Designing Schools for a Changing Future

New teaching techniques and sustainable-design requirements are reflected in design concepts that impact K-12 schools

— By Patrick Glenn, AIA, REFP, LEED AP BD+C, Perkins+Will

Designers today are realizing that 21st Century schools must be designed for a new century of learning skills. Student are becoming more agile and mobile, allowing them to process information at a much more rapid pace than their parents (and sometimes their teachers). To provide a successful environment for these evolving learning skills, schools must be flexible, adaptable and capable of accommodating various-sized groups performing a range of activities. These design requirements must blend with other growing challenges, including sustainable-design concepts and both short- and long-term budget needs.

The concept of planning and building schools to support a new generation's learning and cognitive skills has been developing for some time. The December 18, 2006 issue of *Time* magazine, for instance, featured an article on "How to Build a Student for the 21st Century." It noted that schools have not kept pace with the changes in learning skills and the demand for a more integrated and project-based curriculum.

– Patrick Glenn is an Associate Principal and the K12 Market Sector Leader at Perkins+Will in Dallas.

Budget restraints and a search for new delivery methods have brought precast concrete construction to the forefront for many schools. The Carolina High School in Greenville, S.C., was designed by Perkins+Will with a total-precast concrete system of load-bearing wall panels and double tees. The project won the award as Best School Design in the 2007 PCI Design Awards competition.

Shortly after, *Architectural Record* began offering an annual supplement dedicated to "Schools of the 21st Century." Perkins+Will was featured on the cover of the inaugural issue with its design of Blythewood High School in Blythewood, South Carolina. The project highlighted the growing need for "intimate learning environments" dedicated to specific curricula within larger school campuses. In January 2011, *Architectural Record* showcased another Perkins+Will project: the new Cedar Ridge High School in Round Rock, Texas.

Intensive Collaboration

Today's agile and mobile students are collaborating with fellow students in group projects more often, driving more aspects of school design. Integrated curriculum and project-based learning activities are gaining traction as well. Instead of segregating subjects into several one-hour classes, the subjects are merged into one group project, in which students collaborate and accomplish multiple assignments.

This type of learning approach has proven more engaging and fun while allowing students to inherently retain more of the project's learning aspects compared to the more traditional lecture-assignment approach. Architects can relate to this: Our work environments are not set up in silos but as collaborative efforts. Why should we expect students to perform best in another way?

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As a result, learning spaces must offer a variety of group settings, including traditional lecture-style classrooms, group project rooms accommodating 6-8 students and one-on-one project/tutor rooms. That means schools must have open spaces that can accommodate these activities and be revised to accommodate changes. Maintaining a 200-foot-long, double-loaded corridor with flanking 850-square-foot classrooms is becoming extinct. Today, schools are being designed with the necessary smaller group-learning spaces integrated into the social life of the

The student courtyard at Cedar Ridge High School in Round Rock, Texas, is flanked by two of the four small learning communities designed for the school, which includes upper-level distributed media center and teacher planning areas. Photo: Charles D Smith Photography

This floor plan demonstrates the concept of breaking up a large high school into small learning community groups that encourage more interaction and make the school less overwhelming. Diagram: Perkins+Will

The central student cafeteria at Cedar Ridge High School in Round Rock, Texas, is located in the center of the school and fronts the central student outdoor learning courtyards. Photo: Charles D Smith Photography

school, or they are including operable partitions so spaces can quickly be divided into smaller spaces.

Smaller learning communities also are growing within the larger institution. Large comprehensive high schools and middle schools are incorporating this planning idea more than smaller schools, so they can break down the overwhelming social expectations a high school student endures during a normal school day. The idea takes a large school, perhaps 2,400 students, and organizes the private instructional learning spaces into learning clusters. These smaller units house up to 600 students, allowing day-to-day activities to be more compact and less overwhelming.

The integrated curriculum and project-based learning at Cedar Ridge High School in Round Rock, Texas, is highlighted by the Culinary Arts Classroom and Lab, which is part of the Academy of International Business & Economics curriculum. Photo: Charles D Smith Photography

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Shared spaces, such as the media center, gymnasium, performing arts center, and cafeteria, are typically organized around a central campus region. Enhancing each cluster's independence is the trend toward creating a smaller central media center and using the saved space as dedicated media centers for each learning cluster, specializing in that unit's respective focus. Distributing administration, counselors and teacher-planning areas throughout the cluster allows adults

to be more dispersed, increasing teacher-to-student interaction, furthering the academic-support process.

These types of design strategies help to facilitate schools that are more student-focused, instead of past generation designs that were more teacher-focused. Today the teacher is more of a roaming guide to instructional projects rather that the former teaching pedagogy of one way delivery of information.

Advanced, portable technology also drives planning. Students today have never been without a computer, the internet or even iPods. Incorporating infrastructure so students can utilize laptops, smart boards and other digital-presentation devices enhances the learning process and allows it to be presented in a form with which students are comfortable. These techniques are critical to a 21st Century school's mission. Providing resources for blogging, tweeting and internet research allow students to have fingertip access to project-related information.

Focus on Sustainable Design

Sustainable design concepts, more widely known as "green design," are playing a big social and environmental role in school design, especially for recruiting and retaining highly-regarded teachers and administrators. They also increase the school's attractiveness to relocating families, creating a marketing advantage.

Students benefit as well. A large amount of research and data directly support the notion that sustainable-design techniques generate better student performance in addition to long-term operational savings. Among the techniques becoming standard today are the proper passive orientation of the building and the inclusion of daylight in the classroom. Studies show students perform better in math and reading especially when they are able to receive direct daylight in the classrooms.

Positioning the building in such a way as to capture indirect north daylight provides the best option without generating heat in the late spring and early fall months. Providing windows on the southern exposure allows indoor spaces to take advantage of sunlight during the winter, but overhangs and sunshades should be properly integrated to control and shade summer sun. Providing minimal window openings on the east and west façades will also help control transitional temperature swings throughout the day.

Other sustainable strategies may include collecting rainwater to be used for site irrigation, installing internal plumbing devices such as infrared sensors to control water waste, maximize use of highly energy-efficient mechanical units, and improving indoor air quality—which in turn helps lower student absenteeism and raises focus and attention. (For more on Indoor Environmental Quality, see the article on page 14.)

Another common strategy that helps schools become good stewards of our environment is specifying materials with high levels of recycled content that are harvested and manu-

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Adding visual interest to interiors, such as in the upper school media center at St. Alcuin Montessori School, provides a playful look that encourages learning (by mimicking the night time constellation Ursa Major). A series of glass-block windows limit the amount of direct west sun that penetrates into the learning space. Photo: Charles D Smith Photography

Large amounts of daylight, which filter into the upper-school media center at St. Alcuin Montessori School in Dallas brighten the space naturally and aid student performance. Photo: Charles D Smith Photography

The Carolina High School in Greenville, South Carolina, shows that precast concrete can simulate the traditional look of brick that administrators want to retain while providing more contemporary benefits of an engineered material. Photo: Perkins+Will

factured within a 500 mile radius. This focus can aid in lowering costs while demonstrating a commitment of environmental awareness to the school community.

Designing on a Budget

School budgets today are tighter than ever. Most school districts have gone through some level of operational and maintenance cuts, whether in cutting back supplies and other operational costs, or the more extreme option of laying off personnel. Financial constraints on the operational and maintenance side sometimes create confusion when communities look at capital-construction and building-improvement programs.

To be sensitive to these concerns, school districts are asking architectural and construction teams to do more with less. For example, Texas school districts are focusing more attention on improving existing school buildings rather than continuing to build new schools, which require more teachers and staff. Such projects as roof replacements, window replacements or chiller and boiler upgrades are becoming more common as districts try to be more creative and strategic with their construction and maintenance dollars. Some of these are designated as "20-year renovations," which are intended to last 20 years before any additional improvements are made.

These renovations take existing schools designed from the 1950s, 1960s or 1970s and bring them up to current standards. On occasion, the renovations can be quite complex, especially when older schools have implemented design trends that are now antiquated. It is not uncommon for our firm to be asked to take an existing school with an open-classroom plan or a layout featuring a departmental structure and redesign it to create small learning communities with distributed media resources and administration.

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Although providing the same end result for an existing renovated school can be much more complex, substantial dollars can be saved while preserving older schools, which have a neighborhood heritage. Improvements can unify a once struggling community, as it sees the local district making a commitment to not only improving the school's physical appearance but also to upgrading the design to enhance the academic support that will prepare students for 21st-Century challenges.

Efficient Delivery Methods

Regardless of whether the project involves a new design, a renovation or a combination, there are a variety of construction-delivery models to choose among. The two most commons for schools are CSP (Competitive Sealed Proposal) and CM@R (Construction Manager at Risk). The CSP process is essentially the traditional design-bid-build method, with contractor qualifications and experience added to the evaluation. A combination of qualitative factors are analyzed, not just the bid price.

The CM@R methodology has gained in popularity in the past ten years, and is becoming the preferred method of delivery for many school districts across Texas. Allowing the construction manager to participate in the design process creates many benefits for the client. The biggest and most influential benefit, especially for an architect, is the ability for the CM to participate in the conceptual design stage and understand the client's expectations from the beginning of the design process.

Too often, it becomes difficult for contractors to support the architect's mission and design because they are excluded from the early discussions and presentations. As a result, they are unaware of the owner's key priorities as the project develops. Understanding the design from its infancy, the contractor or CM can adjust as situations arise and filter for options in construction methods, material costs or schedules that align with those needs.

The CM can also be used as a resource by the architect during the design process to price new or design-specific systems and to evaluate their practicality and budget impact. Additionally, the CM can participate in the detailing process, to help make financially- and schedule-sound recommendations that support the overall design expectations. Delivering a project with the CM@R method generally requires greater CM services cost, but typically that cost should be offset with the added savings and schedule benefits that result.

The newly discussed Integrated Project Delivery method is gaining popularity but has not fully reached the school community. This concept is similar to the design-build methodology but includes the owner in a three-part team that shares financial performance and risk. Because of the traditional manner in which schools are funded and

Travelers Rest High School in Travelers Rest, South Carolina, welcomes students with an exterior featuring precast concrete exterior wall panels accented with thin brick. Photo: Perkins+Will

the public, tax-supported way in which schools operate, this type of design/construction delivery method has made it difficult to create agreeable solutions for all three parties.

Precast Concrete Use Grows

Current budget constraints and a search for new delivery methods have brought precast concrete construction to the forefront for many school projects. Understanding the material's benefits can be advantageous for architects facing limited financial means and aggressive construction schedules. Utilizing precast concrete structural panels, for instance, provides structural benefits via lower costs and faster erection schedules.

They also provide many other benefits such as flexible, open-interior spaces, thermal mass, a much greater fire-resistance rating than steel structure, and a more durable and maintenance-free finish. Increasing durability and lowering maintenance needs are always added values for projects involving school kids. The precast concrete industry has also made advances in the aesthetic choices for large structural panels, including thin brick that can resemble traditional means of construction as well as the brick façade that administrators still want even as traditional teaching methods fall by the wayside.

Precast concrete structural panels not only can improve the bottom line for tight school budgets, but their capabilities for producing repetitive designs provide an efficient way to duplicate small learning communities. Some schools have as many as four identical building wings in their overall design, which plays to precast concrete's efficiency.

The structural panels also provide benefits to some aggressively growing districts by creating a prototypical design that can be used for multiple school buildings of the same design built to accommodate rapidly increasing student enrollments.

Precast concrete panels provide a much higher level of quality control since much of the fabrication and curing happens off-site under controlled production measures. This quality is evident as students and parents see the rapid enclosure of the building and its durability once it is occupied.

Schools are changing in many ways to accommodate new generations of students. The design and construction industries need to be open to this change and be ready to provide leadership to plan and construct schools for the 21st Century. Airports have changed their appearance, operation and security measures since the 1940s. Hospitals and research facilities have changed immensely since the early 1900s in pursuit of increasing healthcare standards and technology. Why would schools still be designed as if our society is stuck in the 1950s?

State policy makers, school boards and school administrators will continue this trend of recognizing that change is necessary for today's generational student to compete. The learning and cognitive principles behind 21st Century school designs will continue to evolve, and the built learning environment must be designed to evolve with them as we cope with integrating into a global society. ■

For more information on these or other projects, visit www.pci.org/ascent.