4. Nodes: places of intense activity
5. Landmarks: points of reference that are visually distinguishable

Combining multiple elements in the site and floor plan as well as the three-dimensional space can assist with wayfinding. Like a city, the paths or circulation spaces should provide clear access to major areas, or districts, within the school. When a child reaches an edge, they should have a clear sense of leaving a space and entering a new place. Nodes are located at the intersection where activities occur along a path. Points of interests or entrances can be distinguished as landmarks.

Adults in unfamiliar areas would rely on maps to reach their destination. Children, on the other hand, orient themselves in relation to their own positions. For example, a child would use the relationship between their favorite playground equipment to their classroom to understand the environment they are in. In the classroom, they might use the materials, types of lighting, or furniture to understand the space. For children, many times, the social and natural elements of the environment are more important than the built structures. When including signage for children, graphics appropriately scaled to the age groups should be used. Designers must be careful, however, because overuse of signs can cause cluttering and can become ineffective. Public spaces tend to need more visual cues while private spaces require less. These components, whether inside or outside, should be clearly planned and understandable for all users.[103]

10.7 CONCLUSION

There are many new ideas for creating better learning environments for children. These ideas not only solve the issues of traditional schools, but they also enhance the skills of the students when they occupy the spaces. Aside from these solutions, there are other factors and elements around the school that need to be considered. This includes the overall school design, characteristics of the site, the school's connection with the community, the main entrance design, crowding, and wayfinding. As designers go through the design process, they will realize that there are other factors to consider as well.

[102] Frumkin, Howard. *Safe and Healthy School Environments*. Oxford : Oxford University Press, 2006.
[103] Perkins, L. Bradford. *Elementary and Secondary Schools*. New York: J. Wiley & Sons, 2001.

CONCLUSION

A child's attendance and experiences in elementary school will always have a big impact on their physical, cognitive, and psychosocial development. The basic skills obtained during these beginning years of their formal education develop over time and their ability to perform specific tasks as adults is greatly affected without a good foundation. Since all the skills they acquire and develop throughout the years are influenced by the spaces of the learning environments, it is crucial that designers provide appropriate designs to enhance their growth. Historically, schools were not created for the well-being of the users. Instead, they followed a strict set of requirements which created rigid, passive settings that not only reflected the perspectives of adults, instead of the children, but they also did not enhance their skills. Compared to the past, much has changed, including the teaching methods, academic curriculum, and technology but the designs of schools have remained the same, unable to support the needs of the users and the new changes. Past designs that hindered development and growth can still be found in schools today. Knowing this, designers need to generate innovative ideas that prevent past problems from reoccurring, support the new changes, and enhance the developmental progress of the children. Designs that positively impact the physical, cognitive, and psychosocial skills of children at a young age will result in higher academic achievement and better capabilities as they get older.

Prior to designing better elementary schools, it is important for designers to understand what skills the children are expected to know as well as how the role of the teacher affects their ability to acquire and develop their skills. It is also essential that they are aware of the problems of traditional schools so that the same mistakes would not be repeated in new and future schools.

Although the rate of growth of each child is different in elementary school, there are certain tasks and abilities that the average child is expected to know by a certain age. When they first attend at the age of four, children learn how to perform simple physical tasks such as hopping, swinging, and skipping. Eventually, they should be able to complete more complex activities such as kicking a ball while running or spinning while jumping. As they develop these physical skills, their cognitive skills are influenced. Also at age four, children begin to acquire basic reading, writing, and math skills by learning the letters of the alphabet and recognizing small numbers. Eventually, they are able to make sense of words as well as solve simple addition and subtraction. As they reach an older age, they should be able to complete more difficult tasks such as reading, writing, and understanding paragraphs as well as problem solving. Being away from home, which is a comfortable and familiar setting, children need to develop their psychosocial skills in school. They do so by communicating with their classmates and teachers during formal and informal conversations. Children who are unable to achieve these basic skills will find difficulties performing certain activities when they reach adulthood.

While analyzing traditional schools based on their impact on child development, designers will realize that they do not support the developmental needs of the users but instead inhibit growth. The classrooms, where children spent most of their time, were passive learning environments. The teacher instructed in the front of the class while the students listened and absorbed the information. Furniture was uncomfortable and was bolted to the floor, which restricted movement and collaboration between the students. Windows were small or eliminated completely which did not allow for daylighting, natural ventilation, or views of the outdoors. Research has shown that these design features do not enhance the physical, cognitive and psychosocial skills of the students. Although it is a known fact that they are

problematic, they are very similar to present day schools. The teaching method and learning process are still linear and the teacher has full control of the setting. Furniture does not support ergonomics and is laid out in rows and columns which do not promote collaboration. Many schools today desire flexible and adaptable spaces that not only support the different needs of each individual but also have the ability to accommodate for future changes. The designs of past and present schools, however, do not support these wishes. Some teachers are attempting to integrate new teaching methods to contrast the traditional methods and to enhance the skills of the children, but the spaces designed still reflect schools of the past and do not allow them to. Because children spend majority of their school day in the classrooms during this critical moment in their lives, much attention is needed when generating design solutions for the classrooms.

Before designers can start creating new ideas for the classrooms, however, they must consider two important elements that apply not only to the classrooms, but also to all the spaces of the school that affect the development and education of the students. These two elements are technology and furniture.

Technology, such as film, radio, and television for example, has always been integrated into learning environments. Each was effective for a short period of time in the past, but they are no longer efficient for new schools because they reflect the traditional, linear teaching method and learning process. Although research has proven this to be true, teachers are still using these technologies as tools for teaching in present day schools. The introduction of computers and internet, on the other hand, differ from the previous technologies because they create active learning environments. Students are more involved in the activities that require the use of computers and internet. The introduction of portable devices also allow for more hands-on activities and group assignments. Being able to access these tools around the school anytime of the day creates flexible spaces that develop the cognitive and psychosocial skills of the students. Because technology is changing so quickly, it is difficult to determine what technologies should be integrated into new schools. Tools that seem efficient at the moment might be considered ineffective in the future. When planning for the use of technology in new schools, educators must determine what the users will be able to do with them and whether or not they are efficient and effective for their development. The technologies in schools need to help users work smarter and not harder.

Furniture in schools has always been and still is standard and uncomfortable. Schools provide the students with tables and chairs that are "one-size-fits-all" in design. Knowing that each individual child develops at their own rate, these pieces of furniture should no longer be provided because they do not support the varying physical characteristics of the students. Using these standard pieces of furniture that do not support ergonomics, children are constantly moving around, trying to find a comfortable position. This not only affects their physical health, but it also decreases productivity. In order to resolve these issues, lightweight, flexible furniture needs to be included in all spaces of the school. Tables should be height adjustable and mobile to support sitting and standing activities of individuals and groups. Chairs should not only be mobile and stackable for easy moving and storing, but they should also be height, backrest, and seat adjustable to accommodate the physical needs of each individual user. Soft seating should also be included to create relaxing, comfortable spaces for quiet tasks or casual conversations. By providing flexible furniture, schools will produce long-term physical, emotional, and social benefits for the users.

With an understanding of the importance of technology and furniture, designers can now incorporate them with their design ideas to solve reoccurring issues that were found in past and present day schools. Since the classrooms have the greatest impact on the development of the children, they must be carefully designed. In order to enhance their physical, cognitive, and psychosocial skills and support the ideas of flexibility and adaptability in new schools, classrooms must be irregular in plan and able to transform spatially with the incorporation of non-fixed elements and flexible furniture. This idea contrasts traditional classrooms because they now accommodate a wide range of activities for the different academic subjects. The furniture and non-fixed elements can be reconfigured to create temporary spaces that support assignments for individuals, partners, small groups, and large groups, which schools in the past were not able to do. This enhances both their cognitive and psychosocial skills. The irregular plan also creates breakout areas for more quiet or private activities. Technology should be integrated with each academic subject so that students can learn to master those skills. It is also important that the transformable classrooms have windows that allow for views of nature, daylighting, and air flow because they improve health and productivity of the users. Schools of the past lacked these elements and the users were negatively affected by them.

Although children spend most of their school days in the classroom, designers must make sure that the other spaces in the school are appropriate when they occupy them. The spaces that all users use are the hallways but mainly for one function, which is circulation. Hallways serve only one purpose but they account for 30% of the school's total floor area. With the rising cost and scarcity of land, schools cannot afford to pay for these wasted spaces. In order to solve this problem, designers should create multi-functional hallways that can be used for circulation as well as learning and socializing. Since this space will now function like an alternative classroom, it should be designed like a classroom. Contrasting the long, narrow, and double-loaded corridors of the past, multi-functional hallways need to vary in shape and size to provide different experiences and opportunities for the users. The incorporation of a variety of flexible furniture will allow the users to occupy the spaces for personal or educational purposes. Like a classroom, there needs to be breakout areas, or cave spaces, with soft seating for more quiet or private activities. It is essential that windows are integrated throughout for ventilation, natural lighting, and views of the outdoors. From occupying the multi-functional hallways and performing a variety of tasks in small and large groups, children are able to develop their cognitive and psychosocial skills.

Other problems designers will realize while analyzing traditional schools is the lack of site space or landscaping. Students are mainly kept indoors when they are in school and the only exception is during recess or physical education. Studies have shown that views of the natural environment or physical experiences in them relax the mind and reduce stress. Even with this finding, however, educators assume that more time spent indoors will result in better test scores and are considering reducing or eliminating recess. Although the sizes of school sites are different all over the world, it is essential to provide outdoor learning spaces, both man-made and natural, that supports different activities. This includes terraces that are located directly outside of the classrooms as well as places for gardening, observing the climate, nature walks, and animal care. These spaces, whether they are occupied for personal or education reasons, are new experiences for the children to enhance their skills. These opportunities were not provided in the past but should be in new schools.

Many schools of the past have been criticized for not being scaled appropriately to the size of the children but are designed from the perspective of adults. Current schools have the same problem as well. The cafeterias of elementary school reflect this issue. During lunch time, children get to take a break from all

the school work, relax, and converse casually with their classmates but the large cafeterias do not allow them to do so. Although the large space can accommodate all the users of the school at one time, endure constant use and abuse, and the long tables can be folded up quickly for cleaning, they do not support the developmental needs of the children. When they are eating, they should be able to enhance their psychosocial skills by chatting with their friends and classmates. New research has shown that smaller spaces in the learning environments result in better academic performance and achievements because they are more proportional and welcoming. Instead of creating large cafeterias in new schools, small eating areas with flexible furniture located all over the campus should be provided. With this solution, the students do not have to deal with the crowding and noise issues of cafeterias and they have the freedom to eat and chat wherever they want. Having the students clean up the spaces they occupy will enhance their leadership skills and creates a sense of ownership. Like the other spaces of the school, designers need to provide users with views, natural ventilation, and daylighting whenever possible. Outdoor eating terraces can also be provided for different experiences. Because these spaces can be occupied before, during, or after school, at a minimum, secure wireless internet should be provided for efficient and easy access.

The design solutions for classrooms, hallways, outdoor learning spaces, and small eating areas mainly develop the cognitive and psychosocial skills of the children. The best place for them to develop these and greatly improve their physical skills is out in the playgrounds. Playgrounds in the past used to be inspiring and exciting but the many lawsuits and injuries have forced schools to provide children with fixed, plastic structures and large areas of greenery that are boring and uninspiring. News schools need to bring back the challenging playgrounds that let children swing, slide, and climb as well as run, jump, play ball, and have imaginative play. This includes a mix of structures, hardscape, landscape, and topographic elements. It is important that the playgrounds are age appropriate and the floor surfaces are covered with soft materials in case of accidents. While interacting with other students as they occupy the playground spaces, children are enhancing all the necessary skills.

When designing new elementary schools, there are other features of the school that designers need to consider, even though they do not play a big role in the developmental process of the children. Elementary school is the first place for education for many young children. The overall design of the school needs to be comfortable and inviting, resembling the small, residential homes that they are used to seeing. These characteristics are familiar to the students and they make transitioning from the home to the school setting much easier. Because all the children vary in age and are different physically, cognitively, and psychosocially, designers cannot expect them all to have the same experiences and reaction to the spaces. The design of the site needs to group children of similar age groups together because they have more similarities. Areas for all grade levels should also be provided to promote interaction. Many schools today want to have spaces that are flexible and adaptable. Creating a connection between the school and community makes the school facilities serve multiple purposes and they encourage collaboration and cooperation. All users get a greater sense of ownership when they use the facilities. Now that there are different users of the school, designing a recognizable main entrance is important. Here is a place where the users get their first impression of the school. It needs to be friendly and inviting as well as create a sense of safety and security. A signature element will define the entrance while the shelter creates a transition between the street and the school. The office and a main community space enhance the security while the student displays give visitors a sense of the school's learning mission. Small schools are desirable but not always achievable. In larger schools, designers must understand the effects of crowding and wayfinding for the users. Being overstimulated by large crowds

may lead to physical and mental problems such as high blood pressure or aggressive behavior. Not being able to maneuver through the campus may also cause stress and anxiety. Because of this, designers must incorporate wayfinding strategies to assist the users in finding their destination.

There are many ways to approach the designs of new elementary schools. Whether they are based on budget, site constraints, climate, or culture, for example, the solutions that designers develop should enhance the physical, cognitive, and psychosocial skills of the children. Their ideas create a foundation for these children, where the skills they acquire at this age will affect them in the future. In order for children to have experiences that improve their skills, designers must include ideas that not only solve problems of traditional and present day schools, but also provide innovations that are flexible and adaptable for future changes. Integration of technology, flexible furniture, transformable classrooms, multi-functional hallways, outdoor learning spaces, small eating areas, and challenging playgrounds are just some of the many ideas that can assist the children during this crucial developmental stage in their lives. These ideas are solutions for the major spaces in the school that the children occupy and have the most impact on their development. Although they are not the absolute and only solutions, these ideas should be used as a starting point for all new school designs. The role of the designer is to determine what solutions are appropriate and how they should be altered, manipulated, and applied based on a case by case basis.

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