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The Latest Thinking and Best  
Ideas on the Planning and Design  
of K-12 School Buildings

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# Little Green Schoolhouses

The massive schools construction program currently underway provides a **once-in-a-generation opportunity** to create buildings that will influence the lives of students for decades to come **BY DEANE EVANS, FAIA**

**H**igh-performance schools—those that integrate the best in today's design strategies and building technologies—and can also referred to as "green" or "sustainable"—can help us make the most of the opportunity presented by today's massive school construction programs. What is a high-performance school? While there are many variations, in general high-performance schools are healthy, productive, and comfortable environments for students and teachers, that provide high levels of acoustic, thermal and visual comfort. Their windows and skylights admit generous amounts of daylight, and the buildings are safe and secure. There are other advantages. They are cost-effective to own and operate because they use durable products and systems. Their systems and materials are chosen using life-cycle cost analysis, rather than the cheapest first-cost. During design, energy analysis tools are used to optimize the building's performance, and after construction its equipment is "commissioned"—fine-tuned so it operates correctly. High-performance schools are available for use by non-students during hours when the school is not in operation, and community participation during design is encouraged.

These buildings also use highly-efficient heating, cooling, and lighting systems fueled by renewable sources where possible. Their site planning is environmentally responsive, controlling such things as glare from parking lot lights and stormwater runoff, and their plumbing systems make efficient use of water.

While creating a school that achieves all



these performance objectives may sound challenging, it is actually very straightforward. It does, however, require an integrated, whole-building approach during the design process—an approach that establishes high performance as a top priority from the very beginning. Key systems and technologies—the "building blocks" of a high-performance school—must be considered holistically, and their selection is optimized based on their combined impact on the comfort and productivity of students and teachers. The result will be an entire facility that is optimized to achieve long-term value and and operational efficiency.

It is worth noting that high performance does not mean "high-tech." Optimizing a school's performance does require creative thinking and diligent management, but highly-complex systems or cutting-edge technologies are emphatically not required to create a high-performance facility.



Newark Science Park High School, recently opened by the architecture firm Einhorn Yaffee Prescott, in Newark, New Jersey, allows students to observe its sustainable features firsthand. These include photovoltaic panels, geothermal and energy-recovery systems.

## HOW CAN I GET ONE?

The key to creating a high-performance school is to start out by making high performance a top priority for the project. There are many guidelines available for helping designers and educators achieve these objectives (a box on page 26 contains web links to these organizations as well, as others which are referred to in this article.) Of course, the design and construction process must be managed effectively. Luckily, there are two



Harley Ellis Deveraux, an architecture and engineering firm, and Greenworks Studio, a sustainable design consultant, recently completed Charles H. McKim Elementary, a CHPS school in Los Angeles.



Light shelves bounce light through short windows onto classroom ceilings, and shade the glass below.

solid process management strategies available as well. A school development team can use a rating system to help guide the design process, or it can use an interactive-management approach based on a series of questions asked at each stage of the design process, to keep the team constantly focused on the building blocks of a high-performance school. At the time this article was written, the best-known means for evaluating the performance of green buildings in general is the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Rating System. Its new LEED for Schools Rating System will be released in the spring of 2007. The "CHPS Criteria," produced by the Collaborative for High Performance Schools, also has an excellent assessment method. The best-known question-based system is contained in the "High Performance School Buildings Resource and Strategy Guide" published by the Sustainable Buildings Industry Council (SBIC). Whichever approach is used, the key is to set high performance as a critical goal early in the process, make sure that the design team has buy-in from key decisionmakers along the way, and that everyone stays committed.

## BENEFITS

Does a high-performance school really make a difference—for students, teachers and the

community? The answer is yes. SBIC and CHPS list the following key benefits for a high-performance school: better student performance; reduced operating costs; increased average daily attendance; better teacher satisfaction and retention, and reduced liability exposure. While all these benefits are important, the first two are worth special attention. A recent study commissioned by the National Clearinghouse for Educational Facilities concluded that, "School facilities affect learning. Spatial configurations, noise, heat, cold, light, and air quality obviously bear on students' and teachers' abilities to perform." In addition, a 2006 report from the National Research Council found that, "there is a robust body of evidence indicating that the health of children and adults can be affected by air quality in a school" and that, "Sufficient evidence exists to conclude that there is an association between decreased noise levels in schools and improvement in student performance."

Taken together, these studies point to at least one clear conclusion: school buildings matter. They are not merely settings in which teaching and learning take place, but are active variables in the process and can have positive, or negative, impacts on student performance. High-performance schools, by definition, seek to optimize systems with the greatest observed impacts on student and

teacher performance: lighting and daylighting, indoor air quality, moisture control, and acoustic, visual and thermal comfort.

High-performance schools also make energy efficiency a high priority—and reduced energy use is one of the key ways to reduce a school's operating costs. Whether through conservation or the use of renewable energy strategies such as daylighting, photovoltaics or solar hot water, a high performance facility seeks to drive energy use as low as possible while still maintaining a high-quality learning environment. The U.S. Department of Energy estimates that, "New high-performance schools—designed to save energy and reduce environmental impact—can cost 50 percent less to operate than traditionally designed schools." This can mean substantial savings to a school's operating bottom line—and is another clear advantage of a high-performance facility.

## DOES IT COST MORE?

There are actually two short answers to this question: "yes, but..." and "no, but...". The "yes, but" camp—reinforced by studies for the USGBC and the U.S. General Services Administration—holds that it does cost more to create a high performance "green" facility, but that these extra costs are quickly recouped by the benefits provided by the extra investment. According to a study by



The architecture firm Innovative Design has used skylights in large rooms, such as this gymnasium at Heritage Middle School. Baffles block direct sunlight.



Innovative Design used a similar approach at Durant Road Middle School. Both schools are in the Wake County Public Schools System in Raleigh, North Carolina.

Greg Kats, et al. of Capital E, the school's energy savings alone will pay back an investment in high performance, while other benefits can increase this payback many times. Although the increases in first cost are real, varying from 0.6 percent for the USGBC's basic LEED certification to 6.5 percent for a LEED Platinum certification, it is clear that they pay for themselves quickly and provide lasting benefits for a facility over its lifetime.

The "no, but..." camp holds that once a design team knows how to do it, delivering a high-performance facility should not cost more, assuming that the budget is not artificially low to begin with. This opinion seems to be reinforced by a recent study by Davis Langdon, an international cost-estimating firm. Based on an analysis of the firm's comprehensive database of school costs, it appears that schools seeking LEED certification can be found across a wide spectrum of per-square-foot costs—from

low to high. Schools not seeking LEED can also be found across the same spectrum. That means LEED schools can be achieved for the same costs as other schools, whether the other schools are inexpensive or expensive. Wherever one is on the cost spectrum, a high-performance facility should be deliverable. Whichever camp you are in, there are some key things to remember about the cost issue.

- + First costs trend lower with experience. As the team gets more knowledgeable and comfortable with high performance, they also become more efficient.
- + Life cycle costs are always lower in a high performance facility, so there's always (eventually) a net benefit for any additional investment that might be needed.
- + Mindset is critical. The more the team is committed to creating a high performance facility within an existing budget, the more likely they are to succeed.

## NEXT STEPS

Every school building is a critical component of a quality education, lasting longer and affecting more students than any book, computer or white board ever will. A huge amount of new knowledge that has developed over the last decade gives us the ability to make these buildings, that are so important to the education of our children, into truly outstanding, high performance facilities—even on limited budgets. A great deal of this information is available on the Web and easy for everyone to access. All that remains is for us to use these tools as we go forward to make sure that every "School of the 21st Century" is a high-performance facility. ■

Deane Evans, FAIA, currently directs the Center for Architecture and Building Science Research at the New Jersey Institute of Technology. He also serves as vice-chair of the Sustainable Buildings Industry Council.

Kats, Greg et al. "National Review of Green Schools: Costs, Benefits, and Implications for Massachusetts," Massachusetts Technology Collaborative, December 2005. Download at: <http://www.cap-e.com/ewebeditpro/items/O59F7707.pdf>

Davis Langdon, Lisa Fay Mattiessen, Peter Morris "Costing Green: A Comprehensive Cost Database and Budgeting Methodology," July 2004. Download at: <http://davislangdon-usa.com/Attachment%20Files/Research/costinggreen.pdf>

Schneider, Mark. "Do School Facilities Affect Academic Outcomes?" National Clearinghouse for Educational Facilities; 2002. Download at: <http://www.edfacilities.org/pubs/outcomes.pdf>

Review and Assessment of Health and Productivity Benefits of Green Schools: An Interim Report, National Research Council, published by the National Academies Press, Washington, DC

"Our Schools are Failing Energy 101," U.S. Department of Energy, Energy Efficiency and Renewable Energy: [www.eere.energy.gov/buildings/info/schools/index.html](http://www.eere.energy.gov/buildings/info/schools/index.html)

For more information on high-performance schools and sustainable design see:

Collaborative for High Performance Schools: [www.chps.net](http://www.chps.net)

Sustainable Buildings Industry Council: [www.sbicouncil.org](http://www.sbicouncil.org)

U.S. Green Building Council: [www.usgbc.org](http://www.usgbc.org)

U.S. Department of Energy: [www.energysmartschools.gov](http://www.energysmartschools.gov)

U.S. Department of Environmental Protection [www.epa.gov/schools](http://www.epa.gov/schools)

High-performance School Design online training for architects and engineers: [www.hpschooldesigntraining.com](http://www.hpschooldesigntraining.com)

Information on online daylighting design training programs is available at: [www.daylightingtraining.org](http://www.daylightingtraining.org)

A collection of resources on high-performance schools can be found here: [www.highperformanceschools.org](http://www.highperformanceschools.org)

These organizations also offer resources to those who are interested in building high-performance schools:

U.S. Department of Energy: [www.energysmartschools.gov](http://www.energysmartschools.gov)

U.S. Department of Environmental Protection: [www.epa.gov/schools](http://www.epa.gov/schools)

Sustainable Buildings Industry Council: [www.sbicouncil.org](http://www.sbicouncil.org)