FIRSTSCHOOL DESIGN GUIDE:
Optimal Learning Environments for Children Three to Eight

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By: FirstSchool Design Collaborative
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Teach our children to take flight and color their world with possibilities.

~P. Heinnickel

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LEAD ORGANIZATIONS

FPG Child Development Institute

FPG Child Development Institute is a research unit at the University of North Carolina at Chapel Hill. For more than 40 years, FPG research and outreach has shaped how the nation cares for and educates young children. We are one of the nation's oldest and largest multidisciplinary centers dedicated to the study of children and families focusing on:

Parent and family support;
Early care and education;
Child health and development;
Early identification and intervention;
Equity, access and inclusion; and
Early childhood policy.

Our researchers are internationally renowned experts in the field. Their research has been cited by state and federal policy makers, school districts, academics, professional organizations and many others.

UNC-CH School of Education

The School of Education was established at the University of North Carolina at Chapel Hill in 1885. The school is organized under four academic areas: teaching and learning; educational leadership; human development and psychological studies; and culture, curriculum and change.

The mission of the School is preparing leaders for the education profession and assisting in the development of strong and effective schools. The School provides programs at the undergraduate, masters, and doctoral level. The research of the SOE faculty has contributed significantly to the literature and has been cited by state and federal policy makers, school districts, academics, and professional organizations.

Perkins Eastman

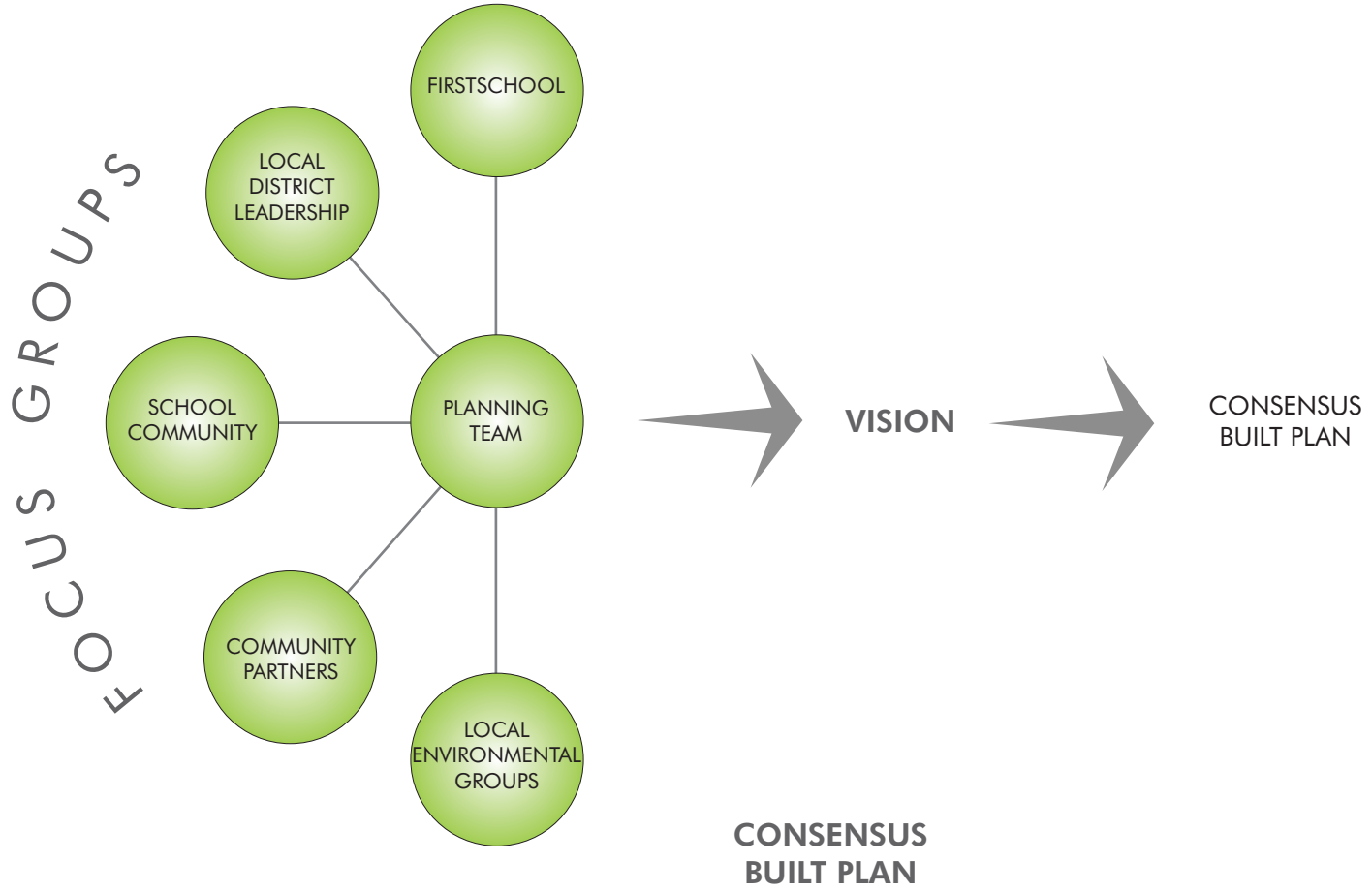
As national leaders in education, Perkins Eastman possesses a long and rich history in the planning and design of child-centered, supportive environments in both traditional and non-traditional settings. Our team of professionals is distinguished by its understanding of emerging educational trends and first-hand experience with a variety of private/independent schools. We also carry experience working with large school districts, navigating the consensus-building, and public approvals process. Our professionals strive to incorporate the unique core goals and mission of each institution by working collaboratively, to make sure curriculum and program drive efficient and functional spaces. We believe in designing learning environments that embrace, enhance, and reinforce each school's teaching and learning methodologies. In addition, the firm brings an enthusiastic commitment to making our projects greener, healthier, and more economically self-sustaining.

Our process is based on the belief that change is not something that is imposed upon schools from the outside, but is rather fostered by people who work in schools, see the need for change and innovation and play significant roles in making change happen.

For over 20 years Perkins Eastman has been creating beautiful and innovative educational spaces that shape the way students learn. With nearly 800 professionals in 10 offices worldwide, our practice carries widespread knowledge allowing us to effectively benchmark educational standards of excellence. Forging a multi-faceted practice around the interests of our principal designers, we have cultivated a diverse portfolio of projects including over 150 projects for primary and secondary school clients.

1.0 FirstSchool Planning Process

In this chapter we provide the background and context for this document and briefly describe the planning process and resulting recommendations.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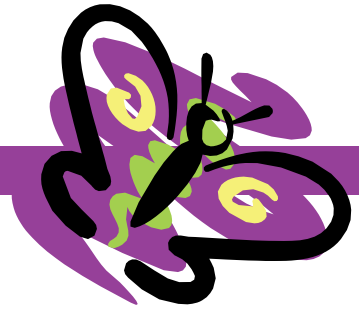
FIRSTSCHOOL
LOCAL DISTRICT LEADERSHIP
SCHOOL COMMUNITY
PLANNING TEAM
COMMUNITY PARTNERS
LOCAL ENVIRONMENTAL GROUPS
VISION
CONSENSUS BUILT PLAN
CONSENSUS BUILT PLAN

FIRSTSCHOOL PLANNING PROCESS

FirstSchool is led by the FPG Child Development Institute in partnership with the School of Education and other departments at the University of North Carolina at Chapel Hill, as well as with local elementary schools, and the broader community. Our work on facilities design began with the FirstSchool Facilities Committee, a one-year collaborative effort to think about what we believed possible for optimal indoor and outdoor educational environments for young children. We benefited from members with specialized knowledge and expertise in early childhood education, special education, child development, school design, outdoor learning environments, community development, technology, environmental impact, universal design, and cultural competency. We worked to envision indoor and outdoor environments that met the FirstSchool goals of 1) supporting relationships and partnerships throughout the school community; 2) enhancing all aspects of child development and learning; and 3) providing for the health and safety of all.

Based on the work of the Facilities Committee, a request for proposals from prospective design teams was drafted. Twenty-one teams submitted proposals and six were interviewed. Design team members included architects, engineers, landscape architects, and variety of consultants specializing in lighting, outdoor environments, and child development. The Perkins Eastman team was chosen based on their early childhood/elementary experience, focus on environmental sustainability, and a positive track record with the university and local school districts. Their philosophy centers on a commitment to strong leadership throughout the entire design process, and is founded on a consensus-based approach that emphasizes collaboration, interactive workshops, stakeholder buy-in, and the clear understanding of project goals and issues from the beginning of every project. The design team led an interactive process that brought together the FirstSchool Facilities Committee with members of a local school community. The result of this collaborative project is this document, designed to provide a full description of the conceptual underpinnings and organization of a state-of-the-art school for children ages 3-8 and the school staff and families who share it.

The purpose of this document is to assist others in collaborative work. We encourage communities to forge partnerships with a broad range of stakeholders, and we invite you to use this document to begin your inquiry into optimal physical environments for children from kindergarten through third grade.



2.0 Overview and Rationale

In this chapter we discuss the rationale for re-thinking education for children from age 3 through third grade. This chapter addresses the need to unite the thinking of early childhood, elementary, and special education. Further, we discuss the commitment of FirstSchool to vulnerable children, and discuss evidence-based innovation.


South Africa

FIRSTSCHOOL

FirstSchool is a public school Pre-kindergarten through third grade initiative. Our two over arching goals are to:

- Create a national framework of early schooling for children from pre-kindergarten through third grade
- Help schools and communities implement FirstSchool concepts

FirstSchool is a framework of evidence-based approaches that help schools and communities respond effectively to an ongoing achievement gap, mediocre quality in too many pre-kindergarten and early elementary classrooms, and insufficient integration of early childhood, elementary, and special education. The framework guides diverse stakeholders to consider multiple features that are critical to systemic change, including: Coordinated School Health and Wellness; Instructional Practices and Curriculum; Evaluation and Research; Facilities; Families and Communities; Finance; Professional Development; and Transitions. These features interact and intertwine. This document focuses on the facility, and highlights other key elements of the FirstSchool model.

Rationale

Why Public Schools?

The United States is at a turning point in public education. For many children, school begins before the traditional age of five when they enter kindergarten. Public schools across the country are providing early care and education for children as young as age three. In fact, nearly a million four-year-olds are served in public schools[1]. State and local governments invest billions of dollars in pre-kindergarten education. We fully expect these investments to expand over the next decade. We have a unique moment in history to thoughtfully and strategically determine how we are going to best educate our young children. The decisions we make today will impact children, families, communities, and the American workforce for generations to come.

Why Pre-Kindergarten-Third Grade?

FirstSchool, as well as the larger pre-kindergarten through third grade movement, calls for re-thinking public education during a child's first years of schooling from age 3 through third grade[2]. This age span represents a unique time in children's development. By age 3, most children have successfully mastered oral language skills. The period between age three and third grade is a time when children learn to read and write; in turn, reading and writing skills enable them to learn. This acquisition of basic skills provides the crucial foundation for later learning. While there is a relatively predictable sequence of development in all domains (i.e. physical, cognitive, emotional, social, and language) during the first nine years of life[3], there is also a substantial amount of variance within groups of children and across the domains. It is essential that these foundations are secured for all children.

State and local governments invest billions of dollars in pre-kindergarten education. We fully expect to see these investments expand over the next decade.

Many children's educational experiences and the indoor and outdoor environments available to them are not high quality, and do not allow them to learn and develop to their full potential.

We cannot think about pre-kindergarten in isolation from the early elementary grades. We believe it is important to move away from separate notions of "early childhood education," "K through12 education" and "special education" toward an integrated approach for children ages 3 to 8 that unites the best of all three. The research base for educating children in these early years draws upon work from each of these fields. Historically, early childhood teacher preparation programs have emphasized child development, whereas preparation programs for elementary school teachers have emphasized academic content (e.g., math, literacy). As children advance through grade levels, they may encounter an increasingly academic curriculum, different teaching styles, varied rules and systems of classroom organization, and decreasing parent involvement[4]. Research has also demonstrated that the developmental appropriateness of classrooms decreases from kindergarten to third grade[5]. Summarizing findings across multiple studies, Pianta[6] noted the "exceptional variability in the nature and quality of learning experiences offered to children in the early grades." All of these findings suggest, when considering the profound effect of early education on long term success[7], that it is vital to have a carefully articulated and continuous plan of learning for children as they launch their academic careers. Successful inclusion of children with special needs, as defined by Schwartz and colleagues[8], goes beyond enrolling them in a program with typically developing children. It involves 1) meaningful and successful participation in the productive learning experiences; 2) membership in the classroom; and 3) the development of positive social relationships within the peer group. In this age of accountability, children's abilities need to be recognized far beyond achievement on standardized tests, and schools and educators must consider how the goals and approaches of special education can be applied more broadly to the education and nurturance of each child in the school community.

Our Commitment to Vulnerable Children

Data from the National Assessment of Educational Progress, our nation's report card on education, suggests that many children have not acquired basic skills by fourth grade (age 9 for most children). In 2007, 43 percent of Caucasian fourth-graders tested at or above "proficient" in reading, and only 14 percent of African-American children and 17 percent of Latino-American children were considered "proficient" or higher in reading[9]. The findings are only slightly better in math[10]. At least half of the educational achievement gaps between poor and non-poor children already exist at kindergarten entry. Racial and cultural minority children and children from low-income families are more likely to enter kindergarten behind their middle class white peers, to have lower educational achievement in reading and math, to be assigned disproportionately to special education classes and, even when their incomes are similar, ethnic minority children fare worse on standardized tests[11]. African-American boys are more likely to be expelled from preschools[12] and African-American and Latino-American boys have higher rates of grade failure[13].

What we do know is that: 1) vulnerable children who participate in high quality early childhood programs have positive cognitive and social outcomes[14]; 2) there is much evidence to support the long-term positive effects of high quality child care programs and the resulting cost savings and benefits to society[15;] and 3) how children perform in the early elementary years predicts how they do in later schooling[16]. FirstSchool will utilize this knowledge to guide change in instructional and institutional practices to address this national crisis.

Evidence-based Innovation

Decades of research has identified effective early education practices by demonstrating the benefits those practices confer on children[17]. A comparison of position papers by national education associations and state and national early learning and performance standards indicates that there is much agreement about what constitutes the enriched learning environments, positive teacher–child relationships, and instructional approaches that make learning meaningful for children and support them as they grow and develop[18]. However, research also tells us that many children's educational experiences and the indoor and outdoor environments available to them are not high quality, and do not allow them to learn and develop to their full potential. "The Journal of Early Intervention" provides guidelines for the use of innovative practice. The publication defines innovative models, programs, techniques or practices as those that have well-formulated and coherent procedures and preliminary evidence demonstrating potential effectiveness[19]. As a society, we possess the knowledge to create indoor and outdoor learning environments which will help children flourish; and, we must commit ourselves to offering such environments to all children.

As a society, we possess the knowledge to create indoor and outdoor learning environments which will help children flourish, and we must rededicate ourselves to offering such environments to all children.

Endnotes:

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3.0 The FirstSchool Framework in Action: Applying FirstSchool Values to Facilities Design

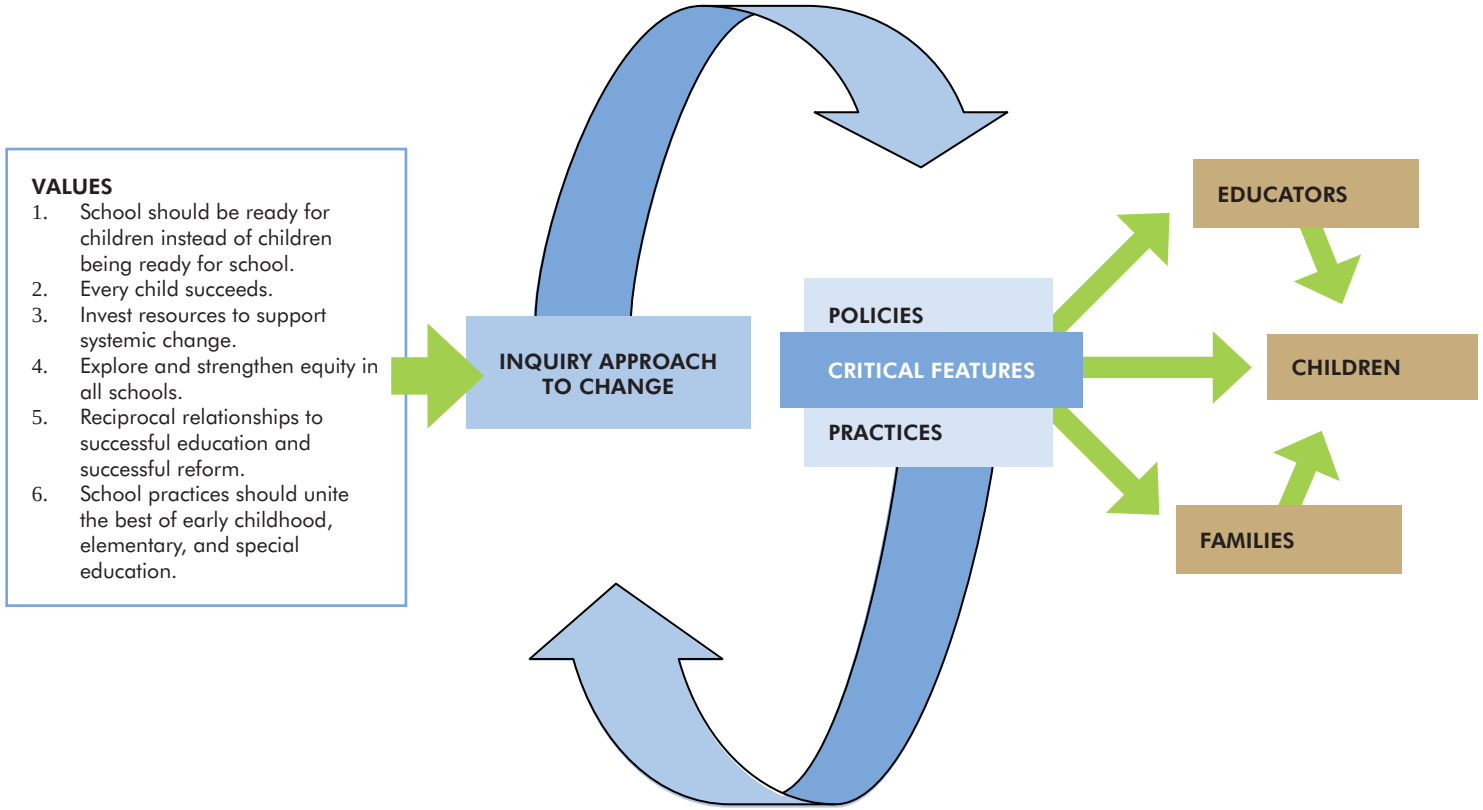
In this chapter we summarize the key values and assumptions that underlie our work and describe how we applied our values to the design of the FirstSchool Facility.

THE FIRSTSCHOOL FRAMEWORK IN ACTION

Applying FirstSchool Values to Facilities Design

FirstSchool values, and the specific application of FirstSchool design principles to those values, are the foundation on which optimal learning environments can be built. FirstSchool partners with districts and schools that share these values. The work of FirstSchool is to engage stakeholders in ongoing inquiry, and to work together to execute ideas that culminate in the development of an optimal physical environment for school staff, children and their families.

FirstSchool Conceptual Framework



The spaces in which children learn and develop must promote and provide for expanding notions of education.

Value 1. Change is based on making schools ready for children, not making children ready for schools. Instead of making younger children "fit" into the K through12 system, FirstSchool asks, "What do schools need to do to make schools welcoming and accessible for all children and their families?"

Value 2. School must be a place where each and every child can succeed. It is the responsibility of schools to ensure that the indoor and outdoor physical environment takes into account each child's unique needs and challenges by providing a variety of settings to support individual learning needs.

Value 3. If we are to dramatically transform the early schooling experience for children in the United States, schools must be willing to invest resources and time to bring about systemic change. Fundamentally, schools must be clean, safe, and environmentally sound. Beyond this, schools must consider their physical environment as a vital component of quality for students, staff, and families. Schools must be willing to invest time and money to assure this.

Value 4. Schools must be willing to actively explore and strengthen equity in all aspects of schooling. Schools must take into account culture, race, ethnicity, and socio-economic status when considering how to make schools ready for children and how to insure that each and every one succeeds. It is irrefutable that schools are not succeeding with all children. A broader repertoire of experiences and instructional approaches must be made available to children. The spaces in which children learn and develop must promote and provide for expanding notions of education.

Value 5. Positive, reciprocal relationships are key to successful reform and successful education. Positive relationships and effective communication are pivotal to an affirmative environment. Proper design of physical space plays a primary role in facilitating the development and maintenance of relationships throughout the school community. Indoor and outdoor spaces that are conducive to communication, such as cozy areas, small outdoor clearings, and conference rooms that insure privacy, set the tone and send the message that getting to know one another and engagement in a variety of groupings is important.

Value 6. The FirstSchool concepts build on the best of early childhood, elementary, and special education practices. These different systems have much to offer each other. FirstSchool is building on a strong knowledge base to ensure that the first years of school provide a solid foundation of learning for each child. Learning environments should reflect what we know about how diverse young children interact with their surroundings across the pre-kindergarten through third grade span.

4.0 Evidence Base

In this chapter we present the research we relied upon to support our premise that an optimal physical environment for young children should be designed to
1) support the development and maintenance of positive relationships and partnerships throughout the school community;
2) maximize children's learning opportunities; and
3) promote and maintain health and wellness for all members of the school community.

THE EVIDENCE BASE

More than 17 million children are in public pre-kindergarten through third grade classrooms across our nation[1]. It is essential that we use all available information to inform our decisions about how indoor and outdoor environments support children's learning and development. Research guides and supports our premise that an indoor and outdoor environment that promotes optimal learning for children should be designed to 1) support the development and maintenance of positive relationships and partnerships throughout the school community; 2) maximize children's learning opportunities; and 3) promote and maintain health and wellness for all members of the school community.

1. **Supporting positive relationships and partnerships throughout the school community**
   Little research has examined the impact of the physical environment on the development and maintenance of relationships and partnerships in schools. However, research does validate the vital function that relationships and partnerships play in positive outcomes for children.

   The development of positive relationships among and between education professionals, families, and children is foundational to all work with young children. This position is based on research that demonstrates that positive and supportive relationships are essential for growth and development, and that children's early experiences have lasting effects[2]. For both children and adults, the cognitive and social development that promotes learning occurs in an interactive context[3]. FirstSchool conscientiously and consistently works to establish positive, pro social environments characterized by mutually reciprocated relationships, respect, and cooperative work[4].

   ### Relationships among school staff and children

   When a child has a trusting relationship with a teacher, she is emotionally freed to engage in learning and exploration. Research has consistently demonstrated an association between positive teacher-child relationships and children's social, emotional, and intellectual competence[5]. A child with a positive relationship with an adult sees that adult as trustworthy and comes to see herself as competent. Competent children feel safe to explore their learning environments. In order to learn through exploration, and remain open to new experiences and ideas, children must have the ability to organize their emotions and behaviors, and they must feel confident in an adult's availability and ability to help[6].

   The use of small group instruction and cooperative peer groups facilitates learning. Lou, Abrami, and Spence[8] report on the positive effects on children's learning when they were in groups of three to four members.

   ### Relationships among school staff and families

   The National Education Goals Panel (NEGP) emphasizes the importance of family and parental support in children's school success. Their objective is for every school to engage parents in a partnership that supports academic learning at home and shared decision making in schools[9]. "Teachers, children and parents are considered key protagonists in the school experience where the school itself evolves as a

It is essential that we use all available information to inform our decisions about how indoor and outdoor environments support children's growth and development.

To develop self-directed, collaborative, productive critical thinkers, there needs to be an increase in project-based, rather than discipline-based, learning. Flexibility in design is key to making various demands on space work effectively for both adults and children living and working in the school environment.

consequence of their interactions"[10]. "To gain greater reciprocity between education professionals and families would be of enormous benefit in our vision to empower the full potential of children"[11].

The physical environment promotes relationships among school staff and with families by providing spaces that allow family members to know they belong and are welcome in the school and spaces that promote communication by insuring privacy, comfort, and access to resources.

Relationships among school staff

By being involved in open discourse and reflecting with each other, education professionals have the opportunity to change their own instructional practices, and improve learning experiences for children.

Within the field of education, communities of practice (COPs) have been defined as "a group of professionals or other stakeholders in pursuit of a shared learning enterprise, commonly focused on a particular topic"[13]. A critical component of a COP model is situated learning where knowledge and reflection are based on everyday practice[14]. Teachers are rarely taught or encouraged to gather and/or use data to drive modifications and changes to their practice. In addition, there is often a lack of collegial support and intellectual stimulation in teaching and a lack of consensus on how to put recommended practices into use. In recent years, communities of practice have been increasingly recognized as promising frameworks for meeting these professional development and practice challenges.

2. **Providing a variety of learning opportunities for young children**

To develop self-directed, collaborative, productive critical thinkers, there needs to be an increase in project-based, rather than discipline-based, learning. In order for this to occur, children need indoor and outdoor spaces that are laboratories, galleries, studios, performance spaces, observation areas, wildlife habitats, practice spaces, homey spaces, individual work spaces, project spaces, messy spaces, and quiet spaces[15].

Documentation is a powerful tool for learning. Early in their history, the educators in Reggio Emilia "realized that systematically documenting the process and results of their work with children would simultaneously serve three key functions: provide the children with a concrete and visible 'memory' of what they said and did; provide the educators with a tool for assessing the children's progress and reflecting upon their own work; and provide parents and the public with detailed information about what happens in school, as a means of eliciting their reactions and support"[16]. In order for documentation to play a significant role, the physical environment must be designed to provide exhibit space in classrooms and throughout the school.

Early experiences with the natural world have been positively linked with the development of imagination and the sense of wonder, an important motivator for lifelong learning. Studies have provided convincing evidence that when children play in nature they're more likely to have positive feelings about

each other and their surroundings, and early experiences with nature are positively linked with the development of imagination, independence, and autonomy[17]. Additionally, there is evidence that concern for the environment is based on affection for nature that develops with direct contact and independent exploration[18]. In a world in need of careful conservation, caring for the environment is essential to healthful living. Contact with nature is a cornerstone of children's science education[19]. Further, immersion in nature contributes to children's cognitive and social development[20]. Children from poor urban and minority backgrounds may have less access to outdoor play, park and recreational activities, and access to the outdoors, making this particularly salient with these children.

3. **Promoting Health and Safety Throughout the School Community**

The World Health Organization[21] provides the following definition of a school environment: "The physical school environment encompasses the school building and all of its contents, including physical structure, infrastructure, furniture, and the use and presence of biological agents; the site on which a school is located; and the surrounding environment including the air, water, and materials with which children come into contact; as well as nearby land uses, roadways, and other hazards." FirstSchool embraces this definition and considers the health, safety, and well being of each person in the community in the design. We take this one step further and think of schools as places that not only prevent illness and injury, but promote and build healthy children, staff, and families.

Unhealthy lifestyle choices and physical inactivity contribute to health complications that include obesity, heart disease, and diabetes. Too many schools offer children and school staff poor food choices, little access to nature, and limited play and physical activity options[22]. Research shows that daily experiences in natural settings increase children's ability to focus and enhance cognitive abilities[23]; and, children who experience school grounds with diverse natural settings are more physically active, more aware of nutrition, more civil to one another, and more creative[24]. The FirstSchool environment must be responsive to the nation's need for healthy and fit children.

At this point in time, much of what we know about environments that promote learning focuses on the physical attributes of light and sound. The Academy of Neuroscience for Architecture (ANFA) is comprised of educators, researchers, architects, and neuroscientists working to identify classroom design elements that boost learning. Director John Eberhard believes that neuroscience research will shape the physical attributes of tomorrow's classrooms. Neuro-scientific methods offer the opportunity to isolate effects of the environment on the brain. Further investigation can enhance understanding of how the senses receive input and how cognitive processes, memory, learning, and emotions alter the perception of stimuli received by the senses[25].

Test scores, attendance, and behavior were better in schools with efficient daylight[26]. Students in classrooms with well-designed skylights performed 20 percent better in reading and mathematics, respectively, than students in classrooms without skylights[27]. In general, natural light inhibits chemicals that

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Young students, English language learners, and those with hearing, language or learning problems have all been shown to have more difficulty learning in rooms with excessive reverberation and noise.

have been shown to reduce learning, memory, and alertness[28], while promoting the production of chemicals that have been implicated in positive mood changes and allowing for better learning. The Reggio Emilia schools have expanded the use of natural light in their architectural design. Windows to the outside that are placed at the child's eye level allow them to be exposed to sunlight and shadows as well as to neighborhood activities[29]. Fluorescent lights can have negative effects on mood, physical health, and learning[30]. Design professionals suggest that a variety of light options be used: skylights and windows for natural light, incandescent light for the warm atmosphere it provides, and full spectrum light[31]. Simply spending time learning and playing outside offers the best and easiest access to natural light. Movement stimulates children and movement is far more prevalent outside, where children can move more freely, where there is wind, where leaves fall and birds fly.

Young students, English language learners, and those with hearing, language or learning problems have all been shown to have more difficulty learning in rooms with excessive reverberation and noise[32]. New construction and renovation of classroom spaces require special attention to the acoustic environment.

The brain's auditory network is not fully developed until about age 15[33]. Adults can miss parts of a message and fill them in using their life and language experience. However, the young student is learning from the messages spoken in the classroom and has limited life experience to use to fill in the blanks.

The typical classroom is a poor auditory learning environment. The American Speech-Language and Hearing Association (ASHA) recommends that the average unoccupied classroom should not exceed a 30 decibel noise level. Average unoccupied classroom noise levels, however, range from 45 to 60 decibels. ASHA[34] developed standards for classroom reverberation times, signal-to-noise ratios, and overall classroom noise levels, but there are no current requirements for schools to adopt a universal standard for acoustics.

In addition to sound architectural practices to create low noise and low reverberation environments, the use of classroom FM systems to boost signal-to-noise ratio have been shown to be an effective method of improving outcomes for school age children. Classroom FM applications have been shown to positively affect reading, spelling[35], phonological and phonemic awareness[36], and speech perception scores of English language learners[37]. One study found that referral rates to special education decreased 50 percent in 37 Wisconsin classrooms over an eight month period after classroom amplification systems were used[38].

Most studies examining the effects of classroom acoustics and classroom FM applications have thus far been completed for traditional elementary school classrooms. There is a trend indicating that younger children (kindergarten and first grade) show the greatest benefit from enhanced listening environments[39].

Accessibility for children, staff, and families with a wide range of individual preferences and abilities

Research studies identify aspects of the physical environment that impact children's development: Tegano et al[40] noted that children prefer playing in small indoor spaces. The researchers reasoned that the reduction in scale makes children feel big, and impacts roles they choose in their play. Data revealed that children also engaged in more complex and sustained play. The FirstSchool design should offer options for creating small spaces within large indoor and outdoor spaces. Children with special needs do not necessarily interpret environmental cues in the same way as typically developing children. Sensitivity to arrangement of the environment can invite children in, and provide them information that helps them feel confident and competent.

Children's ability to navigate (wayfind) in large, complex environments generally improves over time[41]. Young children can construct spatial representations but will have difficulty integrating them when a common frame of reference is not available. They need support to use landmark selection strategies and route examination to help navigate unfamiliar areas. Indoor and outdoor environments can offer children regular practice in this area. Educators can also modify the environment to offer increasing challenges for children.

Both the Americans with Disabilities Act (ADA) and Individuals with Disabilities Education Act (IDEA) (http://www.usdoj.gov/crt/ada/pubs/ada.htm; http://idea.ed.gov/) require physical facilities both indoors and out to accommodate the needs of all children and adults. Part of insuring the most inclusive and least restrictive environment means significant participation in the planning process by people with disabilities, and those who are specialists in those areas.

High performance, sustainable buildings

In his 2006 report, "Greening America's Schools: Costs and Benefits," Kats[42] conservatively estimates that a single green school could reduce carbon dioxide emission by 585,000 pounds per year. If more of the almost 125,000 schools nationwide adopted green designs, technologies, and practices, imagine the potential reduction in emissions and other environmental benefits. The United States Green Building Council offers Leadership in Energy and Environmental Design (LEED®) certification, a green building rating system that serves as a voluntary United States standard for developing high-performance and sustainable buildings which consume less energy and water, and contribute less to landfills and to global warming while promoting a healthier environment. Schools designed according to FirstSchool principles should be eligible for LEED® Silver certification. The LEED® for Schools rating system is available online at <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1586>.

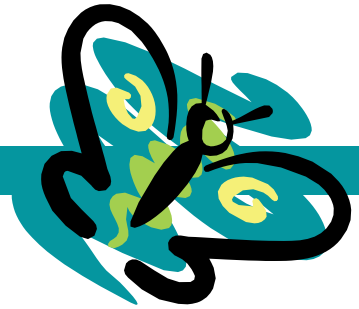
The Collaborative for High Performance Schools (www.chps.net) provides guidelines for high performance school buildings across the following criteria: sustainable sites, water, energy, materials, indoor environmental quality and policy, and operations. The United States Environmental Protection Agency also provides resources for healthy school environments (<http://cfpub.epa.gov/schools/index.cfm>).

Felician Sisters Convent and Our Lady of the Sacred Heart High School
Photo courtesy of Perkins Eastman

High performance buildings - a building that incorporates a variety of sustainability features such as energy and water efficiency, natural stormwater management, sustainably sourced materials, low site impact, and indoor environmental quality.

A single green school could reduce carbon dioxide emission by 585,000 pounds per year.

Endnotes:
1 Clifford, Early & Hills, 1999; Shin, 2005.
2 Bredekamp & Copple, 1997.
3 Pianta & Walsh, 1996; Vygotsky, 1986.
4 Wesley & Buysse, 2001.
5 Cost, Quality, and Child Outcomes Study Team, 1995; Howes, Smith, & Gallinsky, 1995; NICHD Early Child Care Research Network, 1999; Whitebook, Howes, & Phillips, 1990.
6 Bowlby, 1982; Grossman, Grossman, & Zimmerman, 1999.
8 2000.
9 NEGP, 1998.
10 Phillips & Bredekamp, 1998, p. 441.
11 ibid, p. 442.
12 New, 1998.
13 Buysse, Wesley, & Able-Boone, 2001, p. 266.
14 Buysse, Sparkman, & Wesley, 2003.
15 Wolff, 2002.
16 Edwards, Gandini, & Forman, 1998.
17 White and Stoecklin, 1997.
18 Stoecklin, 1999
19 Worth & Grollman, 2003.
20 Moore & Wong, 1997; Wells, 2000.
21 2004.
22 Orange County Partnership for Children, 2006.
23 Wells, 2000.
24 Bell and Dyment, 2006.
25 Eberhard, 2007.
26 Heschong Mahone Group, 1999.
27 Kennedy, 2002.
28 Sanoff, 1994.
29 New, 2000.
30 Hathaway, Hargreaves, Thompson, & Novitsky, 1992; Olds, 1988.
31 Kennedy, 2002.
32 Sanoff, 1994.
33 Bhatnagar, 2002; Chermak & Musiek, 1997.
34 1995.
35 Loven et al., 2003.
36 Flexer et.al., 2002.
37 Crandell, 1996.
38 Long and Flexer, 2001.
39 Mendel et al., 2003.
40 1996.
41 Newcombe and Huttenlocher, 2000.
42 Kats, 2006.



5.0 Design Principles

In this chapter we put forward the FirstSchool design principles and discuss the ways that the physical environment conveys values and messages about how to promote and support relationships, children's growth across all developmental domains, and personal and environmental health. We include the questions we asked ourselves and our partners that helped guide our work.

DESIGN PRINCIPLES

The physical environment of a school community provides more than shelter and work space. It is a powerful entity that conveys values and messages about who is welcome, what is important, and how children learn. School is the place where children, staff, and families spend much of their time, where routine needs are met, relationships are developed, skills are learned, abilities are enhanced, and attitudes towards learning, society, and our environment are formed[1].

FirstSchools values and principles may be conveyed in a physical environment in many ways. In this section we present 1) questions that address general planning concerns for a FirstSchool facility; 2) the questions that guide inquiry into how specific principles can be reflected in the design; and 3) descriptions of the design principles.

Inquiry into general planning concerns for a FirstSchool Facility

- How do you balance the need for security (e.g. weather extremes, public access, intruders) with FirstSchool principles such as daylighting?
- How does the design support your chosen instructional practices or configuration, such as non-graded and multi-age groupings?
- How does the design promote smooth transitions (e.g. moving from one space to another, moving between before school care and the classroom, moving from indoors to out) for children?
- What do you need to consider in facility plans that allow you to utilize the best technology (i.e. wireless facility, sound field systems, smart boards), and reasonable cost? How well will the design accommodate future upgrades and innovation?
- What are your before and after school care needs? How does this facility insure age appropriate space and storage, and how are the difficulties that arise with shared space attended to within your planning?
- How could public access to areas such as the gym, media center, or outdoor learning environment promote community engagement and allow for cost-sharing?

1. Positive relationships and partnerships throughout the school community

Questions for Inquiry

- How are relationships fostered by our indoor and outdoor environments?
- What barriers to relationships are apparent in our design?
- How does a facility promote family and community engagement?
- How does technology support inter-disciplinary work?
- How do we use the skills and talents of staff to enhance the environment?
- How do our values and beliefs influence our design principles and details?
- How does a facility welcome and honor all staff, children, and families?

FirstSchool is designed to be an accessible and welcoming space where parents can learn more about their children's classrooms and teachers, access a variety of resources, and have the opportunity to meet and talk with staff and other families.

Considerations for design

The physical environment can promote and support relationships and partnerships throughout the school community.

- Relationships among school staff and children

  Designing an environment that promotes positive interpersonal interaction and socialization between children and adults, as well as children and their peers means creating spaces indoors and outdoors that are comfortable, accessible, and welcoming; that are conducive to work and play; and that support one-on-one as well as small and large group interactions. Spaces should be interesting. Windows that overlook wildlife habitats, cozy spaces surrounded by books, work areas that have tools and resources that help children explore are spaces that will spark interaction and exchange. Spaces should allow for varying sized groups and permit different uses. Spaces where children learn, socialize, and eat, both indoors and out, should be comfortable, welcoming, and conducive to conversation.

- Relationships among families and with staff

  Families deserve a school community that promotes respect for learning and promotes a sense of belonging, ownership, and pride for all members of the school community. Families are a part of this community. A beautiful, sensitively-organized environment has a major impact on the sense of belonging, comfort, safety, and the capacity of all participants to be responsible and productive. To that end, FirstSchool is designed to be an accessible and welcoming space where parents can learn more about their children's classrooms and teachers, access a variety of resources (including technology and tech support), and have the opportunity to meet and talk with staff and other families. There must be dedicated space for families where they can leave their belongings and talk together, with separate space to store and prepare materials for events. Within the school there should be an indoor or outdoor central gathering space. Display areas of varying kinds throughout the classrooms, and shared spaces should celebrate the diverse community of students, staff, and families through art, photos, murals, and other media.

- Relationships among school staff

  FirstSchool values all members of the FirstSchool community. FirstSchool promotes Professional Learning Communities for educators through both accessible space and the use of state-of-the-art technology. In FirstSchool, school staff have personal and professional spaces that provide them places to plan, work, and meet in small groups. This includes custodians, cafeteria, and office workers. Custodial and service-related spaces need to be conveniently located for maximum efficiency, and demonstrate respect for staff through appropriate office and personal space. There are also spaces for other professionals who spend time at the school, such as community health professionals and social workers, to conduct their work and collaborate. State-of-the-art shared technology support professionals in multiple ways. Technology can maximize the sharing and storage of resources and materials for professional staff and

family members; provide the means for regular communication with multiple disciplines, community stakeholders, university faculty and family members; and support professional development within and across schools by providing opportunities for members of the school community to view and reflect upon their students, their work, and the work of others.

2. Providing a variety of learning opportunities for young children

Questions for Inquiry

- How does a facility promote physical activity for children?
- How does access to multi-sensory, experiential learning impact children's outcomes?
- How do we use the skills and talents of staff to enhance the environment?
- How do our values and beliefs about how children learn influence our design principles and details?
- How does the outdoor environment enhance the learning opportunities we provide inside, and vice versa?
- How do we help educators fully incorporate the outdoor environment in their educational planning?

Considerations for design

FirstSchool believes that children learn and develop to their maximum potential in settings responsive to the unique knowledge, interests, aptitude, learning style, intellectual skills, abilities, and health status of each child. The FirstSchool environment is designed to motivate children's natural excitement for learning, and engage and challenge the minds and bodies of all children in a variety of ways.

- **Indoor Spaces**

  Schools typically have some shared spaces that are designed to support specific learning activities, such as music and art. In a FirstSchool facility there is a wide array of special rooms that extend the learning possibilities for children. Small kitchen areas support the development of skills and knowledge in health, nutrition, math, science, social studies, self regulation, and cooperation. Project areas with adequate space, surfaces, materials, and tools are developed with consideration to age, developmental level, and safety. Themed areas are available for use by multiple groups, and are not necessarily restricted to specific ages or classrooms. A water exploration room is equipped with drains and various water sources; equipment that promotes experimentation; systems that help children attend to water conservation and re-cycling; and a mudroom that facilitates easy clean-up. A specialized technology lab promotes group work and access to state-of-the-art technology with an increasingly global focus including partnerships with schools elsewhere; robotics as an avenue for the integration of problem solving, math, and science; and a focus on computers as a tool for learning.

  The building infrastructure presents a variety of educational opportunities. Transparent walls allow children to view plumbing and electricity at work. Water and compost storage are visible to allow children to view stormwater drainage and decomposition. A variety of measurement tools allow children to gauge the acquisition of solar energy and rain water.

Early experiences with the natural world have been positively linked with the development of imagination and the sense of wonder, an important motivator for lifelong learning. Limiting outdoor playgrounds to gross motor activities and manufactured equipment falls far short of the potential of outdoor areas to be rich play and learning environments.

Organic Architecture -

A philosophy of architecture which promotes harmony between human habitation and the natural world through design approaches so sympathetic and well integrated with its site that buildings, furnishings, and surroundings become part of a unified, interrelated composition.

- **Outdoor Spaces**

Children's physical boundaries have shrunk. Concerns about safety, increased supervision, highly structured lives, less time for free play, and reliance on technology for entertainment are often barriers to children's access to the outside environment in their home lives. Schools offer a safe space, supervision, and educational opportunity that should be maximized to reconnect children to nature. Outdoor space lends itself to a more unstructured use of time with more self-directed opportunities for children. In addition, these spaces allow children the chance to experience moderate levels of physical risk with adequate adult supervision to protect their overall safety.

The outdoor physical environment provides the stage for action, and stimulates children's active play and learning[2]. In FirstSchool, outdoor spaces are designed so children can test their abilities in an environment that offers many types and levels of challenges and stimulation. The outdoors helps children grow up closely connected to nature. By being exposed to trees, plants, and other natural materials, children can independently discover nature and its processes. The outdoor environment should engage children's sense of inquiry, stimulate their imaginations, invite exploration, and support their developing competencies. Limiting outdoor playgrounds to gross motor activities and manufactured equipment falls far short of the potential of outdoor areas to be rich in play and learning environments. Sand, water, soil, and plants provide settings for open-ended play that emphasizes unstructured creative exploration with diverse materials. Children need tools, open space, and the opportunity to interact with the outdoor environment.

The Preschool Outdoor Environments Measurement Scale[3] describes an ideal outdoor area as one that contains a variety of natural play and learning settings, offering children multiple opportunities to observe, explore, and interact with nature. For example, an edible garden allows children to use tools, care for living things, learn how and when things grow, improve their diet, and appreciate a range of foods. Resident farm animals promote attention to the proper and ethical care of animals. An outdoor water exploration area promotes creativity, innovation, and exploration. The outdoor area also contains a variety of play and learning settings with constructed or manufactured elements that encourage physical activity. In addition to gross motor equipment, outdoor equipment can promote arts and crafts, scientific and mathematical exploration, relaxation, solitude, and dramatic play.

- **Relationship between indoor and outdoor spaces**

FirstSchool is connected within and beyond the school grounds through design, planting, and technology. The building needs to be set within the natural landscape as Frank Lloyd Wright urged in his philosophy of "organic architecture," which maintains that a building should develop out of its natural surroundings[4].

Connections with the community are developed through structural features such as roads, bike paths, shared space for families, and community groups. Design elements demonstrate responsiveness to the cultural, language and ethnic makeup of the community. The school community lives within nature, rather than keeping it at a distance.

3. Promoting Health and Safety Throughout the School Community

Questions for Inquiry: Possible ways to start the discussion

- How can a facility promote physical activity for children?
- What natural materials can we choose that help keep the indoor surfaces sanitary?
- What learning opportunities for children, staff, and families exist in a "Green Environment?"
- What is the impact of daylighting, controlled acoustics, etc., on children's ability to attend and learn?
- What ideas can we use from schools that have taken the lead in providing healthy and nutritious foods; developing and using an edible garden; linking school nutrition to local farmers; and creatively funding these efforts?

Considerations for design

- **Health and safety for children, staff and families**

  FirstSchool promotes the health, well being, safety, and nutrition of all members of the FirstSchool community; protects children and staff from illness and injury; and pro-actively works to prevent disease. The health of the FirstSchool community is promoted through attention to and provision for staff and children's daily need for physical activity, sensory stimulation, fresh air, rest, and nourishment. The building design permits members of the community to rely on natural light, and is structured to reduce noise. Outdoor plumbing provides for drinking water, hand-washing, and toilet facilities to be accessible in all areas.

- **Accessibility**

  All areas must be accessible for children, families and staff, including indoor learning areas, toilets, sinks, drinking fountains, and outdoor space.

  Schools must fully accommodate all adults and children in the indoor and outdoor environment in as many ways as possible, and make the adaptations and modifications needed to support those with special needs to function at maximum potential.

  The environment must also support a child's development. A developmental task of childhood is to move from total dependence on adults to increasing independence. Independence can best be achieved by providing adult support, and through creating environments that are designed to be used by children with a wide range of individual preferences and abilities, where children have access to materials and

Sustainability

A method of harvesting or using a resource so that the resource is not depleted or permanently damaged.

equipment, and can easily find and put away what they need. In order to allow children to acquire increased levels of autonomy, as well as support children in becoming confident inhabitants and users, the environment must offer graduated challenges for a range of children within groups over time.

Accessibility is also important for families. In order for family members to feel welcome and part of the school community, spaces must be available that are sized for adults, where comfortable adult furniture is present, and where family members (regardless of their physical abilities) feel safe and welcome.

- Sustainability
  FirstSchool is dedicated to developing high-performance and sustainable buildings that minimize impact on the environment through decreased energy use and water consumption, less impact on landfills, less run-off, and the use of natural, rather than synthetic and chemical materials. The design should rely on daylighting, solar power, stormwater storage and use, and environmentally-friendly finishing materials. FirstSchool is dedicated to preserving and utilizing natural space, and educating the people who inhabit it to protect and safeguard the environment.

Endnotes:
1 NAEYC, 2005.
2 Moore & Wong, 1997.
3 De Bord, Hestenes, Moore, Cosco, & McGinnis, 2005.
4 Vatsky, 2007.

6.0 FirstSchool Facility

In this chapter we present a proposal for indoor and outdoor learning environments, shared spaces, specialized instruction, media center, gym or multi-purpose area, administration and support, family resource suite, health services, lobby and reception, and building and food services.

SPACE PROGRAM CONSIDERATIONS

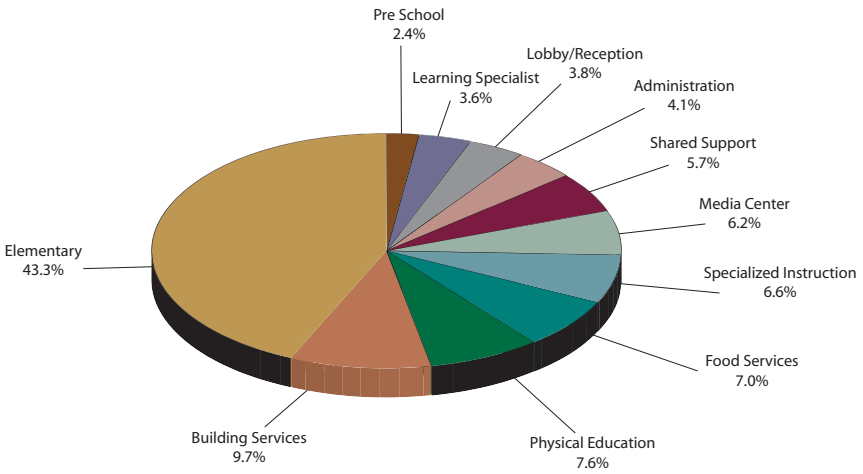
The space program being developed with FirstSchool must take into account many variables. For instance, the school concept developed here is without a specific site. Therefore, assumptions have been made, such as the size and shape of the site; whether it is flat or hilly; a site full of trees or no trees at all; whether the site is a virgin site or if it has been used for other purposes; the location of existing or nearby utilities; direction of the sun and whether there is a dominate north or south exposure or if there are any transportation links close by. Without an existing real site, an assumed site must be used to provide minimal assumptions.

The indoor/outdoor environment is being developed without an existing school in order to demonstrate some ways of implementing FirstSchool principles. This space program may be used to guide and inform the construction of a new school for children three to eight years old or it may be used to support efforts to develop a culture change in schools wherein schools adapt and/or renovate physical spaces to better serve the school staff and the young children and families who attend.

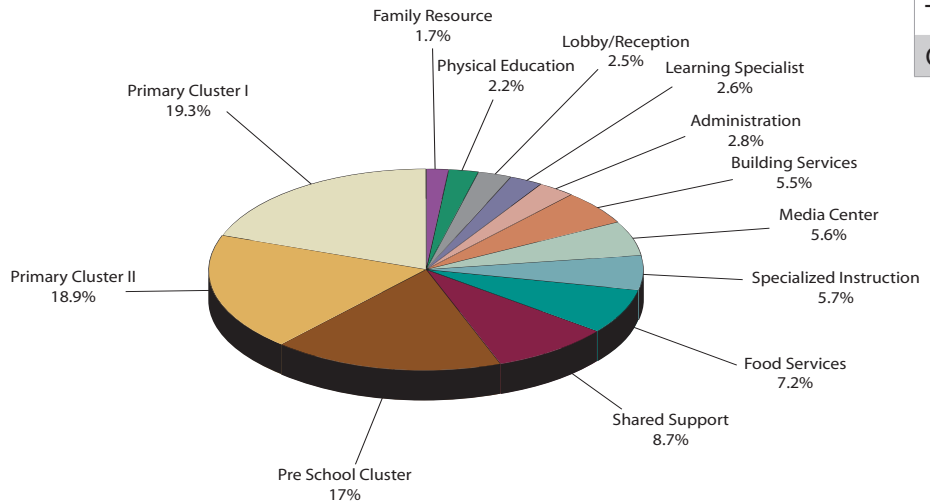
The space program is also being developed within the overall specific space standards and recommendations guideline. At one time the North Carolina Department of Public Instruction (NCDPI) had Facility Standards in place that established minimum construction criterion for individual school districts to adhere to when they constructed new facilities or renovated older ones. Since that time, the State has moved away from the "standards concept" and now has "Facilities Guidelines" in place. While the intent of the Guidelines remains consistent with the previously enacted State Standards, to ensure that school systems provide adequate space for instructional classes and activities, the Guidelines now allow for flexibility and allow for more consideration of local situations, such as availability of land or other limitations that school districts may face. If you are outside this jurisdiction you may have to contact your local agencies for more specific guidelines in your state.

We recognize that the increase of pre-K students will challenge many school districts program models, however, the inclusion of three and four year olds are fundamental to FirstSchool.

Space Program - Interior space requirements (i.e. floor plan layout, square footage, adjacencies) based on programs, objectives, work flow, end user, budget constraints, and growth projections.

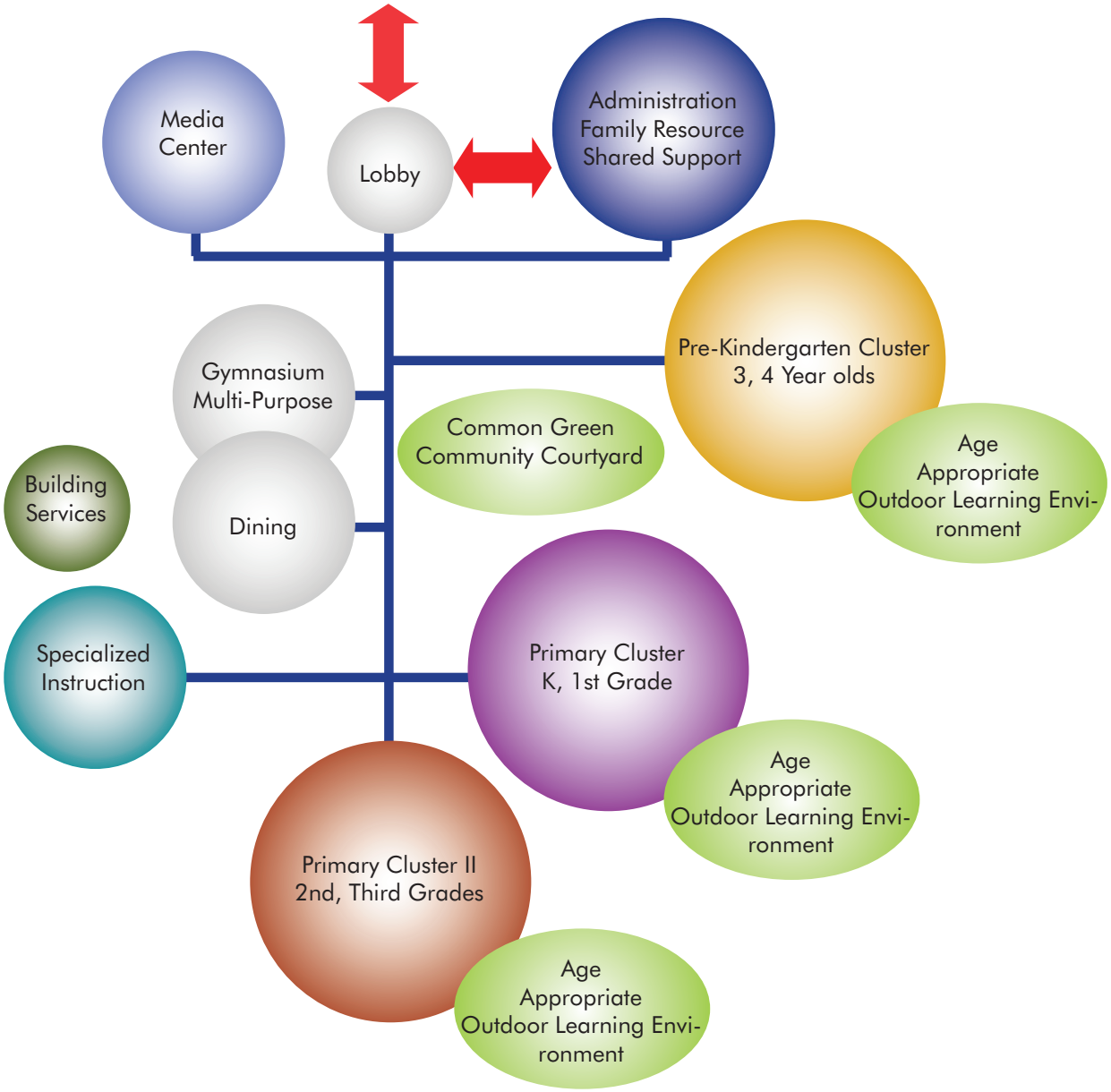


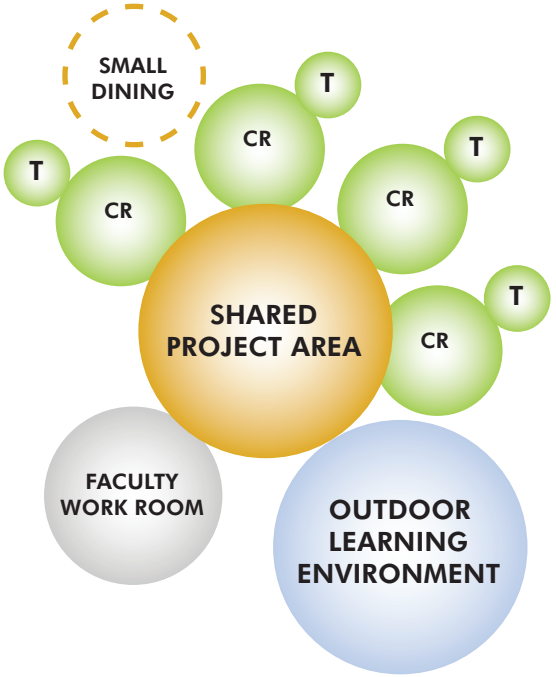
North Carolina guidelines based on 585 students - 158.7 sf/student



FirstSchool program based on 450 students - 159.1 sf/student

Summary of Indoor Spaces	Net Square Feet	% of Total
Pre-K Cluster 3 - 4 Year Olds	9,160	17.3%
Primary Cluster I K - 1st Grade	10,240	19.3%
Primary Cluster II 2nd - 3rd Grade	10,040	18.9%
Specialized Instruction	3,000	5.7%
Media Center	2,950	5.6%
Physical Education	4,600	2.2%
Shared Support	1,200	8.7%
Family Resource Suite	890	1.7%
Learning Specialist	1,400	2.6%
Administration	1,470	2.8%
Building Services	2,930	5.5%
Lobby - Reception	1,300	2.5%
Food Service	3,850	7.2%
Subtotal Square Feet	53,030	
Gross Factor	1.35	
Total Gross Square Feet	71,590	
Gross Square Feet per Student	159.1	


Media Center
Lobby
Administration Family Resource Shared Support
Gymnasium Multi-Purpose
Common Green Community Courtyard
Pre-Kindergarten Cluster 3, 4 Year olds
Age Appropriate Outdoor Learning Environment
Building Services
Dining
Specialized Instruction
Primary Cluster K, 1st Grade
Age Appropriate Outdoor Learning Environment
Primary Cluster II 2nd, Third Grades
Age Appropriate Outdoor Learning Environment

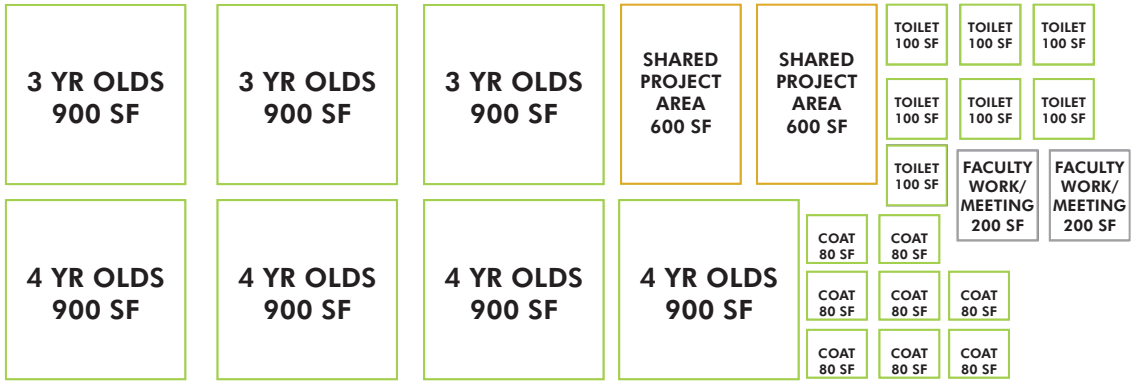


Conceptual Relationships

GENERAL INSTRUCTIONAL / Pre-K Cluster 3-4 year olds

- Adjacent to outdoor space
- Shared project space as breakout space for each classroom
- Relieves space pressure from other specialized classroom space
- Small learning communities
- Focal point at end of corridor
- Standardize classrooms for flexible assignment of rooms
- Close proximity to main entrance and lobby area

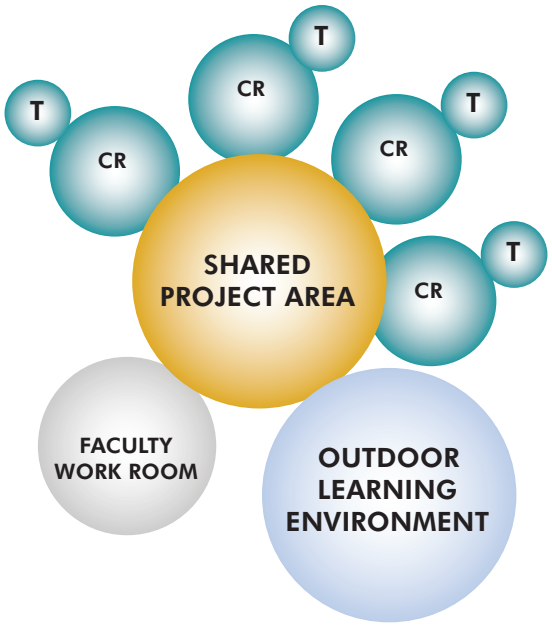
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL	ROOM CAPACITY	CLUSTER CAPACITY	SF PER STUDENT
PRE-K CLUSTER 3 - 4 YEAR OLDS						
3 Year Old Classroom	900	3	2700	16	48	56
4 Year Old Classroom	900	4	3600	16	64	56
Toilet Room	100	7	700			
Coat/Cubby Area	80	7	560			
Shared Project Area	600	2	1200			
Faculty Workroom/Meeting	200	2	400			
Net Square Footage			9,160		112	



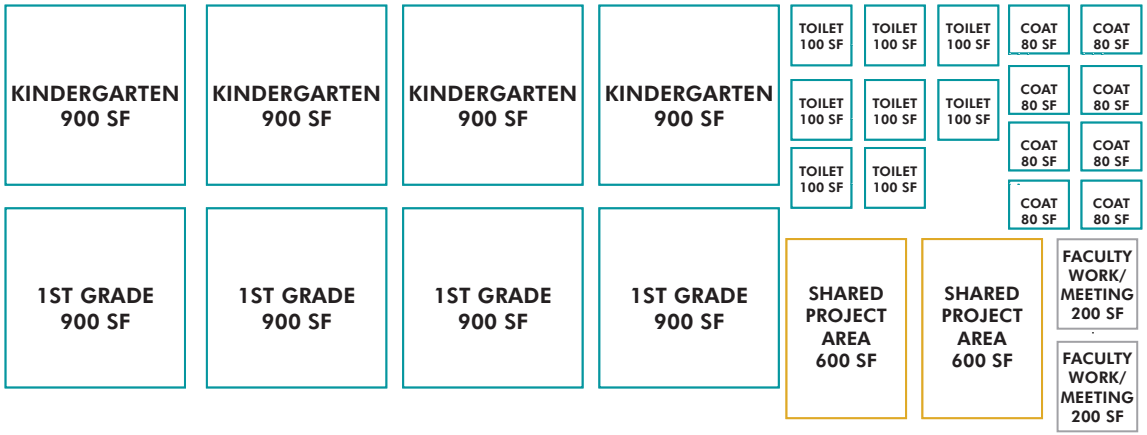
GENERAL INSTRUCTIONAL / Primary Cluster I Kindergarten & 1st Grade

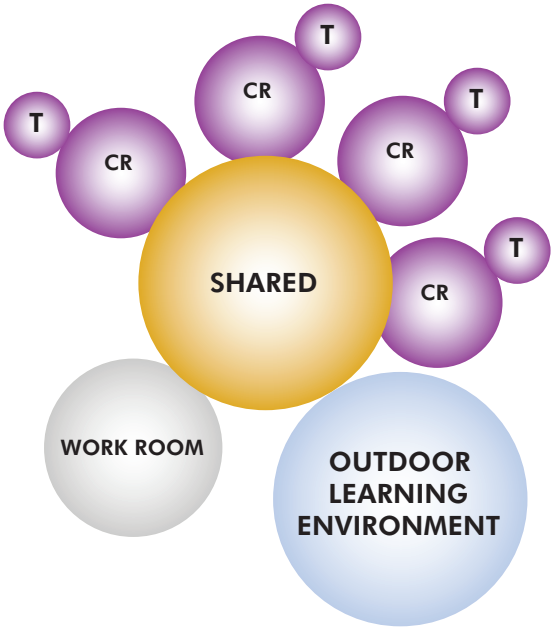
- Adjacent to Outdoor Space
- Shared project area
- Individual classroom toilets
- Destination of arrival
- Standardize classrooms for flexible assignment of rooms

CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL	ROOM CAPACITY	CLUSTER CAPACITY	SF PER STUDENT
PRIMARY CLUSTER I KINDERGARTEN, 1ST GRADES						
Kindergarten Classroom	900	4	3600	21	84	43
1st Grade Classroom	900	4	3600	21	84	43
Toilet Room	100	8	800			
Coat/Cubby Area	80	8	640			
Shared Project Area	600	2	1200			
Faculty Workroom/Meeting	200	2	400			
Net Square Footage			10,240		168	



Conceptual Relationships



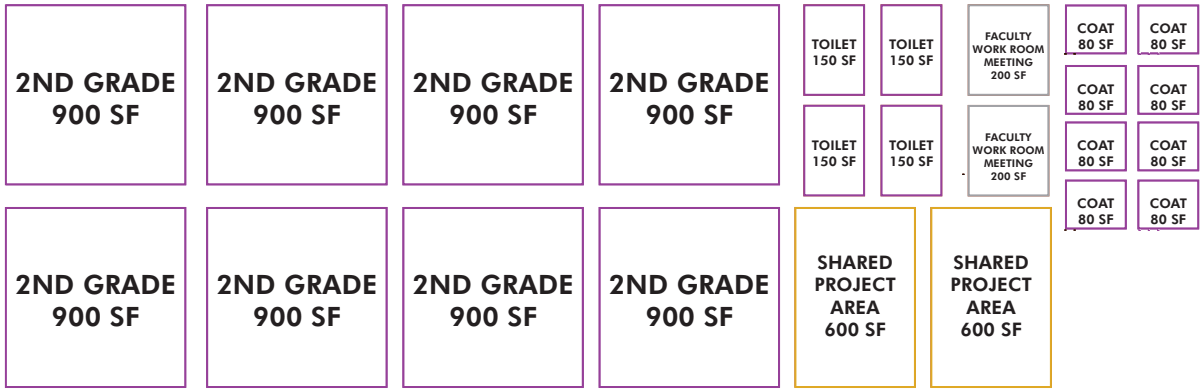


Conceptual Relationships

GENERAL INSTRUCTIONAL / Primary Cluster II 2nd and Third grades

- Sense of arrival
- Create small learning communities
- Shared toilet facilities
- Shared project area
- Adjacent to outdoor space

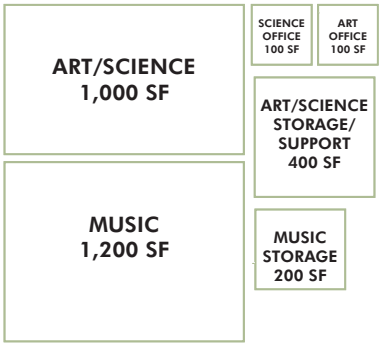
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL	ROOM CAPACITY	CLUSTER CAPACITY	SF PER STUDENT
PRIMARY CLUSTER II 2ND, 3RD GRADES						
2nd Grade Classroom	900	4	3600	21	84	43
Third Grade Classroom	900	4	3600	21	84	43
Toilet Room	150	4	600			
Coat/Cubby Area	80	8	640			
Shared Project Area	600	2	1200			
Faculty Workroom/Meeting	200	2	400			
Net Square Footage			10,040		168	

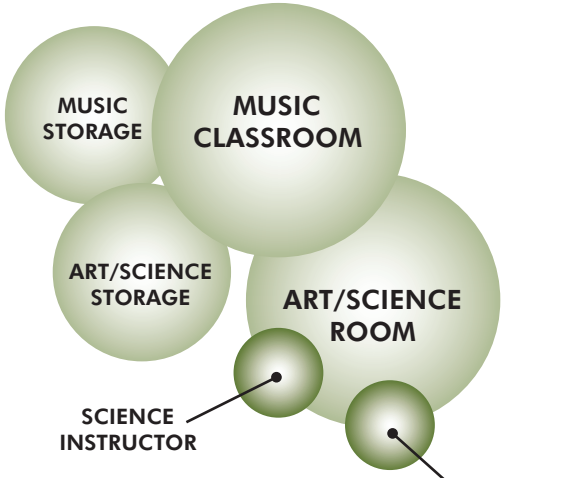


SPECIALIZED INSTRUCTION

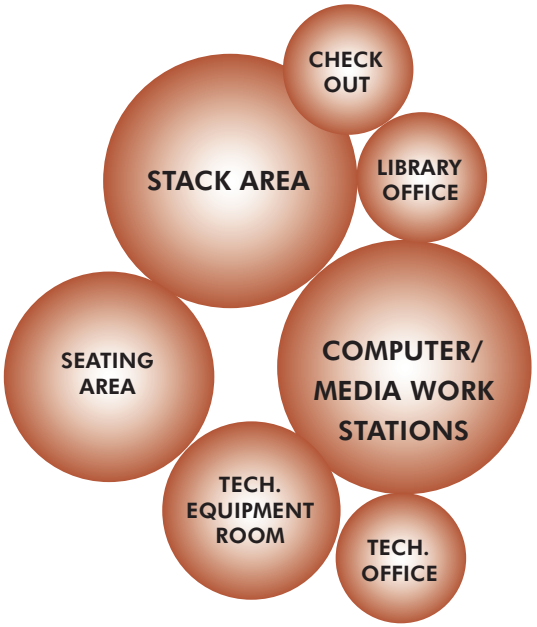
- Art/Science adjacent to outdoor instructional and working space
- Specialized instruction to allow for special projects
- Smaller projects facilitated in classroom clusters to allow more sharing of specialized rooms

CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
SPECIALIZED INSTRUCTION			
Art/Science Room	1,000	1	1,000
Art/Science Storage/Support	400	1	400
Art Instructor Office	100	1	100
Science Instructor Office	100	1	100
Music Classroom	1,200	1	1,200
Music Instrument Storage	200	1	200
Net Square Footage			**3,000**





Conceptual Relationships

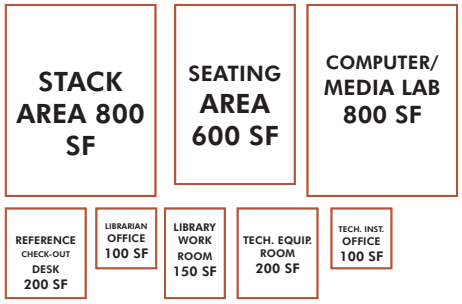


Conceptual Relationships

MEDIA CENTER

- Prominent school feature
- Located near main entrance
- Hub of technology activity for students, staff, and families
- Group computer instruction area
- Emphasizes a variety of individual and group work settings

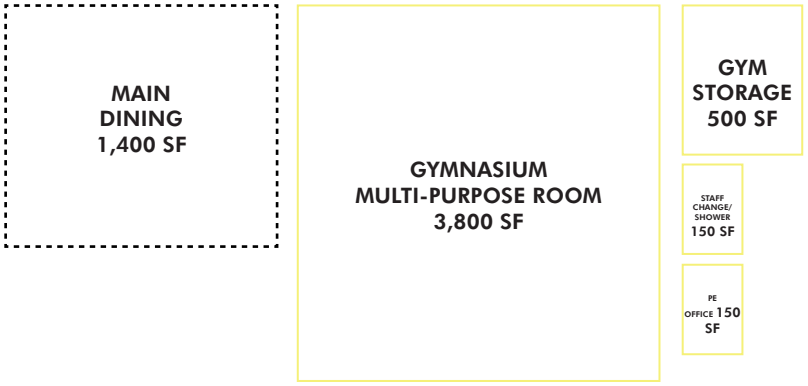
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
MEDIA CENTER			
Stack Area	800	1	800
Seating Area	600	1	600
Computer/Media Work Stations	800	1	800
Reference/Check-Out Desk	200	1	200
Librarian Office	100	1	100
Library Workroom	150	1	150
Technology/Equipment Room	200	1	200
Technology Instructor Office	100	1	100
Net Square Footage			**2,950**

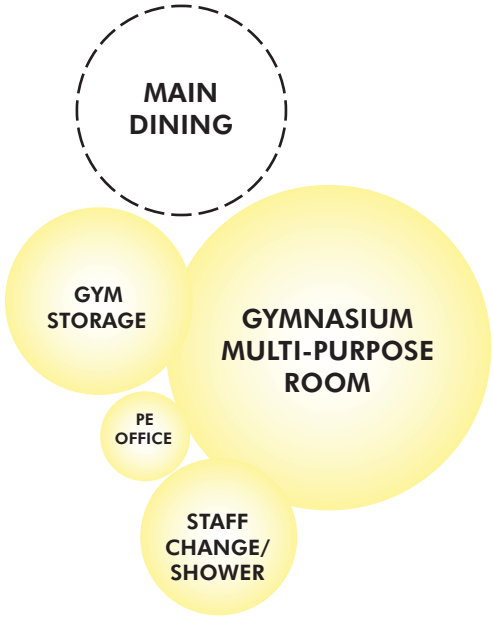


PHYSICAL EDUCATION

- Down-sized to respond to age appropriate activities
- Adjacent to dining for flexible activities
- Create large multi-use functions with flexible divider between spaces
- Can be used to fit the varied types of small or large instruction or gatherings

CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
PHYSICAL EDUCATION			
Gym/Multi-Purpose	3,800	1	3,800
Gym Storage	500	1	500
Physical Education Office	150	1	150
Staff Change Shower	150	1	150
Net Square Footage			4,600



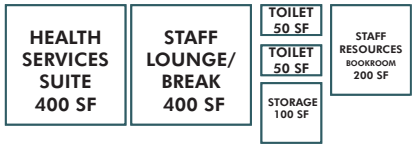


Conceptual Relationships

SHARED SUPPORT

- Staff lounge and resource rooms to be adjacent
- Located adjacent to central administration
- Dedicated space and resource support areas for staff and families
- Location for After-Hours school programs
- Health services to be near administrative services

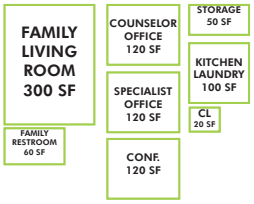
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
SHARED SUPPORT			
Staff Lounge/Break Room	400	1	400
Staff Toilets	50	2	100
Staff Resource/Book Room	200	1	200
Health Service Suite	400	1	400
After School Storage	100	1	100
Net Square Footage			**1,200**



FAMILY RESOURCE SUITE

- Located near school entry and central administration
- Critical commitment to offer dedicated space to families
- Promotes access to school for interaction with staff, students, and their families
- Spaces provide warm comfortable residential settings
- Specialized family counseling and support

CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
FAMILY RESOURCE SUITE			
Family Living Room	300	1	300
Kitchen/Laundry	100	1	100
Small Conference/Tutorial Room	120	1	120
Family Specialist Office	120	1	120
Counselor Office	120	1	120
Family Rest Room	60	1	60
General Storage Room	50	1	50
Coat Closet	20	1	20
Net Square Footage			**890**

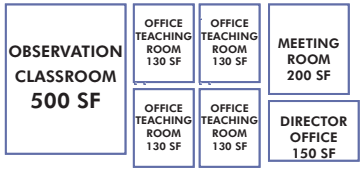


Conceptual Relationships

LEARNING SPECIALISTS

- Offices sized for one-on-one instruction
- Space will vary widely depending on district standards or needs
- Classroom should have one-way observation
- Audio to remote areas

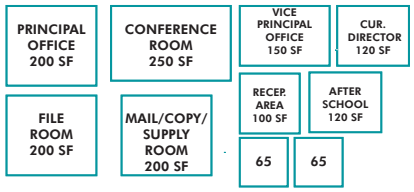
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
LEARNING SPECIALIST			
Observation Classroom	500	1	500
Meeting/Storage Room	200	1	200
Director Office	150	1	150
Office/Teaching Room	130	4	520
Net Square Footage			1,400



ADMINISTRATION

- Located near entry with direct access from main lobby
- Visibility from reception/administration support to main lobby
- Conference room accessible from administration area and general corridor for shared use
- Mail/copy/supply room convenient to faculty break and support area

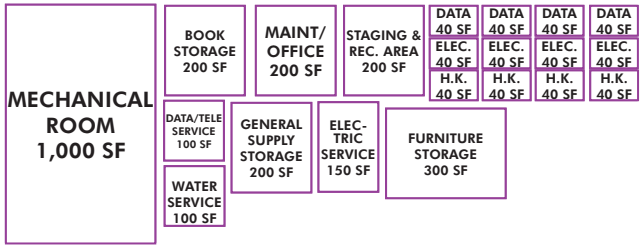
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
ADMINISTRATION			
Principal Office	200	1	200
Vice Principal Office	150	1	150
Administrative Support	65	2	130
Reception Area	100	1	100
Conference Room	250	1	250
Curriculum Director	120	1	120
After School Program Office	120	1	120
File Room	200	1	200
Mail/Copy/Supply Room	200	1	200
Net Square Footage			**1,470**



BUILDING SERVICES

- Consider fresh air intake and separation from building exhaust
- Locate near center of building complex or campus
- Provide screened vehicular access to service and delivery
- Locate one data/telecom, electric, and housekeeping closed in each cluster
- Mechanical program space will vary widely depending on specific systems selected
- Review mechanical systems carefully with the engineers to determine an appropriate space allocation

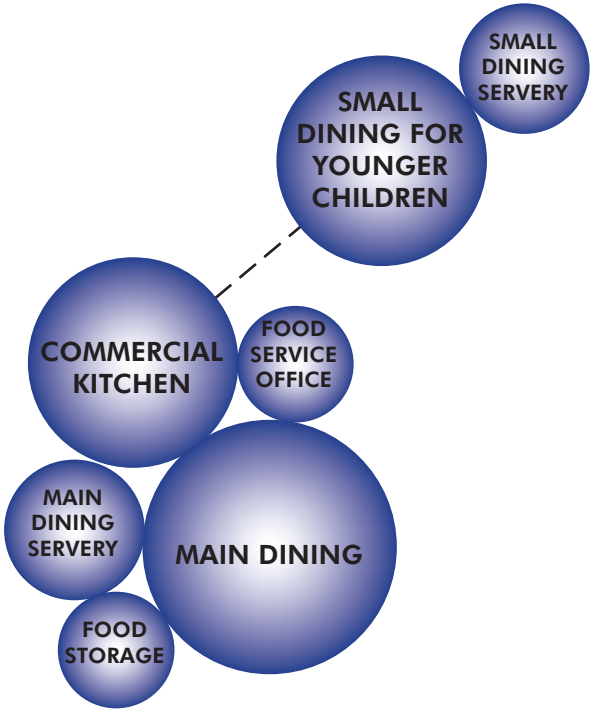
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
BUILDING SERVICES			
Maintenance Shop/Office	200	1	200
Staging and Receiving Areas	200	1	200
Furniture Storage	300	1	300
Book Storage	200	1	200
General Supply Storage	200	1	200
Mechanical Room	1,000	1	1,000
Water Service Room	100	1	100
Electric Service Room	150	1	150
Data/Telecom Service Room	100	1	100
Electric Closet	40	4	160
Data/Telecom Closet	40	4	160
Housekeeping Closet	40	4	160
Total Square Footage			**2,930**



LOBBY AND RECEPTION

- Open and inviting space with direct view to landscape of outdoor courtyard
- Reception/greeting desk connected to administration suite
- Adjacent to media center and administration
- Convey a sense of calming transition from home life to school
- Provide display area for student and community projects

CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL
LOBBY RECEPTION			
Reception/Greeting Desk	200	1	200
Public Toilet Room	300	2	600
Lobby/Entrance	500	1	500
Net Square Footage			1,300

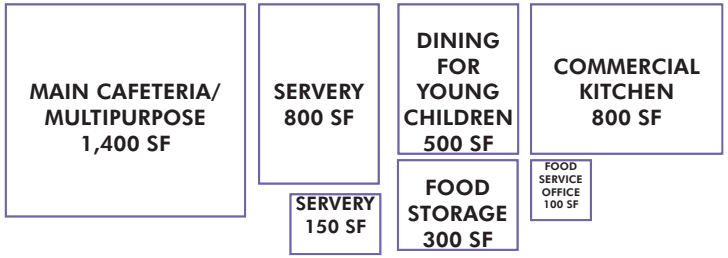


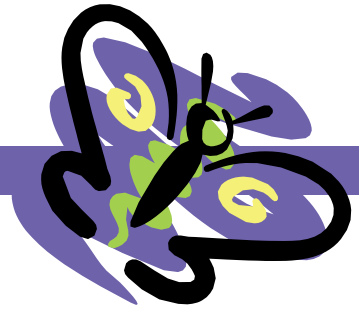
Conceptual Food Service Relationships

Food Service

- Dining facilities sized for fewer lunch periods and group seating of 6-8 students at round tables (15 sf/student)
- Assume four (4) lunch seatings of 90 students in main dining room
- Assume four (4) lunch seatings of 35 students in small dining room
- Food service areas should be designed for several options and at a minimum provisions made for fresh fruit and snack bar
- Small dining room and servery to be located in the Pre-School cluster area
- Provisions should be made for transport of bulk food from the main kitchen

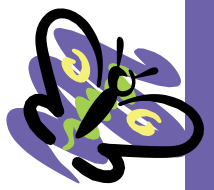
CATEGORY/ROOM/SPACE	AREA	QTY	TOTAL	SEATING CAPACITY
FOOD SERVICE				
Main Dining/Common Room	1,400	1	1,400	90
Main Dining Servery	600	1	600	
Small Dining for Younger Children	500	1	500	35
Small Dining Servery	150	1	150	
Commercial Kitchen	800	1	800	
Food Storage	300	1	300	
Food Service Office	100	1	100	
Net Square Footage			3,850	





7.0 Site Considerations

In this chapter we present ideas for site layout and design with particular attention to sustaining and maximizing the natural environment.



SITE CONSIDERATIONS

7.1 The School Site

Site layout and design is just as important as the spatial relationships of the spaces within the building. Of course, many of the design decisions relating to site issues will vary according to the actual size, orientation and topography of the land. Still, no matter where it is located, the building should be carefully placed within its context and should also sensitively cooperate with the environment.

Site considerations such as zoning, setbacks, building heights, lot coverage, landscape ordinances, and local building codes need to be incorporated into the overall site plan design. Although many building codes are similar in different areas each local jurisdiction usually has unique building and/or local requirements that may alter the building and zoning codes.

The site design in this document is based on an allocation of approximately 72,000 square feet. The recommended size of an elementary school, per the State's Facility Guidelines is 10.0 developable acres plus one developable acre for each 100 students. The 10 acres include adequate space for bus drop-off and parking; service and loading area; staff, faculty, and visitor parking; parent drop-off area; play areas; walking trails; stormwater pond; and minor building expansion. The assumptions here are that the site is basically flat, and the buildings are located with a north-south orientation.

Minimum acreage refers to usable acreage or acreage that can be developed. School site sizes may be larger or smaller than those outlined in the State Guidelines. For example, additional acreage may be necessary to:

- Accommodate community use of the facility and multiuse recreational facilities such as soccer and softball fields.
- Account for areas that cannot be built upon, such as steep slopes, wetlands, rights-of-way, easements, setbacks, buffers, or poor soils.
- Meet requirements imposed by local ordinances, i.e. restrictions governing land that cannot be disturbed within a development and the permitted amount of impervious service will affect the ultimate size of the site.
- Include landscaping and buffers.

Other aspects to consider in siting a new school include natural geographic barriers, road patterns, and existing or non-existing infrastructure such as water, sewer, and roadways. School systems should actively pursue partner agreements with communities, parks and recreation departments, private developers, and business in an effort to maximize joint use of facilities.

"Students are more likely to prosper when their environment is conducive to learning. Well-designed systems send a powerful message to kids about the importance their community places on education."

~The American Association of School Administrators

Fairfield Middle School
Photo courtesy of Perkins Eastman | Photographer: Woodruff/Brown

7.2 Site Design and the Environment

The following are some suggestions that insure a focus on sustaining and maximizing the natural environment. We have also included ways in which the site itself might be integrated into the school curriculum.

1. Site layout should minimize disturbance to natural areas. Wherever feasible, these areas are to be used for outdoor learning locations.
2. Limit amount of impermeable paving by maximizing use of porous materials such as pavers, porous concrete, porous asphalt, turf pavers, etc.
3. Provide preferred parking spaces for hybrid and compact cars.
4. Promote planting and saving of trees to provide canopy coverage particularly near and within parking areas.
5. Site planning should maximize potential for pedestrian and bike access.
6. Site design and layout should include opportunities for improving the land through restoration of degraded ecological attributes such as streams or wetlands. These restored features can be used as outdoor teaching areas.
7. If areas/borders do not exist, create them. They should be composed entirely of native species plantings with drought tolerance, and should come from a local nursery source for proper genetic provenance.
8. Trees and shrubs should provide wildlife food source. Species selection should be based on geographic location.
9. The building should be located on the higher part of the site in order to take advantage of natural slopes for drainage.
10. Provide a variety of covered outdoor activity areas for shaded play and rainy weather.
11. Ensure that all areas are handicapped accessible.
12. The building should be laid on an east/west axis. This will allow most windows to be placed on the North/South side of the building, thus allowing the design to take advantage of natural light and air. This includes sizing the windows based on the orientation of the sun, and using natural breeze to help ventilate.
13. In order to lower construction cost and significantly reduce site disturbance, consider building size reduction, multi-story structures and shared use with other community organizations.
14. Local materials will bring local character to the design. Use of indigenous materials will reduce the cost of shipping materials to the site and the emissions associated with shipping.
15. Green products can contribute to a sustainable design, for example by creating retaining walls with vegetation bags to bring more green to the design and create more areas to treat stormwater.

St. Ignatius School
Photo courtesy of Perkins Eastman | Photographer: Sarah Mechling

Access to nature is linked with development of imagination, independence and autonomy.

Concordia International School | Elementary School
Photo courtesy of Perkins Eastman | Photographer: Tim Griffith

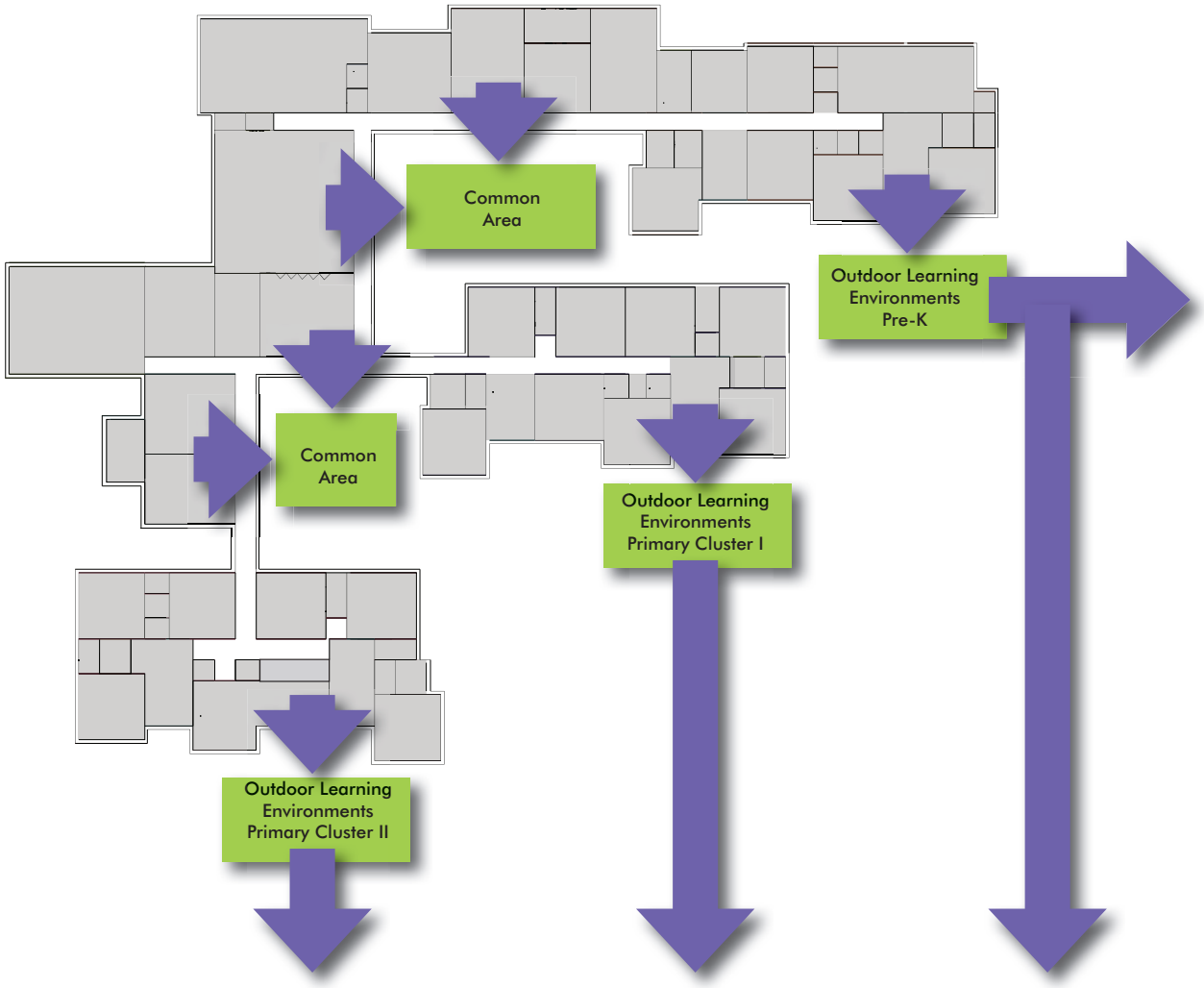
7.3 Student Engagement in Outdoor Play and Learning

Outdoor spaces should be designed so children can test their abilities in an environment that offers challenge and stimulation. Children need tools, open space, and the opportunity to interact with the outdoor environment. Outdoor spaces help children grow up closely connected to nature. By being exposed to trees, plants, and other natural materials, children can independently discover nature and its processes. The outdoor environment should engage children's sense of inquiry, stimulate their imaginations, invite exploration, and support their developing competencies.

An ideal outdoor area should be one that contains a variety of natural play and learning settings, offering children multiple opportunities to observe, explore, and interact with nature. An outdoor water exploration area would promote creativity, innovation, and exploration. Outdoor areas could also contain a variety of play and learning settings with constructed or manufactured elements that encourage physical activity. In addition to gross motor equipment, outdoor areas can promote arts and crafts, scientific and mathematical exploration, relaxation, quiet or dramatic play.

In the FirstSchool Design Guide, it is suggested there be an outdoor learning area adjacent to each cluster of classrooms, promoting the outdoor learning experience related to the age group of each cluster. Outdoor opportunities should be designed for age appropriate learning experiences.

1. Areas should be set aside for natural learning locations, perhaps named, for such things as vegetable production (organic), wildflowers, butterfly gardens, and rainwater harvesting.
2. Plant edible and re-seed gardens: These gardens will bring life and fun to the classroom. Re-seed gardens will allow students to learn nature's patterns.
3. The implementation of composting stations on-site will complete the planting cycle for the students. They will see how leftover food and yard debris can be used to fertilize their gardens.
4. Adventure Play Gardens (APG) give students not only the chance to play, but also a chance to bring lessons learned back into the classroom. APG allows students to explore and enhance their love for the outdoors. These playgrounds, though different from the typical schoolyard, give students a chance to mold, create, build, and manipulate many parts of their play area. APG allows children to take part in the things they love; crawling, digging, damming, and climbing. These spaces can be designed so that children will have plants and rocks to crawl under, soil and sand to dig in, water features to dam, and trees and other objects to climb.
5. Play areas that are responsive to the interests and skills of all young children (age 3 through 8), with attention to safety and supervision needs, facilitate cross-age interaction. The creation of these play spaces will also allow younger and older students to interact and learn from one another.



Outdoor Play and Learning Environment

7.4 A Welcoming Environment

One of the most important features of a school is the degree to which it fosters a sense of welcome and belonging for children and families. As a child approaches the school grounds and facility itself she/he should have a sense of being welcome. Buildings may seem imposing to young children and they can become easily overwhelmed with the size and scope of the space. Children should be able to easily negotiate the space. Doors should be easily opened by young children, pathways should be marked so that children not yet reading can find their way, displays should be placed at eye level for small children, and furniture should be available for young children in common areas as well as in their own classroom areas. The entry and other common areas should be familiar to children. They should see themselves and their families reflected in the art work, and depicted in school activities, photographs, and other displays in the school. The environment should inspire a sense of curiosity reflective of the school's attitude of inquiry as a core attribute of a successful school.

Similarly, unless there is clear thought put into making a school friendly to adult family members, they too may feel uncomfortable entering a strange and imposing space. Having spaces specifically designed for use by family members that are clearly identified and easily accessible helps to let parents and other family members know that they are a welcome part of the school community and encourages them to become active in the life of the school. While the school must be designed to provide security for children at all times, this does not mean the spaces cannot be friendly to both children and adults as they enter the building. Indeed, a sense of safety is essential to a welcoming atmosphere.

8.0 Building Considerations

In this chapter we present the general organizational building model based on the FirstSchool framework. Here we provide an example of an indoor and outdoor school environment developed through the application of FirstSchool values and evidence-based principles. This includes proposals for the arrangement, size, and occupancy of classrooms, shared spaces, specialized instruction, media center, gym or multi-purpose area, administration and support, family resource suite, health services, lobby and reception, and building and food services.

While this design was not created for a specific site or school district, it is intended as one demonstration of FirstSchool principles. It is important to apply these principles in the relevant context of each project and make appropriate adjustments in the design.

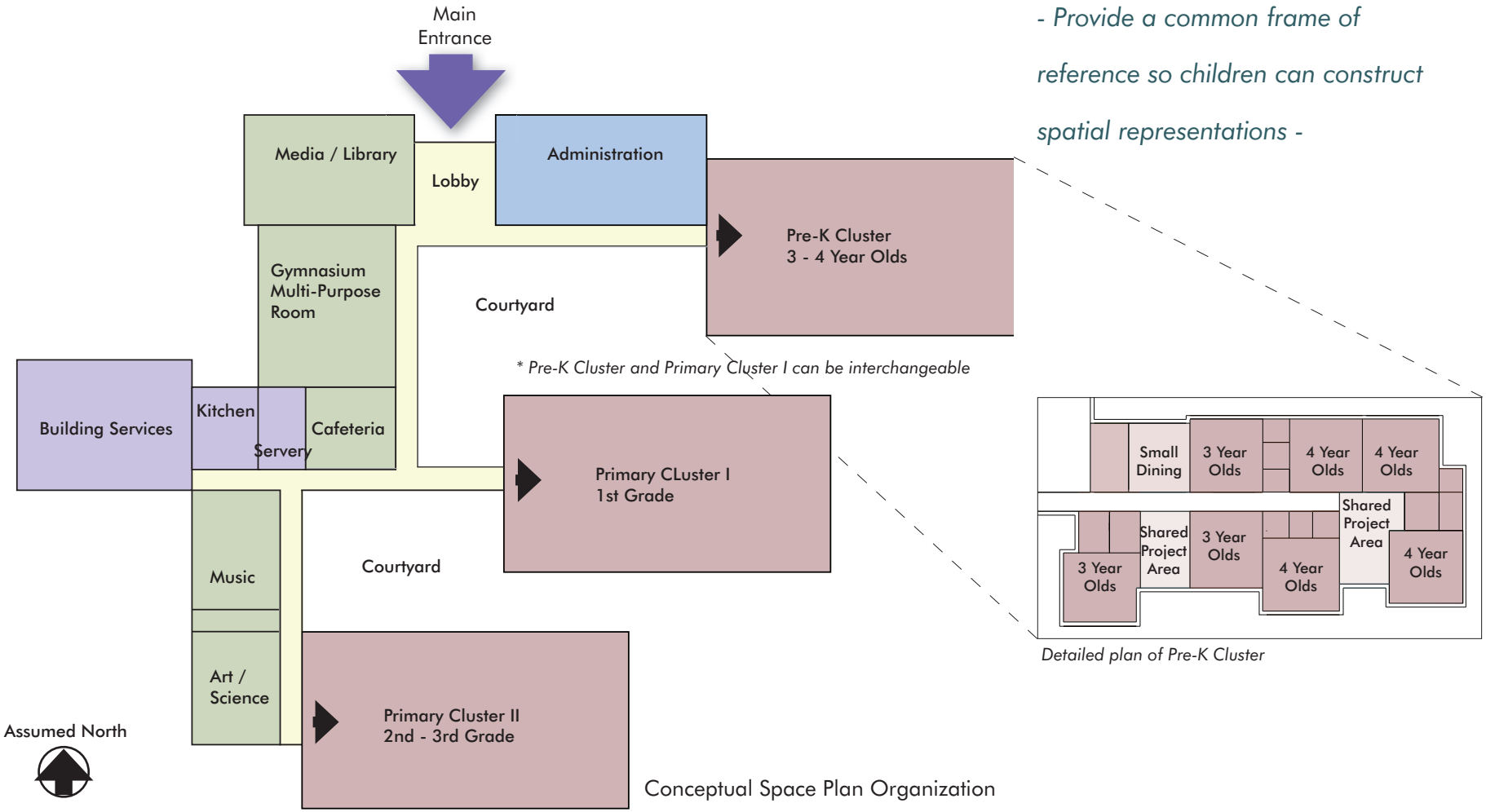
GENERAL ORGANIZATIONAL DIAGRAM

This design assumes:

- A single story facility with direct outdoor access on grade level.
- Classroom clusters located as destinations to limit disruption and promote ownership of shared space.
- The need for personal and professional space for teachers.
- Media Center, Administration, Family Support, Gym/Multi-Purpose and Dining all located near the main entrance for shared community use.
- A variety of shared and age appropriate outdoor learning areas with a secure perimeter.

- Simple wayfinding so children can navigate through complex environments -

- Provide a common frame of reference so children can construct spatial representations -

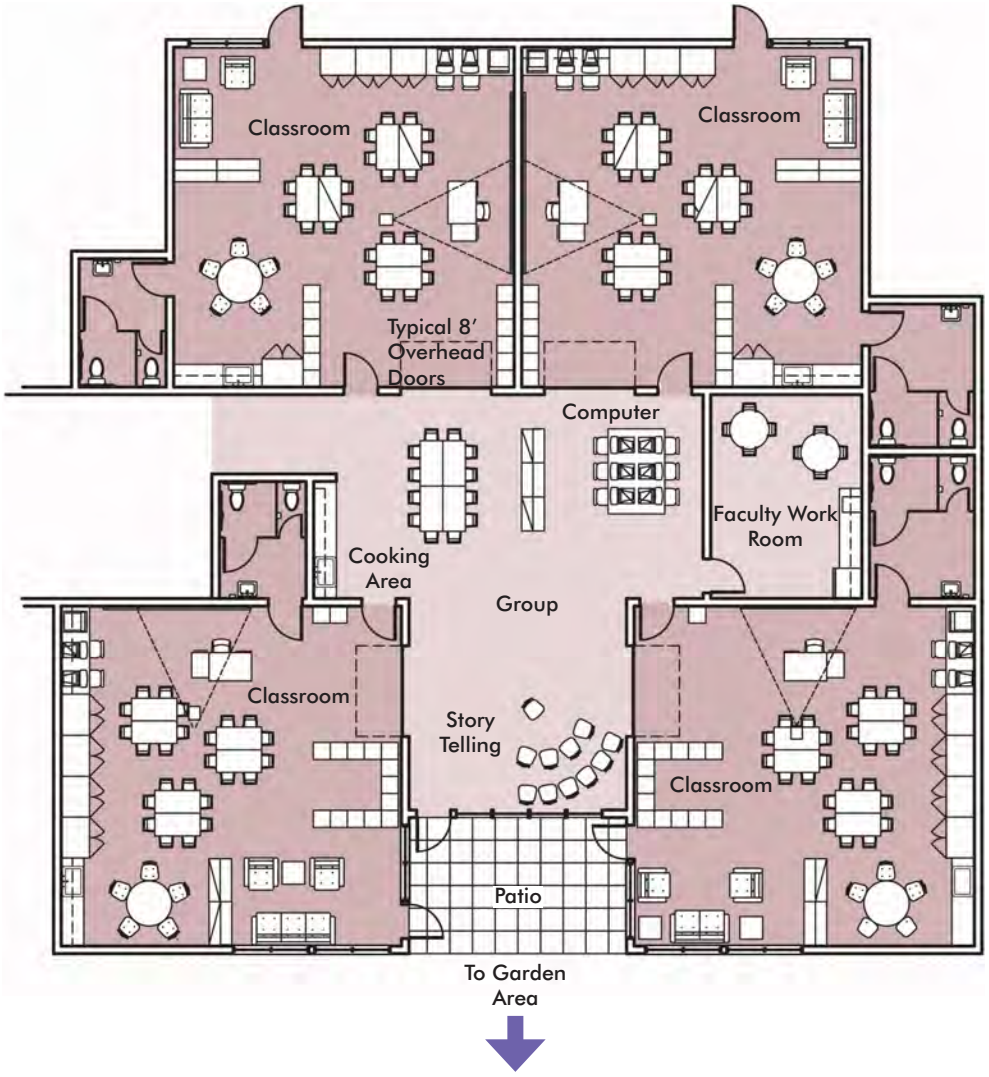


Detailed plan of Pre-K Cluster

Conceptual Space Plan Organization

- Small group instruction and cooperative peer groups facilitate positive effects on children's learning -

Conceptual Pre-K and Primary Cluster I Classroom Layout



8.1 Room Layouts

Pre-K and Primary Cluster I Classrooms (Pre-Kindergarten, Kindergarten, and First Grade)

The classroom cluster was designed to create small learning communities. They are designed to reduce the scale of the school and to give each age group a sense of arriving at a destination. The classrooms are consistent in size across the grade levels and thus can be used flexibly for different kinds of age groupings. There are three or four groupings of classrooms clustered around a central open room or shared project area. There are shared office spaces for teachers in each cluster. These classrooms all have bathrooms. Dining for pre-kindergarten and kindergarten takes place in small dining areas adjacent to classroom space.

Each classroom should have a large oversized door which, when opened, extends the classroom into the shared project area, creating flexible break-out space. This allows for interaction among the students and staff from other classrooms and promotes working together in a community setting. The shared project area can be used for multi-purpose events for either the individual classroom or a combination of classrooms working together, and can be transformed throughout the day into a play area, story time, reading nook, construction area, science area, cooking area, or children's theater area.

The classrooms should have direct access to the outdoors, incorporate controlled day-lighting, ceiling fans, and have operable windows for natural ventilation.

These classrooms are composed of the following features:

- 1,000 sf which includes coat, cubby and storage areas
- Classroom capacity of 21 students
- Approximately 43 sf/student
- Share a common project area
- Have direct access to outside
- Have large doors for opportunity to enlarge classrooms into the shared project space

Early childhood programs and kindergarten spaces typically are larger, more flexible, and able to accommodate far more storage than the rooms designed for older students.

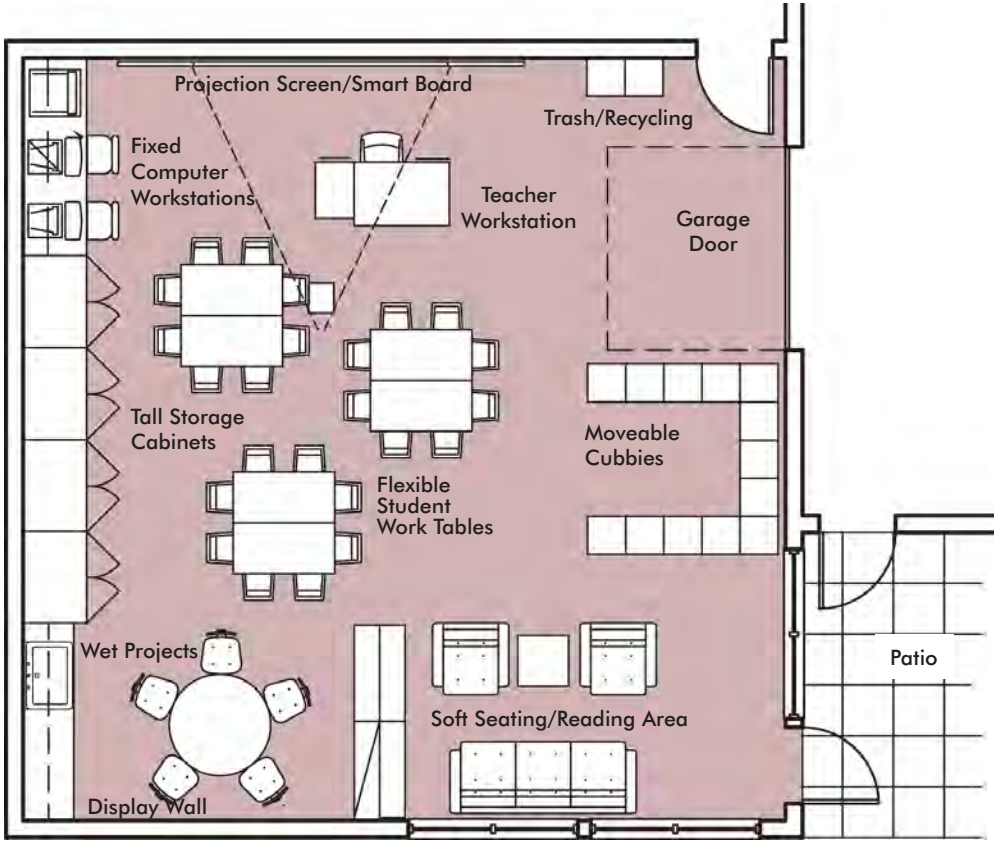
~Building Type Basics for Elementary and Secondary Schools, Bradford Perkins

Concordia International School | Elementary School
Photo courtesy of Perkins Eastman | Photographer: Tim Griffith

Stamford High School | 9th Grade Campus
Photo courtesy of Perkins Eastman | Photographer: Woodruff/Brown

- Classrooms should not have excessive reverberation and noise and should pay special attention to the acoustic environment as well as transmission of sound from space to another -

Conceptual Primary Cluster II Classroom Layout



Primary Cluster II Classroom (Second and Third Grades)

This classroom responds to the needs of second and third graders. Four classrooms are clustered around a central open space or shared project area. The classrooms are designed for flexibility, and provide opportunity for exhibit space. There are spaces within each classroom designed for a variety of activities, including areas for small group work, project development, computers, storage, and work table with sink. The classrooms will also provide for use of state-of-the-art technology, including projection screens, magnetic white boards, and smart boards. The classrooms should have direct access to the outdoors, incorporate controlled day-lighting, and have operable windows for natural ventilation.

These classrooms are composed of the following features:

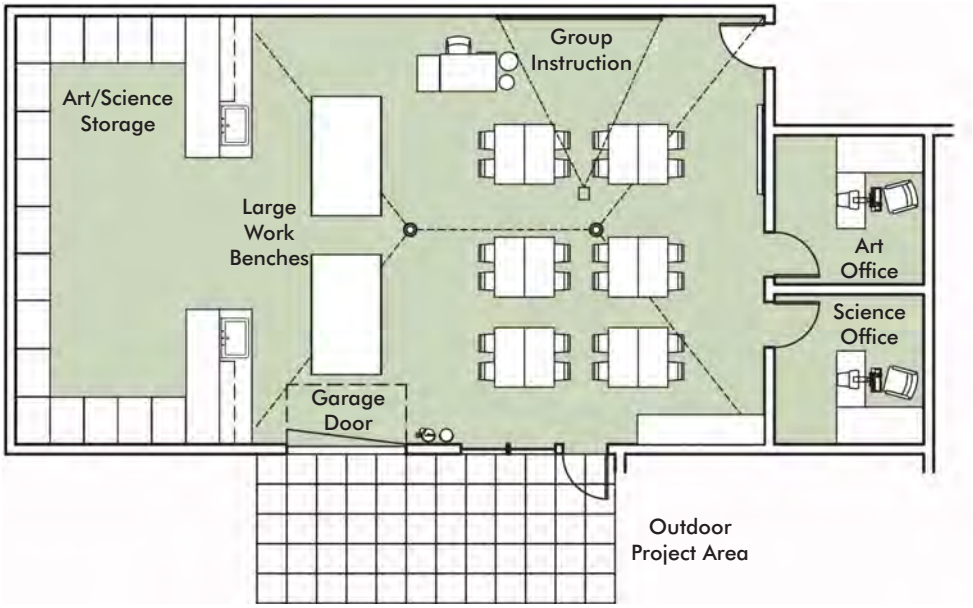
- 1,000 sf which includes coat, cubby and storage areas
- Classroom capacity of 21 students
- Approximately 43 sf/student

Storage, small project areas, extensive display areas, varied floor surfaces, and other features are important design elements.

~Building Type Basics for Elementary and Secondary Schools, Bradford Perkins

Princeton Day School
Photo courtesy of Perkins Eastman | Photographer: Tom Crane

- There should be options for creating small indoor spaces which make children feel big and impacts roles they choose in their play -



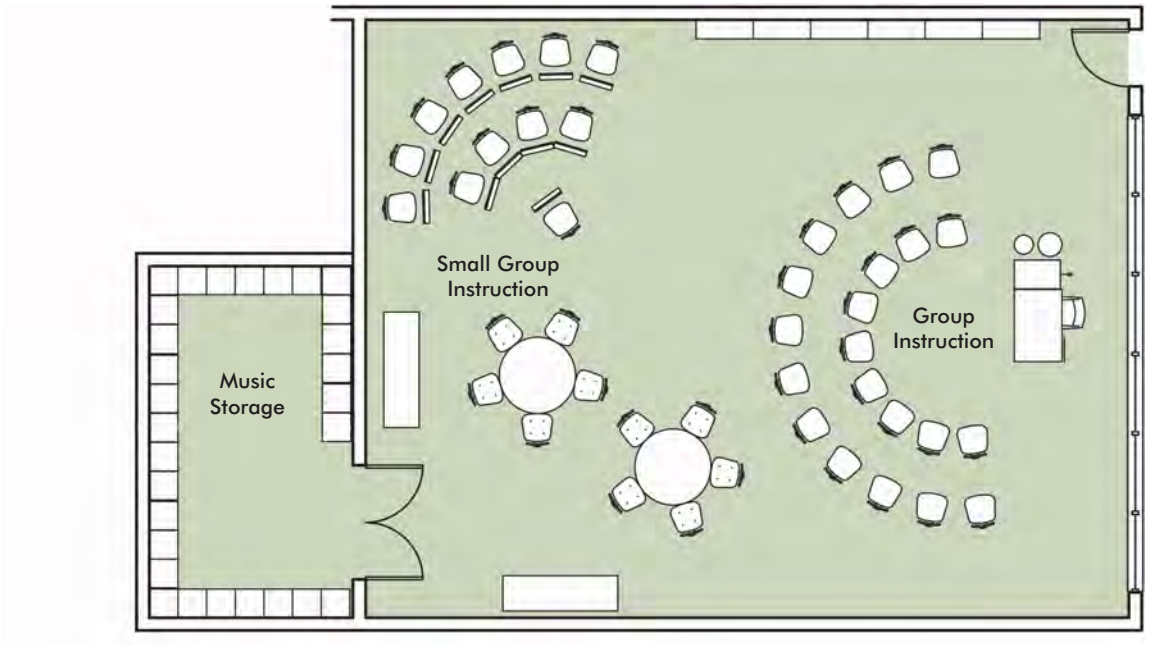
Fairfield High School | Ludlowe Campus
Photo courtesy of Perkins Eastman | Photographer: Woodruff/Brown

Arts and Science Classrooms

The arts/science room is designed for use as both an art and science room. This choice was made because of like needs for sinks, drains, and storage. This is a possible way to consider space restriction, but may not meet the needs for all school programs. The room is designed to be maintenance friendly and includes durable walls, floors, and floor drains for wet projects and cleaning. The space includes several counters with sinks, built-in drawer storage, pre-mounted drying racks and tackable wall surfaces, and space for several computers. Storage room(s) will be provided separately for art and science equipment and supplies. There will be an office for the art instructor and one for the science instructor adjacent to the classroom. The room should have direct access to outdoor project areas with hose bibs. The classrooms should incorporate controlled day-lighting, have operable windows for natural ventilation and should include a large "garage" type door to facilitate movement of projects and furnishings.

The art/science classroom is composed of the following features:

- 1,600 sf which includes offices and storage areas
- Classroom capacity of 21 students
- Approximately 48 sf/student



Music Room

The music room is designed to provide for both large and small groups and open floor space for different kinds of activities, such as performance, dance, and band practice. The space includes built-in storage areas, magnetic white boards, display boards, one mirrored wall for dance classes, and age appropriate furniture.

The music classroom is composed of the following features:

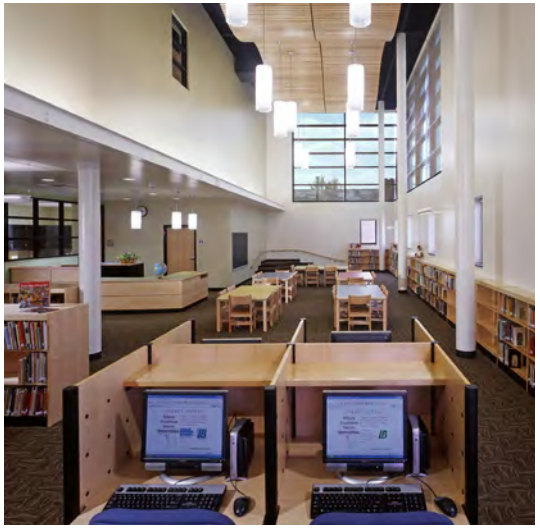
- 1,400 sf which includes storage room
- Classroom capacity of 21 students
- Approximately 57 sf/student
- Acoustic separation from the rest of the school
- Mirrored wall for dance

Byram Hills School District | Wampus Campus
Photo courtesy of Perkins Eastman | Photographer: Tom Crane

Byram Hills School District | Wampus Campus
Photo courtesy of Perkins Eastman | Photographer: Paul Rivera/ArchPhoto

Music rooms require special acoustic treatment, and their location in a building should be carefully considered.

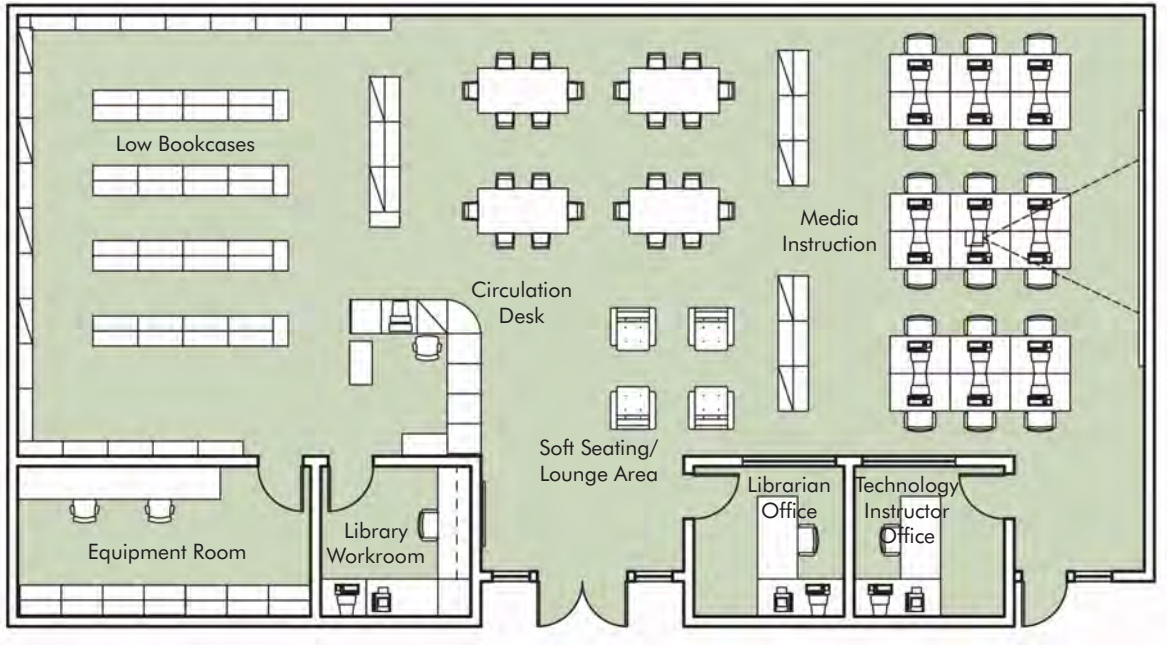
~Building Type Basics for Elementary and Secondary Schools, Bradford Perkins



Helen S. Faison Academy
Photo courtesy of Perkins Eastman | Photographer: Denmarsh Photography

- The physical environment must be designed to promote relationships among staff and with families by providing spaces that support privacy, comfort and access to resources -

Princeton Day School
Photo courtesy of Perkins Eastman | Photographer: Tom Crane

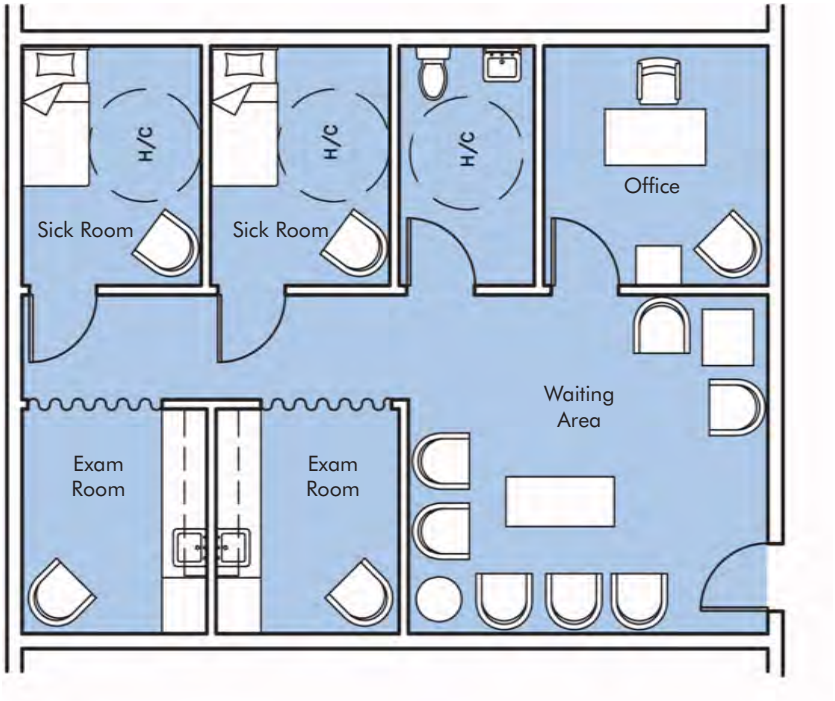


Media Center

The media center is designed as the hub for resources and technology for the school. The media center will be home to library books, journals, newspapers, and magazines. It will also serve as a place to work with computers and will include web access. There will be reading tables and chairs arranged in small study, reading, and instruction areas. The media center is located off the building's main entrance to provide easy access to children and their families.

The media center is composed of the following features:

- 2,950 sf which includes a librarian's office, library work room, technology/equipment room, and a technology instructor's office
- Designed acoustically as a quiet area
- Daylight with control to eliminate any direct sunlight
- Open computer instruction area
- Controlled/secure outdoor reading porch or terrace
- Area for informal instruction with technology support such as projection screen or flat panel monitor; wireless network; powered work tables; etc.



Health Services Suite

The health services suite is designed to meet the health needs of children in the school. It is placed near other administrative areas to insure constant supervision; it provides for privacy and comfort for children who are ill or distressed; and is designed to provide basic services such as screenings for vision, dental, and hearing. The suite is comprised of an exam room with sink and supply storage, sick room with day bed, accessible toilet, office, and waiting area.

The health services room is composed of the following features:

- 400 sf
- Waiting Area
- Accessible Toilet Room
- 2 Exam Rooms
- 2 Sick Rooms

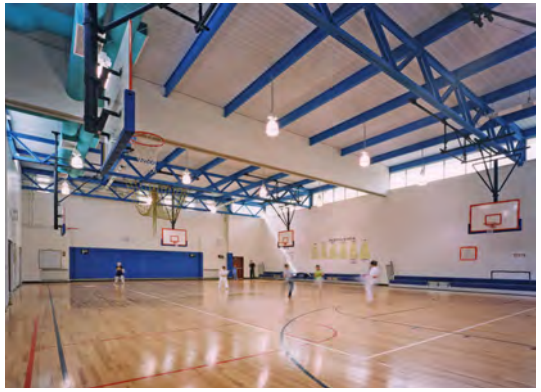
Children's Home of Pittsburgh
Photo courtesy of Perkins Eastman | Photographer: Denmarsh Photography

AnMed Health System
Photo courtesy of Perkins Eastman | Photographer: Dennis Nodine

The health suite is generally located near, or within, the main offices of the school.

~Building Type Basics for Elementary and Secondary Schools, Bradford Perkins

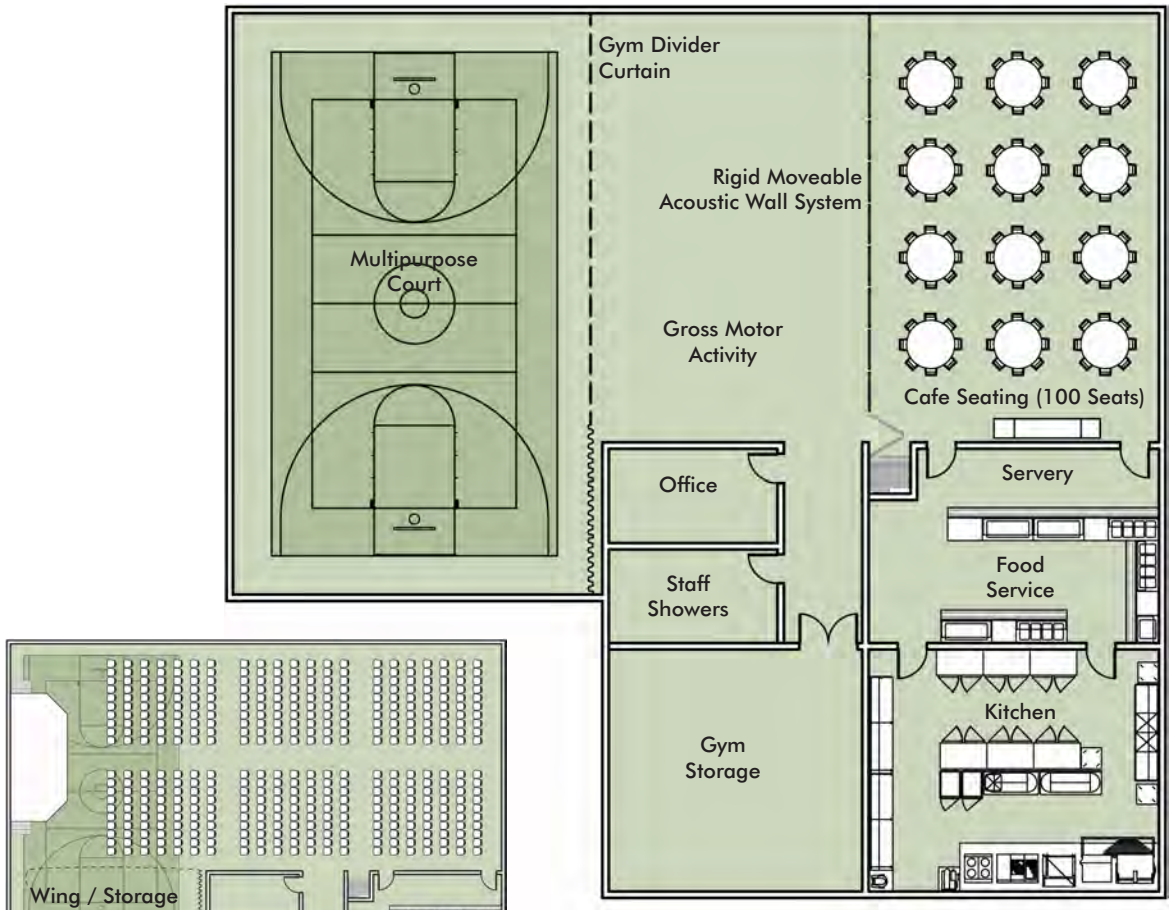
Byram Hills School District | Crittenden Campus
Photo courtesy of Perkins Eastman | Photographer: Paul Rivera/ArchPhoto



Byram Hills School District | Wampus Campus
Photo courtesy of Perkins Eastman | Photographer: Chuck Choi

- Health is promoted through staff and children's daily need for physical activity, sensory stimulation, fresh air, rest and nourishment -

Conceptual Gym and Multipurpose Room/Main Dining Layout



Alternate Layout
Showing Theater Seating
(420 - 450 Seats)

Gym and Multipurpose Room/Main Dining

The gym and multi-purpose room is designed for a variety of activities for all age groups. Activities may include seminars, science fairs, community meetings and gatherings, social events, performances, and after school activities. The space is large and open with high ceilings and windows, is pre-wired for a sound system, has a wood or synthetic gym floor, and maintenance friendly durable walls.

The gym and multipurpose room is located adjacent to the cafeteria where a folding partition separates the two spaces. At any time the folding partition can be opened and the two spaces can be used as a larger multi-purpose room.

The dining area is designed to seat 90 students in 4 separate dining periods throughout the day.
The dining chairs can be folded and moved to the edge of the cafeteria or into storage. There is also direct access to the outside.

The gym and multi-purpose room is composed of the following features:

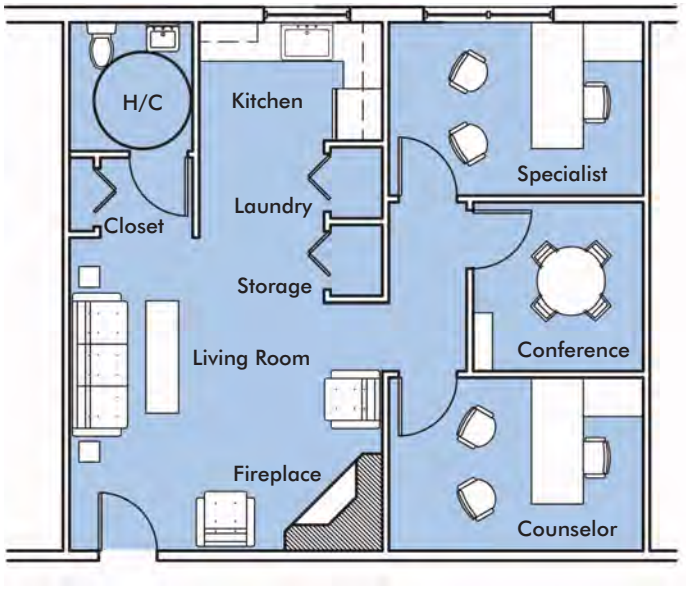
- 4,600 sf which includes the gym/multi-purpose room, gym storage, physical education office, and staff change shower
- 3,200 sf which includes the main cafeteria, cafeteria servery, commercial kitchen, food storage, and food service office.

NOTE: Dining for pre-kindergarten and K takes place in small dining areas adjacent to classroom space. Facilities are designed for moving the food between the main area and the satellite areas and for proper temperature control and sanitation.

Winthrop University | PICU
Photo courtesy of Perkins Eastman | Photographer: James Shanks

Children's Home of Pittsburgh
Photo courtesy of Perkins Eastman | Photographer: Denmarsh Photography

- Spaces must promote relationships among school staff and family members that foster parent involvement in their child's school success -



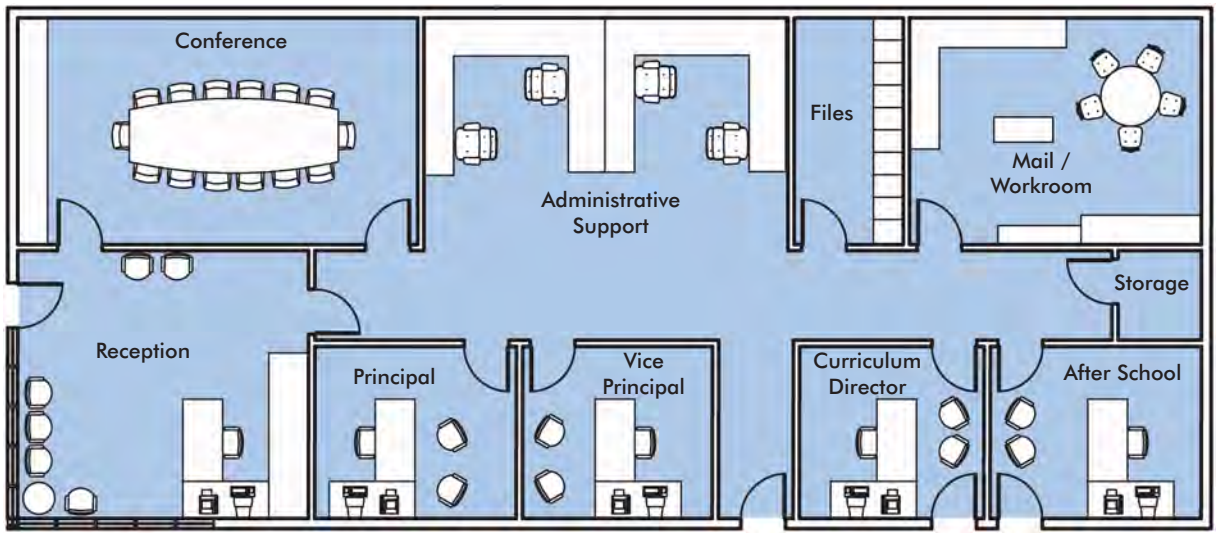
Family Suite

The family suite is designed as dedicated space for parents, siblings, and other family members. It should be a warm and inviting space, similar to one's own home. It is a place where parents, teachers, staff, family, and students interact in a friendly and social environment. It also serves as a resource room for parents and includes computers, network access, books, and magazines. Family Service staff offices are immediately adjacent to this area.

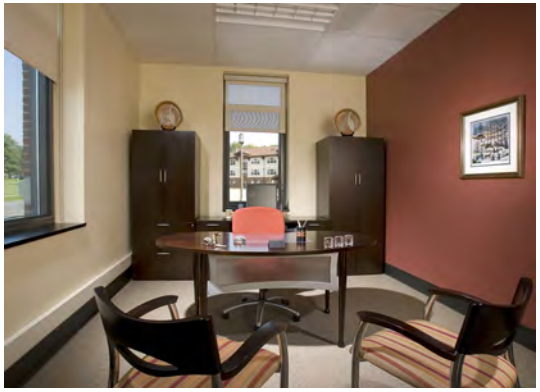
The suite includes a living room furnished with chairs, tables, and couches; kitchen and laundry with stackable washer and dryer; coat closet; a small conference/tutorial room; a counselor's office; and a family specialist office centrally located and near the school entrance.

The family suite is composed of the following features:

- Living room with home-like atmosphere
- Kitchen and Laundry facilities



IUP Living Learning Center
Photo courtesy of Perkins Eastman | Photographer: Massery Photography



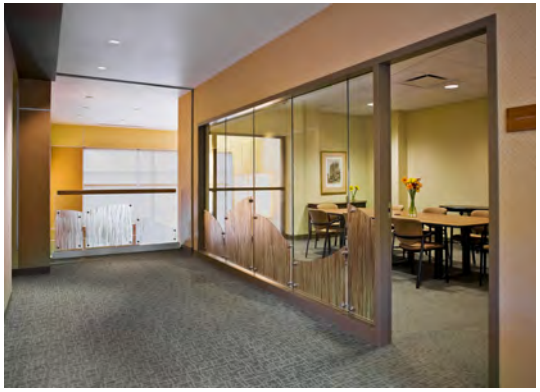
IUP Living Learning Center
Photo courtesy of Perkins Eastman | Photographer: Massery Photography

Administrative Offices and Conference Rooms

The administrative offices are clustered near the entry of the school. The entry is easily recognized and accessible and there is immediate access to staff. Conference and meeting rooms are in the administrative areas as well as throughout the building to allow for private conversations among staff, small tutoring sessions, as well as parent-staff conferences and meetings.

The Administrative offices and conference rooms are composed of the following features:

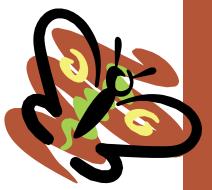
- Located adjacent to main public entrance
- Easily visible from lobby area



Children's Home of Pittsburgh
Photo courtesy of Perkins Eastman | Photographer: Denmarsh Photography

9.0 Facility Systems

In this chapter we present the building systems that support the FirstSchool facility. Included are: LEED®/Sustainability ; Mechanical; Electrical; Data Communications; Food Service; and Interiors.



FACILITY SYSTEMS

The following sections outline options and recommendations for building systems and features. These recommendations are provided with the understanding they might conflict with local standards. We believe if implemented, measurable improvement in indoor air quality (IAQ), building systems performance, and energy efficiency will be realized.

As with earlier sections of this document, every feature of the building is seen as a learning opportunity for children and as a possible mechanism for making the school an integral part of the community. Our emphasis on energy efficiency is seen not only as an end in itself, but also as an opportunity to act as an educational facility, promoting stewardship of the environment, and teaching children that taking care of their community is important and that their actions have an impact on the world in which they live.

9.1 LEED®/Sustainability
9.2 Mechanical
9.3 Electrical
9.4 Data/Telecommunications
9.5 Food Service
9.6 Interiors

LEED® -

a third party certification program and the nationally accepted benchmark for the design, construction and operation of high performance green buildings. LEED® gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. LEED® promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

~ USGBC

9.1 LEED®/Sustainability

FirstSchool is dedicated to developing high-performance and sustainable buildings that minimize impact on the environment. The design should rely on daylighting, solar power, stormwater storage and use, and environmentally-friendly building materials. FirstSchool is dedicated to preserving and utilizing outdoor space, as well as educating its inhabitants about protecting and safeguarding the environment. Every effort is made to make the design features that accomplish the goals of sustainability transparent to users of the space, with particular emphasis on student access to these environmentally-friendly considerations.

The United States Green Building Council (USGBC) offers Leadership in Energy and Environmental Design (LEED®) certification, The LEED® Green Building Rating System serves as a voluntary United States standard for developing high-performance and sustainable buildings which consume less energy and water and contribute less to landfills and to global warming, while promoting a healthier environment. We recommend that schools that are designed according to FirstSchool principles meet or exceed LEED® Silver certification. We have included in this Design Guide a copy of the LEED® Project Checklist. LEED® promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. It is possible to obtain a LEED® Silver certification by adhering to a number of the credits listed on the Checklist. The attached LEED® Checklist has been filled out listing possible credits that would be a minimum of all FirstSchool facilities.

Many building elements can make use of a high percentage of recycled content: carpet, ceramic tile, drywall, structural steel, concrete, and acoustical ceiling tile. All finish selections should avoid the use of formaldehyde and minimize or eliminate Volitile Organic Compounds (VOCs). An achievement of more than a 30 percent reduction in energy consumption, compared against a baseline model, would include heat recovery from air and kitchen exhausts; individual controls in each classroom; landscaped plantings which shade the south and west facades; and recycled roof water used in the evaporative cooler. Large openings in the classrooms, along with high-reflectant paint and shades, could provide plenty of controllable natural light.

Features of high-performance and sustainable designs are as follows:

1. Utilize rainwater management strategies that target "capture and reuse" approaches, and/or approaches that promote infiltration and vegetative uptake. Look for opportunities to bring water into the learning environment through use of visible features such as scuppers, weirs, water wheels, runnels, etc.
2. Collect, store, and use rainwater for beneficial uses including supplemental plumbing and irrigation of native landscapes or vegetated gardens.
3. Limit turf grass areas and instead focus on native vegetation requiring minimal maintenance by students and faculty.
4. Integrate stormwater management with bioswales, vegetative filters, and filter strips throughout parking areas, and promote sheet flow to these areas and recharge groundwater systems.
5. The use of green roofs will help with both the cost of heating and cooling the building and the treatment of rainwater.
6. Rain gardens can help to treat rainwater and runoff from parking lots, preventing untreated water from entering local streams.
7. The use of renewable energies such as sunlight, solar harvesting, wind harvesting, animal waste, and rainwater harvesting will reduce energy cost and greenhouse gas emissions.
8. Other principles, such as use of gray water for irrigation or building sanitary systems, should be considered.
9. Using high energy-efficient windows and skylights and direct/indirect lighting fixtures allows for a healthy and economical mix of natural and electric illumination in new and renovated schools.
10. Provide a high performance building envelope, exceeding minimal thermal requirements with special attention to the use of continuous air barriers to reduce air infiltration.
11. Daylighting requires attention to location, placement, and shading of windows and skylights relative to the building's solar orientation. This design concept can provide:
    - Balanced, diffused, and glare free daylight from two or more directions;
    - Sufficient light levels for tasks in the space;
    - Operable shading devices to reduce light intensity for audio-visual programs and computer work;
    - Windows for interest, relaxation, and communication with the outdoors; and
    - Exterior shading devices as needed to minimize solar heat gain during cooling season.

Daylighting -

The practice of placing windows, or other transparent media, and reflective surfaces so that, during the day, natural light provides effective internal illumination.

Within the overall architectural design of a building, particular attention is given to daylighting when the aim is to maximize visual comfort, productivity, or to reduce energy use. Energy savings from daylighting are achieved in two ways — either from the reduced use of electric lighting, or from passive solar heating or cooling.

Byram Hills School District | Wampus Campus
Photo courtesy of Perkins Eastman | Photographer: Chuck Choi

Byram Hills School District | Wampus Campus
Photo courtesy of Perkins Eastman | Photographer: Chuck Choi

The following are daylighting design considerations for architects:
- Building orientation for cost effective solar access;
- Roofing material and reflective factor and lightwells;
- Lightshelves and skylights;
- Collaboration with the electrical engineer to balance day lighting control;
- Interior finishes; and
- Windows: glazing, location, and orientation.

The following are daylighting design considerations for electrical engineers:
- Selecting suitable light source for application;
- Use of efficient luminaries and ones with high coefficient of utilization;
- Designs based on recommendations from IES and Ashrae; and
- Using modern technology to balance day lighting controls.

A balance control system integrates dimming controls, daylight sensors, and occupancy sensors with a network of digitally-addressable dimming ballasts.

9.1.1 Passive Solar Guidelines and Building Envelope

Passive solar buildings aim to maintain interior thermal comfort throughout the sun's daily and annual cycles, while reducing the requirement for active mechanical heating and cooling systems that require an energy source. The basic processes that are used in passive solar energy include the thermal energy flows associated with radiation, conduction, and natural convection. When sunlight strikes a building, the building materials can reflect, transmit, or absorb the solar radiation. Additionally, the heat produced by the sun causes air movement that can be predictable in designed spaces. These basic responses to solar heat lead to design elements, material choice, and material placement that can provide optimal heating and cooling for the FirstSchool building.

The FirstSchool building will focus on passive solar building design. These elements revolve around a set of core physical environmental and scientific principles. Specific attention is directed to the site and location of the dwelling, the prevailing climate, design and construction, solar orientation, placement of glazing and shading elements, and incorporation of thermal mass based on careful consideration of latitude, altitude, climatic conditions, and heating/cooling requirements.

There are basic passive solar building design elements required to optimize the use of natural elements and to minimize mechanical systems which heat and cool the building. These include:
- Orientating the building to face the equator, or a few degrees to the East to capture the morning sun, and a South face to receive sunlight into the building throughout the day during the winter-heating season;
- Elongating the building dimension along the east/west axis;

- Adequately sizing windows that face the midday winter sun;
- Adequately shading windows in the summer;
- Minimizing windows on other sides, especially west facing windows;
- Erecting correctly-sized, latitude-specific overhangs, or shading elements (shrubbery, trees, trellises, fences, shutters, etc.) to reduce cooling loads during the cooling season;
- Using the appropriate amount and type of insulation, including radiant barriers and bulk insulation, and the use of green roofs to minimize seasonal excessive heat gain or loss;
- Using thermal mass to store excess solar energy during winter days (which is then re-radiated during the night).

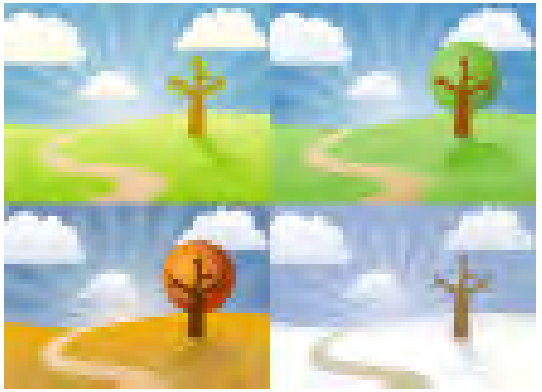
We recommend wall massing and insulation and a cool or green roof to provide a radiant barrier, that will significantly reduce the roof solar cooling load for the building. Overall, the combination of the building configuration and orientation, in conjunction with providing strategic overhang elements and natural shading components, will reduce the heating and cooling loads for the building significantly. If we assume a one-to-two story building that is long and narrow with a high proportion of exterior skin to interior area, we estimate that approximately 40% to 55% of the heating and cooling load for the building (excluding ventilation) will be produce from the exterior skin and roof.

Achieving an ideal solution requires careful integration of these principles. Modern refinements through computer modeling and application of other technologies can achieve significant energy savings without necessarily sacrificing functionality or creative aesthetics. Commissioning offers a quality-oriented process for achieving, verifying, and documenting that the performance of the facility, systems, and assemblies meet the defined objectives and criteria. This independent third party professional will help ensure that the strategies and recommendations required by the owner are achieved.

9.1.2 Human Behavior

The staff, faculty, and students all take an active role in reducing energy and incorporating a sustainable environment for the new building. Some of these actions include:

- Eliminating the number of printers in individual spaces. These printers are normally older and have a higher heat gain to the space than larger units that have a much lower efficiency. Designing space for central printer and copying areas in lieu of printers in individual offices;
- Eliminating old equipment that is inefficient;
- Turning off or unplugging power sources at night or that are not being used; and
- Promoting a paperless classroom and instituting policies that maintain paper records electronically, minimizing the need for individual printers, copiers, and other equipment that generates heat and consumes energy to operate.



Concordia International School | Elementary School
Photo courtesy of Perkins Eastman | Photographer: Tim Griffeth

40% to 55% of the heating and cooling load for the building (excluding ventilation) will be produced from the exterior skin and roof.

9.2 Mechanical

Overview

A vital aspect of the system design is promoting energy efficiency and maintainability of the systems. As rising energy costs and diminishing operating budgets become frequent issues at school districts across the country, providing energy efficient and sensible systems should be a priority for any new facility.

Energy costs typically account for 16% of a school district's "controllable" costs. New guidelines for schools are being developed in collaboration with The American Institute of Architects (AIA), the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Illuminating Engineering Society of North America (IESNA), the United States Green Building Council (USGBC), and the United States Department of Energy (DOE) to achieve energy savings over the minimum code requirements of ANSI/ASHRAE/IESNA Standard 90.1-1999.

The initial energy saving target is 30% which is the first step in the process towards achieving a net zero building – defined as a building that, on an annual basis, draws from outside resources using on-site renewable energy sources. Heating, cooling and refrigeration equipment, lighting controls, and appliances are all being studied to maximize energy efficiency within the modern school. .

The optimum mechanical and electrical designs for school buildings aim to improve the environment for students and staff. This is accomplished by designing and constructing systems that promote exceptional indoor air quality (IAQ), reduce airborne noise, and increase occupant comfort.

The system should be transparent to the staff and students of the school to allow for learning opportunities. For example, meters that track air quality, energy consumption, or water use should be accessible to staff and students for use in math and science instruction.

9.2.1 Building Envelope

The building technologies being proposed advances the research and development in the next generation of energy-efficient components, materials, and equipment to reduce energy along with the architectural impact of site location, site orientation, and building form/geometry (massing) of the building.

Energy modeling of each building is crucial to saving energy. The building envelope and building orientation are critical components for the use of passive solar systems that reduce energy consumption through orientation of the building, daylighting, and location of overhangs, shading, and glazing locations.

9.2.2 Mechanical Systems

More than half the total energy used for heating, cooling, ventilation, refrigeration, and water heating is electrical. Air conditioning is the single leading cause of peak demand of electricity. The electrical loads need to be reduced to achieve the net-zero energy schools of the future. Practices that are being used to reduce energy consumption and reduce the carbon dioxide footprint include:

1. Energy Plant Systems

   Research has contributed to the development of energy efficiency in mechanical equipment. Large refrigeration equipment (chillers) and heat pump systems can substantially reduce energy consumption and cost. Today, most school designers specify gas-fired hot water boilers for heating and air-cooled chillers for cooling the building.

   New technology:

a. High efficiency non-condensing hot water boilers requiring lower temperature hot water and less energy. Larger boiler systems may have air-side economizers that can heat outside air required for combustion or pre-heat domestic hot water. Providing variable speed drives on pumps will also save pumping energy.
b. Water cooled refrigeration systems with high efficient compressors in lieu of air-cooled equipment. These systems can reduce overall refrigeration cost by 20 percent. In addition, thermal storage can be used in conjunction with the plant whereby chilled water is made on off-peak hours and stored for daytime use.
c. Geothermal water source heat pumps have shown excellent energy savings using underground water as a heat sink versus air.

2. HVAC Delivery Systems

   Most schools are designed with variable air volume systems which distribute air from main air-handling units. The main units heat and cool the air, mix with ventilation air, and distribute to the rooms depending on need. The amount of air varies depending on what temperature the thermostat is set. If the air is too cold, hot water coils heat the air for that specific room.

   New technology:

a. Individual heat pump systems as explained above;
b. Radiant convection panel systems where hot and cold water is distributed to panels located in the ceiling to heat and cool the space;
c. Underfloor displacement systems where air conditioning and heating is distributed from below the floor in lieu of through ceiling diffusers. This system allows for the air to be delivered directly to the occupants and there is no need to condition the entire volume of the room.

The initial energy saving target is 30% which is the first step in the process towards achieving a net zero building – defined as a building that, on an annual basis, draws from outside resources using on-site renewable energy sources.

Felician Sisters Convent and Our Lady of the Sacred Heart High School
Photo courtesy of Perkins Eastman

d. Water is a much more efficient way to transport energy than air. The smaller air handling units for ventilation also use heat recovery wheels or glycol loops in the units. Active chilled beam systems introduce ventilation air to units in the ceiling that also have a cooling coil. Chilled water is pumped around to the ceiling units and the cooler air is induced down in the space. Main air handling units are not required except for ventilation air (approximately 20 percent of the size), and large fans are not required. Heating is through finned tube radiation.
f. Demand control ventilation is becoming a common practice to minimize the amount of outside air that is needed in the building. Carbon dioxide sensors maintain specified levels and as those levels increase, more outside air is introduced.

3. Renewable Energy Sources

Renewable energy sources are being used in some schools today, including solar domestic hot water systems that heat domestic water for the school.

New technology:

a. DOE is investigating the development of a new system for calculating heat loss and gain through the building envelope. Advanced wall systems are being developed with air tightness, thermal mass, and durability.
b. Photovoltaics will be a major energy producer in future schools. New materials and systems are being developed for both residential and larger institutional use. System types will include stand alone, battery, and generator type systems where energy can be used instantaneously or stored for future demand. Photovoltaics with roof shingles will generate electricity and be incorporated into the building structure.
c. Solar hot water and pool heaters are now being used but only to achieve the net-zero energy building, active solar space heating will need to be developed further through researching building materials and fluids for both space heating and cooling.
d. Fuel cells will also be a viable source of energy in the future, but at this point, they do not reduce the carbon footprint for the environment.

4. Controls/Commissioning

Diagnostic and real-time monitoring tools will be incorporated in new school buildings. These tools will be used by school administrators, maintenance staff, and students to gain an understanding of what the impact of energy consumption has on budgets and the environment.

9.2.3 Water Conservation

The goal for the FirstSchool facility is to maximize water efficiency within the building by reducing the amount of water used and reducing the amount of waste water treated by the local municipal treatment plant. Multiple options will be evaluated to reduce water use. Specifying low flow and waterless type plumbing fixtures, flow restrictors, along with occupant sensors will achieve less water used in the building. In addition, the reuse of grey water, and stormwater retention for non-potable water applications, will enhance water conservation for the building and the surrounding site.

We estimated that the building is being designed to house 450 staff and students. We have also estimated that the building will use approximately 480,000 gallons a year of water for plumbing fixtures based on current codes. If we specify high efficient dual flow plumbing fixtures, we can reduce the water usage by 57 percent or 276,000 gallons annually. These design features incorporated into the building today will increase the water savings over the life of the building as the population of the facility grows.

This reduction in water usage is for the internal water usage of the building and does not include site water retainage or the reclamation of process/non-regulated water such as condensate return from HVAC equipment that will also enhance the water saving potential of the overall building and site.

New Technology:

1. Low Flow Plumping Fixtures

   In 1995, the National Energy Policy Act mandated that toilets use no more than 1.6 gallons of water per flush. Since then, low-flow plumbing fixtures, including toilets, faucet aerators, and shower heads have been developed that save substantial amounts of water compared to conventional fixtures providing the same utility.

   Low-flow toilets use a maximum of 1.6 gallons of water per flush compared with about 3.5 gallons of water used by a standard toilet. The initial introduction of low flow toilets generated complaints that the low-flow toilets had trouble clearing the bowl and frequently clogged. Flushing performance has improved in recent years but some models may still not perform as well as older high flow toilets. Some toilets have large drain passages, and redesigned bowls and tanks for easier wash down. Others supplement the gravity system with water supply line pressure, compressed air, or a vacuum pump.

2. High Efficiency Toilets

   Designed for water conservation, high efficiency toilets (HETs) have been defined by the plumbing industry and the Environmental Protection Agency (EPA) as those that use an average of 20 percent less water per flush than the industry standard of 1.6 gallons. Using a high efficiency unit (1.28 gallons per flush) can save up to 8,760 gallons of water each year for a family of four with average daily flushes of six each.

We have estimated that the building will use approximately 480,000 gallons a year of water for plumbing fixtures based on current codes. If we specify high efficient dual flow plumbing fixtures, we can reduce the water usage by 57 percent or 276,000 gallons annually.

Harvey Milk Middle School
Photo courtesy of Perkins Eastman | Photographer: Seth Boyd

Children's Museum of Pittsburgh
Photo courtesy of Perkins Eastman

3. **Gravity Fed Single Flush Toilets**
   Gravity fed single flush toilets operate the same way as any standard toilet, however, they use less total capacity per flush. Typical flush capacities that are available for these models are 1.1 and 1.28 gallons.

4. **Dual-Flush Toilets**
   Designed for light and heavy flushes, dual-flush toilets tend to average less than 1.2 gallons per flush. They meet HET criteria of 1.28 gallons per flush or less (HET criteria for dual flush toilets identify the effective flush volume as the average of one high flush and two low flushes). Dual flush models are available from many well-known manufacturers with light flush capacities from 0.8 to 1.1 gallons and heavy flush capacities from 1.3 to 1.6 gallons per flush. These toilets typically operate with a handle that can move up or down, or have a two button system. One direction or button will activate the lower flow flush, while the other will activate the higher flow flush.

5. **Pressure Assist Toilets**
   Pressure assist, or pressurized tank toilets are another high performance, low consumption alternative. These toilets use either water line pressure or a device in the tank to create additional force from air pressure to flush the toilet. The device in the tank could either be a storage device with compressed air that would require replacement, or a tank that creates pressure when the tank is being filled. These toilets typically average 1.1 to 1.2 gallons per flush. Some pressure assist systems move a greater volume of water at a significantly lesser volume of sound.

6. **Power Assist Toilets**
   Power assist toilets operate using a pump to force water down at a higher velocity than gravity toilets. Power assist toilets require a 120V power source to operate the small fractional horsepower pump. Typical flush volumes are between 1 and 1.3 gallons per flush, and dual-flush models are also available.

7. **Waterless Urinals**
   Before 1993, the standard flush rate for urinals was 3 gallons per flush (gpf). After that date, however, any urinal manufactured for use in the United States must have a flush rate of 1.0 gallons per flush or less. Waterless urinals require no water to flush and no flush valves or other control hardware to operate. Instead, they use replaceable cartridges that contain a liquid sealant. The difference in specific gravity between the trap solution and urine creates a liquid seal. The lighter specific gravity of the seal enables liquid to float to the top of the urinal while sealing the discharge line and preventing sewer odors from backing up into the bathroom.

   The chief benefit of waterless urinals is their lack of water use. No water piping is connected to the unit, which keeps down installation and maintenance costs, as well as water and sewer bills.

9.2.4 Greywater Reuse

Greywater is wastewater from bathtubs, shower drains, sinks, washing machines, and dishwashers. Greywater accounts for 60% of the outflow produced in homes and to a lesser degree, in institutional and commercial buildings. It contains little or no pathogens and 90 percent less nitrogen than black water (toilet water). Because of this, it does not require the same treatment process. Greywater can be recycled for irrigation, toilets, and exterior washing, resulting in water conservation.

9.2.5 Process and Non-Regulated Reuse

There will be opportunities to reclaim water from both storm-water and HVAC equipment. In parts of the country, during many months of the year the humidity in the air is condensed when introduced into the HVAC air conditioning units for buildings. This condensate is normally collected and discharged into the sanitary drain system and eventually to the utilities water treatment facility.

9.2.6 Interior Environment

During the early phases of design, the development of energy strategies will be incorporated into the First-School building. The reduction of overall energy consumption will depend on optimizing on-site resources, including: daylighting, which reduces energy loads both internally and externally; sizing of HVAC systems properly to operate at peak efficiency; and having a comprehensive maintenance plan to maintain the building once construction is completed. In addition, a plan is required to educate the staff and students on how to incorporate energy efficient habits in the workplace and create a sustainable "life style" during the operation of the building's life.

Reducing the internal loads of the building will be a major focus for reducing the overall energy consumption of the building. As stated above, optimizing on-site resources such as daylighting, energy efficient lighting systems and controls, and specifying energy efficient equipment for both the mechanical systems and office equipment is also needed.

9.2.7 Daylighting

Daylighting is essential for the most energy-efficient and sustainable building design. Effective daylighting uses sunlight to offset electrical lighting loads. When properly designed, daylighting saves energy and reduces cooling loads. In addition to energy benefits, a number of studies have shown that daylight can also help improve learning. From a student and teacher productivity standpoint, classrooms are the most beneficial spaces to daylight.

If carefully designed, vertical fenestration and skylights can provide interior illumination without excessive solar heat gain. Electric lighting systems can then be extinguished or dimmed for most school hours, saving significant energy and maintenance costs. The key to daylighting is an integrated design in which HVAC and electric lighting controls are optimized to take full advantage of and harvest energy savings. Added first

Clerestories, skylights, and light shelves will offer opportunities to provide top lighted and side lighted daylighting, in conjunction with integrated lighting systems.

Brunswick County Academy
Photo courtesy of Perkins Eastman | Photographer: Paul Rivera/ArchPhoto

Byram Hills School District | Crittenden Campus
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costs of fenestration are offset by reduced costs in HVAC equipment. Daylighting must provide controlled, quality lighting. For daylighting to save energy, it must be "superior" to the electrical lighting. Lighting and daylighting design can provide predicable and consistent lighting energy savings of up to 40 percent.

As the FirstSchool building is designed with an elongated East-West orientation and an expansive North-South facade, it will offer many opportunities for daylighting. Clerestories, skylights, and light shelves will offer opportunities to provide top lighted and side lighted daylighting, in conjunction with integrated lighting systems.

9.2.8 Humidity Control

There are many different types of air conditioning systems that can be used in schools. Typically, chilled water or direct expansion type systems are used. In a typical DX application, the compressor cycles off regularly to avoid over cooling. As the compressor operates for a smaller percentage of the hour, dehumidification capacity decreases significantly. In a typical chilled water application, a modulating valve reduces system capacity by throttling the water flow rate through the cooling coil. As the water throttles down, less moisture is removed from the air.

The spaces relative humidity will increase under part load conditions and can present conditions where mold will form with relative humidity levels above 60 percent using either chilled water or DX system. Depending on the air conditioning system selected (single-zone and packaged DX systems, heat pumps, or fan-coil units) this equipment can be designed to minimize higher humidity at part-load conditions mainly through control modifications. The use of dedicated outside air units can also help minimize higher humidity levels.

9.3 Electrical

Energy consumption for all lighting in the United States is estimated to be about 22 percent of the total electricity generated. More than 50 percent is consumed in the commercial sector where lighting coincides with peak electrical demand and contributes to a building's internal heat generation, which also increases air-conditioning load.

The DOE technical objective is to develop and demonstrate energy efficient, high quality, long lasting lighting technologies to illuminate buildings with 50 percent less electricity than in 2005.

The focus of decreasing energy consumption from lighting is as follows;

a. For conventional lighting, decreased energy consumption is due to the improvement in the quality and performance of fluorescent and high intensity discharge (HID) light sources, advances in fixtures, controls, and distribution systems; along with optimizing lighting quality.

b. Solid state lighting is also targeting improvements in efficiency, performance, lifetime, and quality of light from both organic and inorganic light emitting diodes. LED type fixtures are being developed and used in more facilities each day.

In addition, green school lighting design typically emphasizes providing views and managing daylight. It specifically focuses on increasing daylight, reducing glare and minimizing energy. Using high energy efficient windows and skylights and direct/indirect lighting fixtures allows a healthy and economical mix of natural and electric illumination in new and renovated schools.

Compared to electric lighting, daylighting has a better light quality that is more appropriate for human visual tasks. Lighting system design can improve attributes of the "Light Quality". The controllable attributes of light quality are: better distribution of light throughout the space, and absence of flicker and noise associated with electric light fixtures and ballasts.

Lighting controls are also being investigated in more detail for monitor and control efficiency. Balance Daylighting Control uses modern technology to integrate dimming control, daylight sensing, and occupancy sensing with a network of digitally addressable dimming ballasts.

The development of highly efficient, cost-effective, solid-state lighting technologies, along with advanced windows and space heating and cooling technologies, can help reduce total building energy use by 60-70 percent. This improvement in component and system energy efficiency, coupled with on site renewable energy supply systems, can result in marketable net zero energy buildings.

All of these features offer opportunities for teachers and students to observe the environmentally friendly components and monitor and assess energy and cost saving measures.

9.3.1 Lighting

Lighting systems that use the most current, energy-efficient lamps, ballasts, and integrated controls should be included in the FirstSchool building design. Because lighting energy savings also produce cooling savings, HVAC energy savings of 10 to 15 percent are possible in cooling–dominated climates. Moreover, even though the cost of the high-performance system may be about the same or more than a basic solution, the cost of HVAC capacity can also be reduced.

For daylighting and electrical lighting to be used efficiently, spaces must have light-colored finishes. Ceiling reflectance should be at least 70 percent (preferably 80 percent to 90 percent). The average reflectance of the walls should be at least 50 percent. Floor surfaces should be a minimum of 20 percent.

The development of highly efficient, cost-effective, solid-state lighting technologies, along with advanced windows and space heating and cooling technologies, can help reduce total building energy use by 60-70 percent. This improvement in component and system energy efficiency, coupled with on site renewable energy supply systems, can result in marketable net zero energy buildings.

Byram Hills School District | Crittenden Campus
Photo courtesy of Perkins Eastman | Photographer: Paul Rivera/ArchPhoto

For each Energy Star certified computer and LCD monitor, approximately 860kWh of energy are saved in one year.

T8 lamps and electronic ballasts are the standard commercial fluorescent lighting system in the United States. To achieve the highest energy savings, the more efficient lamps and ballast are required. T5 lamps, an alternate to T8 lamps, can be used since they have a higher output and offer superior overall performance in several key applications. The key difference between T8 and T5 lamps involves performance at rated temperatures. T5 lamps reach peak efficiency when the surrounding air is 95 degrees, while T8 lamps peak at 77 degrees. Specific applications will need to be evaluated.

We will use occupancy sensors, either passive infrared or ultrasonic, in most areas of the building. The greatest energy savings are achieved with manual on/automatic/off sensors when daylighting is used.

9.3.2 Equipment

Plug loads contribute up to 25 percent of the electrical load in the school. A large contributor to this load is equipment and appliances left on after use and equipment that has a phantom load when not in use. The use of occupancy sensors and unplugging fixtures is a way to control these loads and reduce energy.

Purchase of technology equipment with the Energy Star certification can significantly cut down on power consumption and the building's carbon footprint. For each Energy Star certified computer and LCD monitor, approximately 860kWh of energy are saved in one year. By using certified equipment, each machine can save an additional $5-$10 in office cooling loads annually. Certified copiers and fax machines are on average 25 percent more efficient than their non-certified counterparts. We will make recommendations and provide a list of Energy Star certified equipment to assist in purchasing.

9.4 Data/Telecommunications

Integrated Technology

For students to thrive in a world enabled by information technology, we must give them the skills to make sense of and use the available information. Many students already use computers and surf the Web on their own, but there's more to educational technology than desktop computers. Teachers and students need access to wireless laptops, and handhelds, digital cameras, microscopes, web-based video equipment, graphing calculators, and even cellular devices. They need to become responsible and savvy users and purveyors of information so that they may successfully collaborate across miles and cultures.

Switches, routers, firewalls and other equipment, both wired and wireless, are required to make technology integration seamless. Commercial grade structured cabling systems are a must. Integrating support for technology into the building design is critical.

As the demand for technology in education grows, so does the space required to support that technology. Independently cooled telecom/equipment rooms are required for approximately every 10,000 square feet of learning space. Separate space will be needed to house cellular repeaters and third party network equipment. Smaller localized closets will be necessary to support A/V equipment for teacherless two-way conference classrooms.

In terms of port density, each office will be provided with two standard telecom outlets. All other spaces including lounge areas, computer labs, and classrooms will be provided with data drops to accommodate expected computer usage. Each standard outlet will consist of one voice port and two data ports. All telecom rooms will be interconnected with fiber optic and copper riser cabling to support maximum bandwidth and flexibility for whatever the future holds. The telephone system will be designed to support Voice over Internet Protocol (VoIP). Wireless access points will be located throughout the building to allow WiFi connectivity both inside and outside the classroom.

As a result of integrating technology into the building design, the student receives the technologically advanced education required to survive and thrive in the fast paced tech-driven world in which we live.

9.5 Food Service

The facility will provide for the preparation of food for service to a maximum of 450 students pre-kindergarten through third grade. The building will have two dining areas for students. One larger area will be for the older students (kindergarten through third grade) and one smaller dining area will be for pre-kindergarten students (and possibly kindergarten students depending on the configuration of the school).

Food deliveries will arrive at the loading dock and be stored in dry food storage and walk-in cold storage assemblies. Because many food items are pre-cooked and/or frozen, the walk-in cold storage assembly will be larger than dry storage and the freezer will be larger than the cooler.

Prep areas will include (but not be limited to) prep sinks, slicers, food processors, and small mixers.

All equipment will be heavy duty commercial grade. The cooking equipment will include a convection oven, convection steamer, range, and a tilting braising pan. The exhaust hood's automatic fire suppression system will include cooking equipment fuel shut-off.

The kindergarten through third grade dining room will have one serving line. This line will include hot and cold food, plain top, milk cabinet, ice cream dispenser, cashier counter, and tray/silver cart. Heated cabinets and refrigerators will store prepared food for serving areas. The pre-kindergarten dining room will serve family style meals. Children will serve themselves from community bowls and platters.

Byram Hills School District | Crittenden Campus
Photo courtesy of Perkins Eastman | Photographer: Paul Rivera/ArchPhoto

This kitchen is designed to prepare and transport food to dining areas (pre-kindergarten and kindergarten through third grade). There will be parking for food transport carts, both hot and ambient.

Trays will be reusable and returned to the dish room. Compartmented trays which hold dishes and flatware would reduce the amount of trash, but would increase labor and the amount of space needed for cleaning/drying and storage. Another option is that all dishes and flatware be disposable.

The can wash will be outside the rear door on the loading dock, on the same level as the kitchen floor. A janitor's closet will include a mop sink and chemical storage. An office will be in the vicinity of the back door and there will also be an employee restroom, locker area, and washer/dryer.

Trays and/or flatware/dishes are to be washed by machine in a conventional dishwashing arrangement. Hose reels will be provided for cleaning of the floor and equipment. Pots will be washed in a three-compartment sink.

To enhance worker safety and comfort, all aisles will be a minimum of 42" wide. The kitchen floor will have a non-slip finish. Kitchen walls will be a smooth, easily cleanable surface. All kitchen and cafeteria equipment will be NSF and UL approved and will be of a commercial, heavy-duty quality. These items will be installed per all national and local codes.

9.6 Interiors

The principals that serve as the basis for the FirstSchool Model for optimum interiors should be a seamless transition between comfort and scale; accessibility; materials; finishes; and visual transitions, such as light, color and texture. All of these elements serve a vital role in the overall development of the learning process at the earliest age of a student. The spaces need to be designed to organize, control, transition, and interplay all of these elements. Considerations include open and flexible environments; durable, flexible and low maintenance materials and finishes; environments to support playful exploration; and use of natural light.

Comfort and Scale

Each student should feel that he or she has "a home away from home." Child comfort is most critical in those areas within the building where children spend most of the day. To create such a comfort level, the scale of the building and interior inhabitant space must be based on the respective ages of the student population. It is important that the students do not feel overwhelmed or out of place. This must take into consideration the size of the spaces, width of corridors, height of ceilings and furnishings relative to the scale of the children.

Accessibility
Provisions for handicapped access and wheelchair clearances to meet the Americans with Disabilities (ADA) height regulations, which tend to be higher than necessary for general students, must be balanced with the lower heights required for younger student populations.

Materials
School buildings are among the public structures that are called upon to last for a long time and endure decades of accommodating schoolchildren and various educational programs. These factors should be a major factor in the selection of finish materials. The materials should be durable and maintainable and withstand years of use and abuse while continuing to provide an atmosphere conductive to learning.

The following are the general material selection criteria used for the major spaces:

- Walls
  For durability, high impact gypsum products, painted concrete masonry blocks, ground-face or textured block, and brick are common alternative. For warmer materials wood and vinyl wall coverings are used.
- Floors
  Carpet materials for classrooms and large play areas should be given consideration to both enhance acoustic quality and reduce injuries associated with slippery, harder surfaces. Solution-dyed products with integral moisture backing should be specified to ensure color retention and easy cleanup of soils and spills.
  In areas used for artwork, toilet rooms, and wet or messy activities, the use of VCT or sheet-vinyl products, which provide long-term durability and maintainability as well as many aesthetic options, should be considered.
- Ceilings
  Acoustics should be addressed for each area designed. Acoustic ceiling tile is a good material to use when addressing acoustics in certain rooms. In areas with harder surfaces such as large expanses of glass wall or hard tile flooring, acoustic tile ceilings may not be adequate. Consideration should be given to the use of acoustic wall treatments such as fabric-wrapped panels.
- Wall Protection
  The protection of openings and corners, always a consideration, will ultimately help the facility maintain its appearance. The use of corner guards at key impact areas is recommended, and consideration should be given to recessed guards with carefully coordinated coloring.
- Trim and Casework
  The use of natural wood to enhance the quality of a space is often desirable and can provide a very durable low-maintenance alternative to painted trim and cabinets. Among the common woods used for their durability and affordability are maple and oak. If painted cabinets are desired, factory polyester or vinyl paint coatings offer good durability as well as easy cleanup. Countertops of plastic laminate

are quite functional, but may peel and delaminate over time. Melamine materials should be used on concealed surfaces only.

The following list contains considerations in material selection for interior materials within a school building project:

- Administration: Soft flooring; acoustical walls; appropriate lighting; cleanable surfaces; ventilation for copying areas
- Offices: Acoustical walls; durability; proper air change and ventilation
- Nurse's area: sanitary conditions; germ-resistant environment; hard and non porous flooring; smooth surfaces; proper ventilation; humidity; and temperature levels
- Library: Quiet environment; non-glare surfaces for computer use; indirect lighting; controlled moisture and humidity levels
- Classrooms: Easily cleaned flooring; hard flooring; environment conducive to concentration; water-resistant walls, floors around sink areas
- Kitchen: Hard non-slip flooring; ability to withstand heavy daily cleaning with chemicals; seamless surfaces for food prep and cooking; splash-guard surfaces at sink area; floor and wall surfaces resistant to oil and cooking residues; smooth surfaces to resist the growth of bacteria
- Dining: Hard flooring; smooth surfaces; finishes that can be cleaned with disinfectants; hard and smooth wall surfaces for cleaning
- Gymnasium: Resilient floor surface that allows true bounce and spring action; hard wall surfaces for ball play; padded wall sections; noise reduction treatments; durability of all products used; vandal-resistant materials
- Locker rooms: nonporous and nonslip flooring; water and humidity resistant materials; mildew resistant curtains; vandal resistant materials; ventilation; moisture resistant wall surfaces
- Science: Chemical and acid resistant materials; hard and cleanable floor finish; proper ventilation for chemical and gas use; water resistant work surfaces; chemical storage
- Art: Cleanable walls, floors and ceilings; hard and smooth flooring; natural light; heavy duty storage shelving; water resistant work surfaces, walls and floors

Finishes

The choice of interior finish materials can have the most profound effect on the physical environment and its familiarity to children. Finishes can also have an impact upon behavior and attendance. Many finishes consisting of endless vinyl tile, painted block walls, seas of carpeted floors are often associated with the most institutional settings and convey a stronger sense of factory than home.

A combination of finishes that create a strong design statement can provide a visually interesting environment for the students. Color, graphic patterns, texture, and special materials on walls, floor and ceilings can be strategically applied throughout the spaces to create a warm and interesting sense of place.

Textures friendly to a child's skin and body adds another aspect to a child's experience with the physical environment. A number of textures can be considered such as wood, ceramic tile, various plaster surfaces, metal or wire screens, fabric, rubber, various metal surfaces, safety mirror and glass.

Visual Transition

The wide use of light, color and texture can be very desirable.

Light, both natural and artificial, must be carefully planned. Varied lighting not only adds to the interest of the environment, but also provides options for creating moods, supporting different activities, and learning. Day-lighting may be a significant part of the education curriculum. Daylight should be allowed to enter the building from different orientations and locations. Large windows, skylights, and outdoor sundials will help to connect sunlight with the children's daily lives.

Color can be vibrant or subdued, but there is no need to limit environments designed for children to the ubiquitous primary colors. Research has suggested that bright red hues create excitement, and deep purples and greens are stabilizing and soothing. Yellow, as well as being restful, is the first color that can be perceived by small infants. Color that is very simple that provide a neutral backdrop allows the environment to be personalized and animated by its inhabitants. The neutral backdrop would not compete with the artwork and projects of the children.

10.0 FINANCIAL PLANNING FOR A FIRSTSCHOOL FACILITY

In this chapter we present information on funding capital construction and renovations for schools serving young children.

FINANCIAL PLANNING

10.1 Financial Planning for FirstSchool Buildings

Many communities across the United States are providing publicly-funded pre-kindergarten programs. The pre-kindergarten classrooms are often in school settings and staffed by school employees[1]. Yet, most often the education of preschool aged children is not paid for through the typical combination of local, state, and federal funding mechanisms used to finance education for the kindergarten through twelfth grade population. Instead, a complex blend of funding from various agencies (each with differing fiscal requirements) is used to pay for these new school services. Furthermore, since these very young children have needs that are different from those of older children, the services themselves are somewhat different in ways that have cost implications. This unique population of students places new requirements on program administrators as they seek to provide optimal programs for these young children in a school setting.

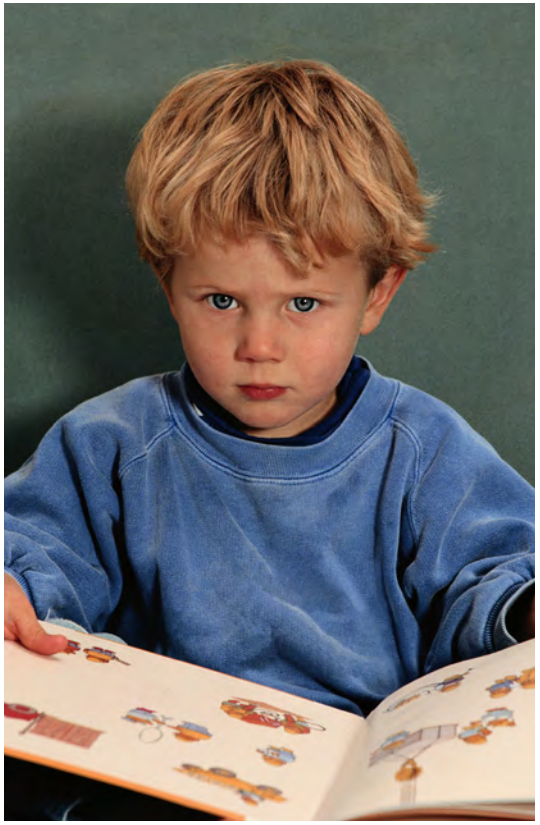
10.2 Funding Capital Construction Costs

While the funding for operational costs is often from a mix of federal, state, and local funding sources, rarely is there a corresponding mix of funding available for financing construction or the major renovations many existing schools require in order to provide appropriate space for the early childhood programs. Most often, school districts serving children in pre-kindergarten programs finance construction and renovation costs from the same sources used for other kindergarten through twelfth grade facilities. A few states have special provisions for assisting with financing construction of facilities for pre-kindergarten services. New Jersey and Connecticut, for example, both have such provisions[2].

For most local school districts, however, financing of such facilities will be accomplished through normal school financing mechanisms. This means accessing state funds for construction or relying on local bond issues. For example, Charlotte-Mecklenburg school system in North Carolina has financed renovation of older schools as special pre-kindergarten centers and has added pre-kindergarten classrooms to elementary school buildings under recent construction bonds for some 3,000 preschoolers served in the district. It has recently secured additional funding in a bond referendum to construct a new pre-kindergarten facility to address a higher than expected demand for its program. Increasingly schools are including pre-kindergarten classrooms in their standard plans for elementary school buildings.

Increasingly, schools are being seen as general community resources with libraries and media centers designed for beyond normal use by the children in the school; with playgrounds designed for community as well as school use; and with meeting spaces available for non school uses. In such cases enhanced funding to enable spaces to be designed for multiple use and users may come from county or city general revenues or bonds, or from special funding sources specifically aimed at community development.

In addition to the normal state and local school construction financing model, a few special initiatives exist specifically for facilities for young children. There are provisions under federal Head Start regulations that allow Head Start funds to be used to finance a portion of the capital costs for facilities serving Head Start children. School districts which are Head Start grantees have the ability to access Head Start funds to pay a



portion of the costs of facilities serving children in the program, even when the facility serves other children as well. Details on the Head Start options are available at: http://eclkc.ohs.acf.hhs.gov/hslc/Program%20Design%20and%20Management/FiscalProcurement%20Standards.

10.3 Issues in Financing Schools Serving Younger Children

Financing construction for preschool aged children can be difficult. In districts with a declining population, renovation of existing buildings to serve younger children can be seen as an effective use of public facilities. However, more often districts are under intense pressure to increase the total capacity of the school system to meet the needs of an increasing population. Building pre-kindergarten classrooms may be seen as competing with the funding needs of older children. This is potentially a major issue; in one district where we have worked it became insurmountable. The building being proposed was to house children ages three to seven years of age. However, the school board only considered the official school age population when considering the extent to which the proposed building would increase district capacity. Thus, when the total cost of the facility was calculated, the per-child cost was determined using only the number of children, ages five to seven, who would be using the space, making the per child cost appear much higher than if the full number of children using the space was considered.

Despite the long waiting list for pre-kindergarten slots in the district, board support for the concepts and goals of the project, and the additional financial relief that this particular project would have offered the district the board rejected the proposal.

10.4 Special Issues in Constructing Buildings for 3 and 4 Year Olds

Particular attention must be given to designing spaces that, in fact, meet the full range of needs of the youngest children served. This publication describes elements of facilities that are key to successful programming for young children in the school environment. Often, special regulations are in effect for programs that serve Head Start children, children receiving child care subsidies, or other special funds. These regulations may call for special provisions on the playground, toilet facilities, meal and snack preparation, and dining areas, as well as entry and exit requirements. The amount of classroom space required per child may be greater than that found in many kindergarten through twelfth grade classrooms, and more staff may need to be accommodated per classroom than is the case with older children. In addition, there is a greater need for dedicated spaces for families in the facility, to promote the necessary relationship between programs and families of young children. Provisions within the facility which foster close working relationships with community agencies, including health, social services, mental health, and other core community agencies are also advantageous. These provisions may include co-location of services at the school site. These are but a few of the specific provisions needed in facilities serving children below the traditional age of entry to school. The model program described in this document provides numerous examples of how such provisions may be combined in a school setting.

Endnotes:
1 Clifford, Early & Hills, 1999.
2 Sussman and Gillman, 2007.

11.0 Staffing and Operations

In this chapter we discuss how re-conceptualizing education for young children could impact the spaces and settings that facilitate different arrangements.

STAFFING AND OPERATIONS

William Malloy and the FirstSchool Transitions Committee have provided guidance about how staffing and operations for FirstSchool could vary from traditional schools[1]. Reconceptualizing indoor and outdoor learning environments could mean the need for additional staff and/or reconsideration of the roles and responsibilities of individuals. The facility must be able to furnish space and settings that facilitate these different arrangements.

Cunningham & Cardiero[2] suggest that the team providing support services to children and families consist of the following professionals: counselors, psychologists, social workers, therapists (e.g., speech, occupational, and physical), health care, special educators, and remediation specialists. Each of these professionals will require office and service space. Attention must be given to their accessibility; and proximity to one another, to children, and to family members for optimal engagement and efficient communication. The responsibility for monitoring and coordinating support services for all children in FirstSchool should be assigned to one person. Three and four year old children in an elementary school may require different staffing as well. When staff to child ratios are lower, supervision must be constant and unwavering; coordination with the family and knowledge of services that the family uses or needs are essential. Other teams that require adequate space include a child study/student support team, site advisory team, transition team, and an exceptional education diagnosis/placement team.

In a large school community, the population may be divided into "homes" in an effort to enhance relationships with a more manageable number of children and families. Each home team works toward consistency and a continuum of academic and social development both within and across grades. Options for collaboration at the home level embrace the full spectrum of the interactions ranging from individual child and family consultation to team interactions. The goal of this approach is to promote collaboration that integrates services based on the unique needs of child and family rather than the availability of services.

Particularly for children age three to five, FirstSchool advocates for the implementation of non-graded primary school classrooms. Called variously mixed-age, multi-age, or non-graded, these groupings allow children of various ages (usually a span of one to three years) and abilities to learn together and from each other. Multi-age classrooms allow children to progress according to individual rates of learning, without being compelled to meet normative standards.

Inherent in these collaborative structures is the need for both accessible space and the use of state-of-the-art technology. These teams and staff members will need personal and professional spaces that provide them places to plan, work, and meet in small groups. As well, there must be spaces for professionals who spend some of their time in schools, such as community health professionals, to conduct their work and collaborate. Technology support, within and outside the school community, provides the means for regular communication with multiple disciplines, community stakeholders, university faculty, and family members. Flexibility in design is key to making these various demands on space work effectively for both adults and children living and working in the school environment.

Endnote:
1 2008.
2 2000.

12.0 Partnering and Next Steps

In this chapter we present multiple ways in which schools wishing to implement FirstSchool principles can partner and work with us.

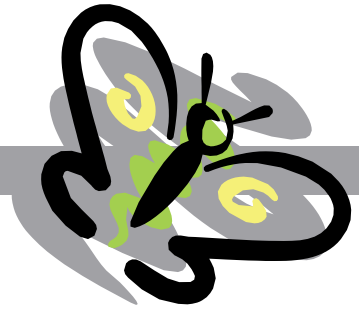
PARTNERING AND NEXT STEPS

There are multiple pathways for schools wishing to implement FirstSchool principles. FirstSchool will provide technical assistance to districts, creating new schools for children three to eight years old. In addition, FirstSchool will partner with existing schools to apply the FirstSchool framework across critical features, including the facility. Please see section 2.1 for more details about the collaborative process.

This document addresses the needs of multiple audiences. While it is designed primarily to guide and inform the construction of a new school for children ages three to eight, it may also be used to support efforts to develop a culture change in schools wherein schools adapt or renovate physical space to better serve the school staff and the young children and families who attend. Additionally, we recognize that some district leaders will decide that any one of a number of different configurations better meets the needs of their entire community – pre-kindergarten through second grade, pre-kindergarten through fifth grade, etc. The size and geographic distribution of the student population at different grade levels, projected changes in the population size and distribution, available resources, existing school buildings, and educational philosophy will all contribute to these decisions. While this document considers the space needs of a pre-kindergarten through third grade community, we believe it can be a useful tool when designing or reconsidering space for any of these configurations. A collaborative, inquiry-driven process will allow stakeholders to identify ways to modify the suggested design to suit the needs of a slightly different age range. For example, if fourth and fifth graders are included, a larger gross motor space may be necessary; if the school serves only pre-kindergarten and kindergarten students, a smaller gross motor room might be suitable. Please see chapter 10 for further discussion of this inquiry process. Finally, FirstSchool will partner with schools to apply the FirstSchool framework across critical features of systemic change that include, in addition to the facility, instructional practices and curriculum; families and communities; transitions; school health and wellness; finance; evaluation and research; and professional development. Please see section 2.1 for more details about the collaborative process.

In all cases, FirstSchool provides technical assistance to school districts, individual schools, and state education agencies interested in implementing FirstSchool concepts. Our process is based on the belief that change is not something that is imposed upon schools from the outside, but is rather fostered by people who work in schools, see the need for change and innovation and play significant roles in making change happen. FirstSchool is based on the assumption that there is more than one way to reach intended outcomes, and that each school's context will shape the beginning points and strategies used to meet desired outcomes. Genuine inquiry can only take place within a trusting environment – one where people can pose hard questions, be honest about their beliefs, and be open to different points of view. An inquiry approach pushes members of the school community to examine and refine their practices, beliefs, and expectations as they work to improve facilities design for young children. This approach provides a clear message that there are no simple answers. Each stakeholder must be able to bring ideas and concerns to the table in order to engage in meaningful discussion.

We invite you to use this document to begin your inquiry into optimal physical environments for children from age 3 through third grade. The first step is to see how FirstSchool principles interact with your realities. Our design principles are guidelines. How those principles take shape will vary in each unique context.



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