

IEQ – A Key to Better Learning Environments

Creating healthy schools for our children.

— By Scott E. Powell, AIA, LEED AP, Craig Gaulden Davis

Gone are the days of the new-building smell. While many people enjoy that smell, the VOCs (volatile organic compounds) and other chemicals that make up those scents are not healthy for us. Spurred by the rating system for sustainable buildings from the USGBC (U.S. Green Building Council), more attention is being paid to the Indoor Environmental Quality (IEQ). This focus has generated a wide range of design techniques that can improve IEQ for school buildings, often with little cost premium.

IEQ essentially looks at items that impact the environment inside a building such as natural lighting, ventilation, occupant comfort, air quality, acoustics, etc. Sustainable design includes guidelines for greatly improving IEQ, and since most people spend the majority of their lives indoors, this becomes an important design consideration.

Schools have focused attention on IEQ with good reason: Poor air quality has been shown to be a deterrent to learning. Studies have shown that children perform better on tests, have fewer headaches, and are less tired in buildings with better IEQ. In addition, many children have allergies that are easily activated by pollutants in the



*A.J. Whittenberg Elementary School of Engineering in Greenville, S.C.
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air. The USGBC has recognized these effects and offers certification targeted toward schools.

The LEED for Schools certification has a number of requirements, including several that focus on ensuring proper indoor air quality. The loss of the new-building smell is the result of products with low VOCs. VOCs are emitted as gases from certain solids or liquids, such as paints, sealants, carpets, cleaning products, etc. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. A decade ago, it was a challenge to specify products with low VOCs, but today manufacturers offer a broad range of low-emitting products.

Increasing Occupant Comfort

The comfort of a building's occupants, including children, is vital to whatever tasks they hope to com-

plete. Increased thermal comfort and attention to the overall building envelope is required by the building code and current ASHRAE standards. Insulated glass and special coatings such as low-E film allow fenestration in exterior walls without compromising the thermal integrity of the building shell.

Precast concrete panels provide outstanding thermal qualities along with many other benefits. For example, typical exterior precast concrete sandwich wall panels can provide 3 or more inches of continuous insulation sandwiched between wythes of concrete. This maximizes both the insulating properties desired and thermal mass, which can reduce HVAC system requirements and improve energy efficiency. The lag effect of thermal mass can also help maintain a more uniform temperature within the building, further enhancing occupant comfort.



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Acoustics and Mold

LEED for Schools has a prerequisite for acoustics. Recent studies confirm common sense: students perform better when they can hear the teacher. There are several factors that affect school acoustics, including isolation and insulation from external noise sources and absorption of internally generated noise.

In the late 1990s, mold as it related to flooring materials, in schools was a big issue, and it resulting in carpet being removed from classrooms, sometimes unnecessarily. Part of the problem was that maintenance personnel were given insufficient equipment and virtually no training. For example, maintenance crews would clean classroom carpets during the summer, leaving a surplus of water in the carpet. Then the staff would leave for vacation, shutting down the mechanical system—which encouraged mold growth.

With proper equipment and training, carpets can save districts money on long-term maintenance costs and help solve the acoustic issue. A.J. Whittenberg Elementary School of Engineering in Greenville, South Carolina, for example, was seeking Silver LEED certification and most likely would not have met the prerequisite for minimal acoustical performance without carpet tile in the classrooms.

The design team eliminated the concern that carpet would absorb contaminants by specifying carpet squares. If a carpet tile becomes soiled, it can be replaced by a surplus tile while the stained tile is shipped to a dry cleaner. In addition to outstanding sound absorption, carpet facilitates differentiation where children can sit on the floor and learn in small groups.

Another method to reduce mold is to eliminate both the moisture and food sources for mold. Today, many schools are moving away from traditionally designed cavity-wall systems to reduce the uncertainty that can be concealed inside the cavity. Often, moisture issues are not known until the damage is great. Face-sealed systems, such as precast concrete, can help greatly reduce moisture penetration and reduce mold potential. Of course, concrete also does not provide a food source for mold.

Acoustics in classrooms often are affected when air conditioning is added to older schools. The least expensive solution has been to re-

place a window with a wall-mounted mechanical unit. The units typically are loud and primarily benefit the students sitting closest to the air source. Schools continue to struggle with sufficient funding for facilities, so wall-mounted mechanical units are still popular today, but they have been greatly improved.

Units today are available with ductwork to properly distribute the air across the classroom. They are also designed to run more quietly and can be placed inside the classroom so only a louver is visible from the exterior rather than the hanging unit. While the units are not energy efficient when compared to a four-pipe system with a sophisticated control system, they allow for individual classroom control and help meet budget constraints.

Finally, noise must be limited from nearby activities, such as outside the classroom. The selection of envelope systems and interior partitions with the appropriate STC rating to help isolate external noise sources will help.

Daylighting

Natural lighting provides the biggest IEQ benefit in children's learning environments. Research shows that children perform better on standardized tests when they are educated in naturally-lit classrooms. However, the daylighting point in the LEED system can be expensive. To pull natural light into classroom interiors, higher ceilings and light shelves are typically necessary, in addition to corridor light wells.

Daylighting may be cost-prohibitive, but architects should continually strive to ensure as many classrooms as possible have exterior exposures facing north or south to reduce glare and provide views to the exterior (achieving 90% of spaces will secure a LEED point). Windows in all spaces are desired, but teachers are likely to close the blinds to block the eastern light when the sun is low and often do not open the blinds in the afternoon.

At the A.J. Whittenberg school, the structural system was changed to allow for ribbon windows on the north- and south-facing classrooms. Horizontal precast panels were hung from a steel frame to accommodate the windows, while sunshades were placed along the south elevation. The result is a light-filled classroom with outstanding thermal comfort and ex-

cellent acoustics. The building is used as a learning tool in the school's engineering curriculum.

Impacting Construction Techniques

Enhancing air quality starts during construction. Duct cleaning has become a popular business, but measures should be taken to protect against dust accumulation from installation onward. It has become common for contractors to install the equivalent of Saran Wrap on each end of ductwork when it is delivered on site to prevent dust from collecting during construction.

All HVAC units should also be provided with temporary filters that are changed periodically during construction. Increased ventilation and the introduction of more outside air allows for more air exchanges, which eliminate the germs and odors that can reside in schools.

Traditional school materials such as brick and block are slowly being replaced with alternative construction materials. Due to durability, low maintenance, speed of construction and other benefits, there has been an increase in the use of precast concrete for educational construction projects. The rapid enclosure helps to minimize outdoor contaminants and moisture exposure. Increased moisture exposure during construction, can lead to mold and other indoor air-quality issues.

The biggest driver for focusing attention on IEQ is the proven benefits it provides to the learning environment, and its value in helping children succeed in school. We may miss that new-building smell, but the creation of a positive atmosphere for learning is worth the sacrifice. Regardless of whether owners are concerned with LEED certification, the design community should strive to create quality indoor environments. These considerations should include solar orientation of the classrooms, an efficient building envelope, mechanical systems with proper temperature controls, and effective acoustics. Many available options do not cost more—but do require more education on the benefits of their use. Our children's future—and ours—depends on our efforts. ■

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