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

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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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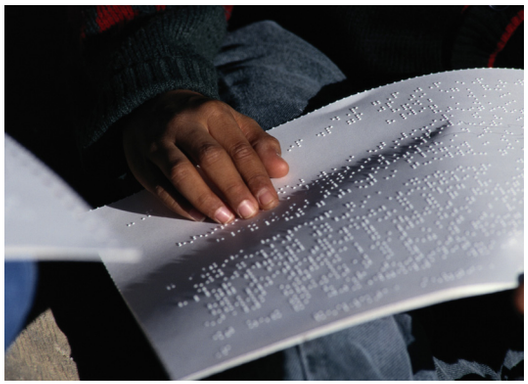

have been shown to reduce learning, memory, and alertness[28], while promoting the production of chemicals that have been implicated in positive mood changes and allowing for better learning. The Reggio Emilia schools have expanded the use of natural light in their architectural design. Windows to the 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.

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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.
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12 New, 1998.
13 Buysse, Wesley, & Able-Boone, 2001, p. 266.
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15 Wolff, 2002.
16 Edwards, Gandini, & Forman, 1998.
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19 Worth & Grollman, 2003.
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23 Wells, 2000.
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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.