K-12 school design
THAT PAYS OFF FOR STUDENTS

JUSTIN MACONOCHIE / COURTESY FANNING HOWEY

Fanning Howey designed the "grand stair" at the Milan (Mich.) Center for Innovative Studies as a multi-purposed central stairway, presentation space, landing area for small group meetings, and circulation pathway.

LEARNING OBJECTIVES

After reading this article, you should be able to:

+ DISCUSS integrated design strategies that help make K-12 facilities more energy efficient and sustainable while reducing the cost of operations.
+ DESCRIBE how current educational approaches inform school facility design, including sustainable design approaches. net-zero energy strategies, and the use of modular or prefabricated classrooms.
+ LIST the various technologies, materials, and systems that create a learning tool out of building features and energy-management systems. to design high-performance schools that emphasize student health and enhance classroom performance.
+ COMPARE various design solutions and architectural features intended to encourage student interaction, physical activity and health, business community involvement, and the use of new technology in the classroom.

BY C.C. SULLIVAN AND BARBARA HORWITZ-BENNETT, CONTRIBUTING EDITORS

More and more educators are being influenced by the Reggio Emilia approach to pedagogy, with its mantra of "environment as the third teacher"—an approach that gives Building Teams a responsibility to pay even closer attention to the special needs of today's schools. In addition to helping support the pedagogical aims of those owner institutions, Building Teams are also crafting new approaches to creating sustainable, high-performance K-12 schools.

As school districts struggle to find the capital to build and maintain energy-efficient, healthy environments, K-12 project teams are developing strategies to help support high-performance educational facilities and stay on budget. This approach begins with Building Teams taking an integrated approach where the architect, engineer, contractor, and building owner collaborate early on in the project and take a holistic approach to the design.

"More and more, stakeholders in the educational sector are moving toward a more holistic approach to built space," says Jay M. Brotman, AIA, Partner with Svigals + Partners (www.svigals.com). Every aspect of the facility can impact students, teachers, staff, and visitors, he notes.

Adopting a holistic system reduces construction and operations costs while creating a better environment, says Steven Turckes, AIA, LEED AP, K-12 Education Global Market Leader for Perkins+Will (www.perkinswill.com). "An integrated approach allows us to first think about how we can design a façade and massing strategy that will make the entire building more efficient, bringing energy costs down and promoting resource conservation," he says.

Whether as part of an integrated project delivery, design-build, or traditional design-bid-build methodology, an integrated team will establish high-performance education and sustainability goals, such as daylighting and natural ventilation, in the conceptual design phase, says Wendy Rogers, AIA, LEED AP BD+C, Design Principal with LPA Inc. (www.lpainc.com). "As part of our process we [should be] constantly asking ourselves, 'What does the site give us for free?'"

While natural ventilation works quite well in mild climates like Southern California, regions like the Midwest will often require more engineered solutions. Michigan-based Peter Basso Associates

(www.pbanet.com) often specifies *dedicated outside air system* (DOAS) and *demand-control ventilation* strategies in schools. The firm's Robert N. Roop, CPD, LEED AP BD+C, K-12 Group Leader and Principal, points out that a DOAS delivers only code-required quantities of pre-treated outside air to occupied spaces. It is considered a high-performance system because it reduces total air quantities being treated and distributed, which allows reductions in fan energy and overall equipment size.

Ian Hadden, PE, LEED AP, Energy/Sustainability Services Manager in the Little Rock, Ark., office of Fanning Howey Associates (www.fhai.com), identifies high-efficiency lighting systems as low-hanging fruit in K-12 designs. With lighting energy on average accounting for 14% of a school building's total energy consumption, Hadden claims that high-efficiency lighting is relatively easy to design, implement, and maintain, and produces significant results.

Hadden, a frequent lecturer with the Council of Educational Facility Planners International (www.cefpi.org), EPA Tools for Schools Program (http://www.epa.gov/iaq/schools), and Rebuild America Energy Smart Schools Program (http://1.usa.gov/13CN73Q), advocates for optimized building orientation to reduce glazing requirements and offset HVAC loads, as well as targeting the building envelope to make sure that *high-performance continuous insulation* (CI) and *air-barrier systems* are properly detailed. Although these materials and assemblies may come with a premium first cost, the resulting energy performance benefits make them worthwhile over the building's lifetime, says Hadden.

Geothermal heating and cooling systems are also coming under consideration. School districts can recoup the investment, based on a typical school facility's long service life.

Chester Bartels, Senior Designer with Hord Coplan Macht, Baltimore, sees *vegetated roofs* gaining popularity, as are water-conserving plumbing fixtures and lighting controls. Bartels is also seeing more *multistory school buildings* to help reduce site footprints and increase overall efficiency.

P+W's Turckes lists *site analysis* as a key element of sustainable design, as well as carefully selected ventilation systems to not only reduce energy consumption but promote good indoor air quality as well. The firm uses calculated material selection to help school clients reduce the use of finite resources and minimize construction waste. They also use *native plant materials* and *absorption drainage* as a step toward boosting biodiversity and water quality.

K-12 SCHOOL BUILDINGS THAT TEACH

The genetics of the K-12 project can extend to layout and design features that reflect the curriculum or needs of the K-12 student body. For example, Svigals+Partners has used sculptures, murals, and terrazzo floor inlays to reinforce classroom lessons, says Brotman. WXY Architecture + Urban Design (www.wxystudio.com) recently developed a floor plan for REED Academy in Oakland, N.J., based on the Reggio Emilia refrain—"environment as teacher"—for a student body challenged with autism spectrum disorders. The solution applies residential design ideas as well as communal spaces like alcoves and "points of interest," which are used in teaching and training, according to Claire Weisz, FAIA, Founding Principal of WXY.

On top of this architectural movement, more schools are capturing sustainable design features as educational tools. Peter Basso's Roop, former President of CEFPI's Midwest–Great Lakes Region, estimates that a third of the firm's K-12 projects employ high-performance design elements as teaching tools—everything from energy dashboards and vision panels to informational displays and accessible rooftop platforms. Students observe, take notes, and get tested.

COIRTESY WXY ARCHITECTURE + URBAN DESIGN

WXY Architecture + Urban Design's design for REED Academy in Oakland, N.J., is based on the Reggio Emilia principles, notably "environment as teacher," for a student body with special needs. This approach to pedagogy places additional responsibilities on Buiding Teams.

This concept has become an imperative of school designs for firms like LPA, says Rogers. "We believe strongly that the sustainable aspects of our building must be demonstrated to create a future generation of informed leaders," she says. Such features as wind anemometers connected to an environmental science lab and environmental graphics in building lobbies have shown up in recent LPA projects.

Hadden sees increasing use of *energy dashboards*, due in part to the technology's decrease in cost. The online tools allow facilities staff to monitor real-time data on water and energy consumption; just as easily, teachers and students can also plug in, using the interface as a learning tool about conservation. Fanning Howey installed such an energy dashboard in the student union at Colonel Smith Middle School in Fort Huachuca, Ariz. The touchscreen displays real-time energy uses from the school's water, wind, and rainwater systems; students can also access this data on their hand-held devices. Hadden reports that teachers are actively incorporating the

MODULAR GAINING STRENGTH with school boards

With budget, space needs, and speed-to-market pressures bearing down on school districts, modular classroom assemblies are often a go-to solution. And while modular does offer many benefits—notably less construction waste, project delivery efficiencies, and factory-controlled, high-quality fabrication—school districts frequently view modular as a temporary solution, and settle for units with poor design and low-quality materials. As a result, when the "temporary" modules inevitably turn into permanent structures, they fall short in terms of aesthetics and building performance.

Today, however, school districts are starting to look at higher-quality modular construction, with the understanding that the classrooms may remain on site for a number of years and must provide a proper learning environment, says Wendy Rogers, AIA, LEED AP BD+C, Design Principal with LPA Inc.

Building Teams are using incremental improvements as a strategy to create better modular solutions. For example, in a recently completed a 35,000-sf modular two-story project, LPA pushed the manufacturer to upgrade many of its standard details in order to ensure that the products met the project's design criteria.

When executed properly, prefab construction can offer column-free interior spaces that promote flexibility and access to crawl space, open ceilings that allow for easy technology upgrades, and rain-screen building envelopes that are highly insulated and allow options and variation for exterior materials, according to Chester Bartels, Senior Designer with Baltimore design firm Hord Coplan Macht.

For example, the firm's modular learning studios at the Barrie School in Silver Spring, Md., easily convert into large group learning spaces, multiple small group collaboration areas, and a large town hall lecture room—all supported by flexible furniture, movable wall panels, smart boards, good acoustics, and strategically designed fenestration for optimized daylighting and views.

A recent exhibition, Green Schools, at the National Building Museum in Washington, D.C., included a green classroom called "Sprout Space," developed by Perkins+Will. (See the time-lapse video of its construction at: http://www.nbm.org/media/video/green-schools/sprout-space-time-lapse.html.) P+W's modular template in Sprout Space offers a healthy, sustainable, and flexible 21st-century modular classroom. The design incorporates passive and active green-building strategies and is highly customizable.

COURTESY PERKINS+WILL

Sprout Space, a modular template designed by Perkins+Will, is a high-performance, customizable solution, bringing K-12 modular design to the next level and attracting interest from school officials.

For instance, Sprout Space can incorporate sunshades, integrated rainwater collection, photovoltaic roof panels, LED lighting with lighting controls, efficient heating and cooling systems, and eco-friendly materials. "Sprout Space also features a dynamic plan that is well-suited for various teaching styles, seating configurations, and outdoor learning opportunities," says Steven Turckes, P+W's K-12 Education Global Market Leader. "Each classroom opens up to the outdoors through large bifold doors, encouraging experiential learning, expanding the classroom, and complementing numerous teaching methods."

Because fabrication occurs simultaneously with foundation and site work, high-quality modular classrooms can be completed four times faster than conventional stick-built projects, says Turckes. Available in modules up to 1,500 sf in size, multiple buildings can also be linked together to create an entire school.

Another customizable modular template, called simply "sky," comes from contractor Silver Creek Industries (silver-creek.net). This high-performance modular classroom, which has been approved by the California Division of the State Architect, offers two contemporary floor plans and a variety of interior and exterior finish options—low- and no-VOC finishes, paints, and adhesives, sound-absorbent surfaces, high-performance windows, clerestory windows, tubular skylights, and an occupancy- and photo-control dimming system.

Ryan McIntosh, LEED AP BD+C, Project Manager and Director of Design Services for Silver Creek, says that sky modules beat California's Title 24 baseline by up to 45%. The module has been developed to meet the CHPS PreFAB rating system, a label that designates qualifying prefabricated classrooms for use in high-performance building projects. Schools and districts can apply the CHPS PreFAB rating toward CHPS Verified recognition for new classrooms.

SHELLEY MARIE IMAGES/EMC2 GROUP/ FANNING HOWEY

The building as teaching tool: Students at Colonel Smith Middle School, Fort Huachuca, Ariz., can access real-time energy data through a dashboard touchscreen or via an app on their mobile devices.

dashboard into project-based learning activities.

Svigals's Brotman points to outdoor labs, such as natural and constructed wetlands his firm developed for recent school projects. Peter Basso Associates recently built a teaching studio on the bank of a pond being used for stormwater retention, fire-protection water supply, and a geo-exchange system.

Harley Ellis Devereaux is designing an accessible green roof at Kearny High School in San Diego, where students will be able to experiment with gardening and see demonstrations of how the photovoltaic arrays operate. "We are also planning to have viewports in the walls of the building where mechanical and plumbing distribution systems can be viewed," says John R. Dale, FAIA, LEED AP, Principal and K-12 Leader in Harley Ellis Devereaux's (www.hedev.com) Los Angeles office.

Bartels notes that passive demonstrations of exposed building systems are a great way to pique students' curiosity, and that they are more likely to reference the accompanying signage or informational graphics to find out exactly what they are looking at and how the building systems work and contribute to building performance.

For Ranch Elementary School, now under construction near San Diego, a Building Team is incorporating lobby informational displays that detail the sustainable features of a grid-neutral building. "Diagrams explaining the combination of crystalline and thin-film photovoltaic arrays and their capacities, the displacement ventilation system in the classrooms and energy dashboards, which will monitor energy performance in both active and passive modes, will be very much in evidence," says Dale, who chairs the AIA Committee on Architecture for Education's Alternate Learning Environments subcommittee.

COLLABORATION AROUND THE TABLE

Meanwhile, the trend toward collaborative learning shows no sign of slowing down, transforming the typical classroom from traditional rows of desks to *multivariate group learning configurations*. "The old factory model of schools based on the needs of employers from the Industrial Age is no longer relevant to today's learner, as 21st-century skills demand a new type of learning environment," says Turckes.

The Reggio Emilia approach favors classrooms that are integrated with the rest of the school and connected to the larger community. This parallels changes in workplace design. Many of today's Fortune 500 companies want to promote "serendipitous encounters" in office settings, which can lead to new ideas and the fostering of multidisciplinary teams inclusive of people with varying expertise. "This way of thinking is being mirrored in schools, as many are actively moving toward the more integrated and project-based learning approaches," says P+W's Turckes. "Schools that support these types of encounters and collaborative learning require spaces that are flexible and technologically enhanced, and that feature areas for small-group projects as well as large group presentations," he says.

The Blue Valley Center for Advanced Professional Studies in Overland Park, Kan., affords students the opportunity to collaborate with business professionals in the community on real-world projects. To support this activity, Perkins+Will created an environment that mirrors a professional workplace, with large flexible spaces, transparent project areas, and small group areas for meetings, presentations, and individual work.

Similar concepts are being tested in the design of Career Tech High School near Sacramento. Collaborating with a number of environmental groups, the Harley Ellis Devereaux–led team set up classroom clusters around a large work studio with easy access to roof gardens and work yards. "The classrooms themselves were designed to easily open up to the adjacent studio spaces so that multiple small group projects can take place simultaneously in varied settings, but with appropriate supervision and visibility," says Harley Ellis's Dale.

Some schools are even adopting ideas from children's museums and interactive science centers, says Lee H. Skolnick, FAIA, Principal of Lee H. Skolnick Architecture + Design Partnership (skolnick.com), which specializes in both facility types. "Like a museum, these schools

COURTESY PERKINS+WILL

The Blue Valley Center for Advanced Professional Studies, a charter high school in Overland Park, Kan., designed by Perkins+Will, employs flexible spaces, transparent project areas, and small-group meeting areas.

COURTESY PERKINS+WILL

A model of sustainable design based on the Collaborative for High Performance Schools principles, Zan Wesley Holmes Jr. Middle School in Dallas features water conservation systems, energy-efficiency strategies, improved indoor air quality, and eco-friendly materials.

CHPS SCHOOL
provides a model of high performance

Incorporating Collaborative for High Performance Schools (CHPS) guidelines as a base, the Perkins+Will–designed Zan Wesley Holmes Jr. Middle School in Dallas capitalizes on natural resources while blending into the surrounding terrain.

In sync with the 29.3-acre site's sloping topography, the architecture is massed to minimize the structure's volume on the side that is surrounded by housing; the other side is expanded to take advantage of the natural views afforded by a park area and natural landscaping.

Set up along a multi-level central spine, the public, multi-purpose spaces are separated from the core academic areas. The building's circulation is set up to encourage social interaction as students move from class to class. Part of the building is organized in clusters of flexible learning communities that can easily respond to changing curriculums. The building also incorporates an outdoor learning area with a covered patio and courtyard space for the science, art, band, and cafeteria spaces.

The 202,000-sf middle school for 1,250 students has a white-coated roof membrane with a high solar reflective index that reduces urban heat island effect. Because the site itself slopes down 45 feet, the building orientation and section design were carefully calculated to eliminate the need for excavating dirt or importing fill. Impervious surfaces were kept to a minimum, and a three-level scheme was implemented to reduce the amount of stormwater runoff.

More than a million gallons of water is saved annually through water-efficient sinks, toilets, and urinals. The school also installed additional metering and monitoring devices in order to track real-time water consumption and better control water usage.

High-performance HVAC, lighting controls, and building materials are enabling the school to perform 30% better than ASHRAE 90.1-2004. Thermal bridging was eliminated via the application of two inches of rigid insulation outside the exterior sheathing to boost the enclosure's thermal performance; a ground-source heat pump delivers energy-efficient heating and cooling.

All floors, walls, and ceilings were made from low-VOC materials. The ceiling tiles have a high noise reduction coefficient. Each classroom has at least one operable window, plus individual temperature and ventilation controls. Carpet tiles, acoustical ceiling tiles, and building insulation products all contain recycled content. The structural frame was produced with concrete containing high fly ash content.

Tying it all together as a teaching tool, Perkins+Will packaged the sustainable design features into an interactive electronic document for use in the classroom.

reflect a narrative that allows the building's features to embody the school's educational philosophy," says Skolnick. "In some cases, the school can use this approach to emphasize integrated, hands-on and real-world learning." In line with the Reggio Emilia philosophy of the school environment as the "third teacher"—after teachers and parents—museum design concepts help create school buildings that work as active learning and teaching tools, he says.

An overlay of visual access to school subjects and inspirational ideas is behind the "informal education" techniques gleaned from children's museums and science centers, says Skolnick. Adapting them within the context of formal education is the main challenge. An innovative example: Summit Elementary School in Casper, Wyo., where nontraditional classrooms with movable walls, a village center, wind turbines, and a range of interactive opportunities actively engage students. Students have access to interactive real-time energy use and production displays, and a map of Wyoming is featured on the school's Village Square floor as a geographical teaching tool, while other graphic floor markings teach measurement and scale. An electronic weather station allows students to track local meteorological phenomena, adds Skolnick, who has served on various panels for the National Endowment for the Arts and the New York State Council on the Arts.

Svigals+Partners employed art and sculptural panels as part of Jonathan K. Reed School in Waterbury, Conn., to reflect the city's industrial history. "The Waterbury Clock Company, which eventually became a Timex plant, was a major presence in Waterbury for over a century," says Barry Svigals, FAIA, Founding Principal. "It seemed appropriate to consider 'time' as part of the school's overall educational theme."

One roadblock to innovation of this kind, however, can come from local codes and regulations. Kate Mraw, CID, LEED AP BD+C, Associate and Interior Designer with LPA, says it can be difficult to incorporate collaborative learning spaces and still conform to California's building code requirements for circulation and egress. "This requires creative solutions for exiting that don't unnecessarily burden the circulation factor," she explains. "It means that collaborative learning actually informs the building design as we design from the inside out."

THE HIGH-TECH DIVIDEND

Going hand in hand with the collaborative learning trends are educational requirements for technology and connectivity that meet today's changing needs. "Nothing has revolutionized the learning experience than the advent of classroom technology has in the recent past," says Roop. It's not just recent technological advancements that Building Teams are concerned about, but how technology will continue to progress in coming years. Consequently, flexible infrastructure design is imperative.

"An ideal solution is to create infrastructure in several places in the classroom— wireless data points above, projection capability at the ceiling, and multiple points of teacher connection—to allow for movement around the classroom and seamless transitions from lecture mode to team projects and presentation," says LPA's Mraw.

Nor is it just a matter of installing a few extra outlets. Rather,

technology is impacting a whole range of design decisions, such as daylighting and acoustics. Furthermore, technology is no longer limited to the classroom. "If learning is going to occur everywhere, then every space—even corridors and commons areas—must support the educational process," say John Gladden, Project Designer with Fanning Howey.

A somewhat counterintuitive trend is the gradual disappearance of dedicated computer labs, as teachers and students are actively using laptops and portable devices throughout the school, not just in one room.

Changes in digital technology are also affecting K-12 designs in a rather interesting way. At Laramie (Wyo.) High School, Perkins+Will is designing much smaller locker spaces as the school anticipates a move from textbooks to personal devices over time, thereby eliminating the need for larger physical storage spaces.

COURTESY LEE H. SKOLNICK ARCHITECTURE + DESIGN PARTNERSHIP

Lee H. Skolnick Architecture + Design Partnership used children's museum and science center design concepts at Summit Elementary School, Casper, Wyo., to create thematic environmental graphics, hands-on interactive stations, interdisciplinary education, and project-based learning.

Advanced projection systems and smart boards are replacing traditional overhead projectors and influencing classroom design. Now that effective projection can take place in daylit rooms and short-throw projection systems don't have to compensate for glare and shadows, classrooms no longer need to be designed like black boxes, cut off from natural light.

One recent advance has been the introduction of systems that incorporate projection surfaces and dry-erase boards as a single package, eliminating the need for separate projectors, overheads, whiteboards, and computers to create an interactive learning environment. However, Bartels cautions Building Teams to research and test these new products before specifying them for any given project, as his firm, Hord Coplan Macht, did in choosing an interactive projector system for the Barrie School Research and Learning Lab and Studio, Silver Spring, Md.

For University High, a charter school on California State University's Fresno campus, interactive projectors were installed in each of the school's 21 classrooms. Now teachers can easily call up presentation slides, Web pages, educational software, flip charts, etextbooks, videos, or an image or page from a document scanner. In math class, for instance, students can be called up to solve problems on the smart board. "The interactivity is a way for students to be out of their seats and working on the board," says Cari Roch, a teacher at University High. "The active participation helps them engage more with the content."

USING SCHOOL DESIGN TO PROMOTE PHYSICAL ACTIVITY AMONG STUDENTS

Schools are doing more than encouraging students to walk to the board. "Active design" is being used as a means to fight child obesity, which has more than doubled in children over the past 30 years, according to the Centers for Disease Control and Prevention. The CDC categorizes more than a third of U.S. children and adolescents as overweight or obese.

"Designers play a key role in designing school buildings that encourage overall student and faculty wellness," says P+W's Turckes, whose firm has contributed to New York City's active-design guidelines (http://centerforactivedesign.org/dl/guidelines.pdf).

SCHOOL IN A BOX for San Diego

Thinking outside the box, LPA Inc. is designing a school inside a box. With an emphasis on three E's—Engage, Educate, and Empower—e3 Civic High is now being constructed on the sixth and seventh floors of a public library in downtown San Diego. Library patrons will be able to see into the school via glass elevators, but will not have physical access to the school.

Learning studios at e3 have been organized in "villages" that are clustered around a shared commons and teaming rooms. To foster impromptu "collisions" of students, faculty, and staff, the design employs a number of strategic spaces:

- Entry – Deliberately leaving out an enclosed lobby and central administration area, visitors enter directly into the school.
- The Park – Supported by controllable lighting, soft furniture, and technology integration, this "living room" setting can also double as a studio space.
- The Plaza – An active gathering space for presentation, performance, and dining.
- Steps – The central staircase connecting the two floors doubles as a social learning space, a circulation route, studio, physical education area, and a place for industry speakers to engage with students.
- Interactive Wall – Linking the villages, the Interactive/Living Wall is a space that students can write on, post displays, or even sit on.
- Gallery – Lined with whiteboard surfaces and specialty lighting, the centrally located gallery provides a blank canvas for students to curate.

The project is tracking LEED Gold certification.

In practice, active design can be as simple as allocating more recreational space for students, as Harley Ellis Devereaux did for the Child Development Center at Santa Ana College in California. Each classroom has its own shaded outdoor patio and an age-appropriate playground. Grassy commons for all the children put the total square footage of outdoor play space per each child at 125.

Incorporating stairs in convenient but prominent locations is another active-design strategy. At the Milan (Mich.) Center for Innovative Studies, the "Grand Stair" also serves as an amphitheater for all-school meetings and presentations. "Simply connecting the first and second floors, which both have environments for project-based learning, allows students to flow from floor to floor during the course of the day," notes Fanning Howey's Gladden. "The amount of movement is incredible compared to what we would see in a traditional classroom setting."

Approaching active design as a way to promote learning by stimulating both the body and the mind, designs can be informed by ways to arouse children's innate curiosity. "Curved paths instead of straight ones make the endpoint destination less immediate and obvious, enticing the student to explore, which is the promise of discovery," explains LPA's Rogers.

LPA also looks for way to bring outdoor space into the learning environment. "Whether measuring distance in a science experiment, demonstrating rhythm in music class, or simply connecting distance and time in math class, the objective is that the outdoors will become an extension of the academic day," says Rogers.

At the same time, practitioners like Carol Ross Barney, FAIA, Founding Principal of Ross Barney Architects, point out that the building codes are somewhat impeding active designs. Ross Barney suggests that perhaps the codes should be re-examined in order to support this important trend and national health issue.

COURTESY HARLEY ELLIS DEVEREAUX

Harley Ellis Devereaux allocated 125 sf of outdoor play space per child to promote physical activity at the Child Development Center at Santa Ana (Calif.) College.

THE ROLE OF GREEN RATING SYSTEMS

For many public school clients, green rating systems are the primary force behind sustainable K-12 designs. "While this is a good thing overall, mandated certification sometimes leads to a 'get-the-points' approach to design," says Svigals+Partners' Brotman. "As architects and owners, we must all do a better job of focusing on our main goal—to improve occupant performance and health."

Hord Coplan Macht references the Collaborative for High Performance Schools (CHPS) standard and the International Living Future Institute's Living Building Challenge. Both were valuable criteria for the design and construction of prefabricated learning environments at Barrie School, Silver Spring, Md., "for a more wide-ranging conversation beyond LEED," according to Bartels.

CHPS (www.chps.org) is a national green schools rating program that originated in California and is used quite extensively there, especially in Southern California, says Harley Ellis Devereaux's Dale. He sees LEED for Schools as a critical benchmark, although he has noticed that LEED certification tends to be more popular among private schools than among public schools.

Because school boards want their constituents to view them as responsible stewards of the environment, however, many request that their K-12 building projects embrace sustainable design strategies, even when they aren't pursuing formal green building certification, he says.

Rogers, who chairs the U.S. Green Building Council's Green School Committee in Orange County, Calif., notes that, while about two-thirds of LPA's K-12 projects are designed to achieve recognition from a green rating system, the firm is wary of placing too much emphasis on rating programs. "We believe that sustainability is much too important to be treated as a scorecard; it is neither additive nor subtractive, but essentially must be ingrained into the DNA of each project," she says.

PUTTING NET-ZERO INTO THE MIX

School districts are becoming increasingly curious about net-zero energy buildings. The idea of constructing a K-12 school that draws virtually no resources from the utility grid has a certain appeal. But crossing the bridge from discussion to action ultimately comes down to investment dollars.

"Although net-zero holds incredible opportunity to help define the next generation of energy-efficient schools, it is still not very common among preK-12 schools," says Turckes, President-elect of CEFPI's Midwest-Great Lakes regional chapter. "This is due to the fact that the best way to reach net-zero requires a fairly robust deployment of renewable energy on site, which many clients find cost-prohibitive."

Bartels reports that in the Mid-Atlantic region, his firm's public school clients are struggling merely to attain the LEED certification levels that are mandated in some jurisdictions, let alone finding the funds to build

renewable energy systems. Fanning Howey's Hadden concurs: "Getting to net-zero typically still requires a significant investment in solar or wind technologies. For many of our clients, that is the deal-breaker."

Yet a handful of K-12 net-zero efforts are still being pursued. On Staten Island, Skidmore, Owings & Merrill (www.som.com) has designed P.S. 62, the first net-zero energy school in New York City. The 68,068-sf, two-story school will serve 444 pre-kindergarten through fifth grade students when it opens in 2015. Designed to comply with the NYC School Construction Authority's Green Schools Guide in lieu of LEED certification, the project will offer an energy-use reduction of 50% over an SCA standard public school.

Other net-zero energy schools: Prairie Hill Learning Center, Roca, Neb.; Hayes Freedom H.S., Camas, Wash.; Evie Garrett Dennis PK-12, Denver; Centennial (Colo.) PK-12; Richardsville Elementary, Bowling Green, Ky.; Kiowa County K-12, Greensburg, Kan.; Sangre de Christo PK-12, Mosca, Calif.; and Lady Bird Johnson Middle School, Irving, Texas.

BRINGING DOWN THE WALLS OF THE TRADITIONAL SCHOOL

Twenty-first-century learning trends are being defined by some project leaders as "The Four Cs": critical thinking, collaboration, communication, and creativity. Some experts suggest adding a fifth: community. "We are breaking down walls within the K-12 school building, quite literally," says Fanning Howey's Gladden. "The next step is to break down the barriers between primary and secondary education, higher education, and the workforce. A high school isn't just for high school students anymore. In the future, there will be a much greater emphasis on creating dynamic connectivity between a school's educational mission and the community's desire for services."

This may be particularly true in the case of so-called "STEM" schools, which emphasize the study of science, technology, engineering, and mathematics. The new Engineering and Science University Magnet School, being designed by Svigals+Partners on the University of New Haven campus, will provide access to university and community resources to students of all abilities and needs, says Brotman.

Students are no longer tethered to their desks, as more learning is taking place in nontraditional environments. "The trend in education needs to switch from distribution of information toward facilitation of applying information in a collaborative environment, replicating the working world," says Peter Basso's Roop.

> EDITOR'S NOTE

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