The design of K-12 schools needs to address ongoing learning approaches as well as heightened concerns over health and welfare.

Photo Courtesy of Rockfon

Updated School Design in a Post-Pandemic World

Strategies for addressing ongoing and emerging needs

Sponsored by ASI Group, Bradley Corp., Mitsubishi Electric Trane HVAC US, NanaWall Systems, and Rockfon | *By Peter J. Arsenault, FAIA, NCARB, LEED-AP*

The COVID-19 pandemic impacted schools in a big way and has led to new opportunities to think about how learning is carried out – both virtually and in-person. It also brought to the forefront the need to create learning environments that are safe, healthy, and that inspire wellness for not only the students, but for teachers and staff, too. Private and public sector efforts are emerging to help address the new needs and opportunities in school design. For example, the recently introduced Elementary and Secondary School Emergency Relief (ESSER) fund has allocated over $100 billion to mitigate the impacts of COVID-19 on students, educators, and their families. Projects to improve indoor air quality, enhance the health of students, and otherwise renovate and upgrade school operations are among the allowable uses for the funds. In light of these needs and opportunities, this continuing education course looks at some strategies that can help architects design or renovate schools to address many of these concerns.

21ST-CENTURY SCHOOL DESIGN

Before the COVID-19 Pandemic, school design was strongly influenced by 21st century thinking about how students work by focusing on new visions of learning environments combined with computer-based technology. Some of those aspects have been reinforced by the pandemic, such as online learning, while other aspects have been updated or reinvented, such as ways to create and use space safely in a school building. While the overall goal remains providing better learning environments, school health and safety have become critical and influential design criteria as well.

One of the strategies that has emerged to address a number of these needs is the use of opening glass walls in school buildings.

CONTINUING EDUCATION

AIA Continuing Education Provider 1 AIA LU/HSW

Learning Objectives

After reading this article, you should be able to:

1. Identify the ways that opening glass walls enhance 21st-century school design for the health and welfare of students through improved learning environments.
2. Assess strategies to improve acoustics in buildings that improve wellness and enhance learning in schools.
3. Determine strategies to provide adequate ventilation and energy-efficient heating and cooling in schools for thermal comfort and health.
4. Explain the importance of proper attention to healthful restroom design in schools, particularly related to sanitary handwashing, privacy, and safety.
5. Determine ways to incorporate the design principles presented into building project documentation as shown in examples.

To receive AIA credit, you are required to read the entire article and pass the quiz. Visit **ce.architecturalrecord.com** for the complete text and to take the quiz for free.

AIA COURSE #K2202D

They provide several attributes that are helpful to school design, as discussed in the following sections.

Flexible Space

Opening glass walls eliminate the fixed walls of the traditional classroom by opening to shared areas. Such a flexible design concept can take a variety of forms. First, it could allow classroom-to-classroom connections, meaning that multiple rooms or grades can be combined, or closed off, at will, to accommodate teaching needs. The separation also allows for greater control of the number of students in a space, when isolation or separation is needed for health reasons. Second, opening glass walls can be used to connect classrooms to common areas, allowing greater interactions and/or isolations to suit the needs of an entire wing or section of a school building. Third, they are quite effective when used in resource centers, so that space and equipment or other things can be shared with different sized groups or grades. The general benefits of this design approach include areas for project-based learning or common areas where students work together on a range of activities with shared resources or presentation areas. Furthermore, creating a flexible classroom configuration optimizes the floor space within the building envelope which can translate into reduced total square footage needs and the related construction costs.

Connection to Outdoor Space

Opening glass walls can also be designed as a connection to outside spaces. This creates an indoor / outdoor learning environment that provides multiple health and educational benefits for students. First, the large glass areas bring daylight and views into the building, which has been shown to benefit the general health and well-being of students, teachers, and staff. Second, the ability to open the glass walls partially or fully allows for an abundance of fresh air ventilation. Such fresh air (and outdoor activity) continues to be a key strategy in preventing the spread of airborne disease. From an educational perspective, opening the glass wall allows for the opportunity for outdoor learning experiences as well.

Sound Control

With opening glass walls, there is a need to properly address the control of sound in and between the spaces where they are located. In particular, sound isolation is needed in flexible space designs so students can properly focus on their work or understand instruction from their teachers. The design challenge in schools can sometimes be finding a way to incorporate the flexible spaces being sought for classrooms and other spaces while still meeting the acoustical needs of those spaces.

Photos courtesy of NanaWall Systems

Flexible spaces that open or close onto each other in school buildings can be achieved with opening glass walls.

Properly specified opening glass walls can provide separation and sound control as needed between adjacent spaces.

Fortunately, manufacturers of opening glass walls have found ways to deliver impressive acoustical properties so designers can feel confident that incorporating such systems into school designs will not be seen as any type of a compromise. The best way to determine acoustical performance in walls is to have them tested to determine their Sound Transmission Class (STC) rating. This common index provides a way to help determine how much sound (measured in decibels) is restricted from passing through a wall or similar assembly. The higher the rating, the less sound that passes through. Ratings that meet acoustical standards promulgated by independent rating programs (i.e., LEED, WELL, CHPS, etc.) can be achieved using properly specified opening glass walls. In so doing, the good acoustics can help create a positive learning environment.

CEILINGS THAT PROMOTE WELLNESS

Ceilings are a significant design element that can play an important role in the health and well-being of everyone inside a school building. A high-performing ceiling needs to address good acoustics but can also contribute to general indoor air quality. To do so, a lot can depend on the choice of the materials that are used in ceilings.

Stone Wool Acoustic Ceiling Tiles & Panels

One ceiling material that is being used increasingly in schools is stone wool. It is a proven material that demonstrates great acoustic properties, resistance to mold and mildew, and excellent fire and smoke performance. Since it is made from stone, it is naturally resistant to mold and mildew growth – it is hydrophobic, does not absorb moisture, and will not support mold, mildew, or other potentially harmful microorganisms. No antimicrobials are needed to provide this level of performance. This resistance can be critical in high-humidity environments, especially if HVAC is turned off when the building is unoccupied, as may be the case over the summer months. Mold and mildew can create an indoor air quality health concern in schools, particularly for people with asthma or other respiratory conditions.

Stone wool is also unaffected by changes in temperature and humidity, so opening windows and allowing fresh air to enter the building does not affect the ceiling performance. Further, stone wool ceiling tiles and panels have earned UL Environment GREENGUARD Gold Certification for low VOC emissions in schools. This certification process takes into consideration safety factors that may impact those with vulnerable immune systems, including children. The stringent UL GREENGUARD Gold certification is recognized by numerous green building and wellness programs including the Collaborative for High Performance Schools (CHPS), the WELL Building Standard, and LEED.

Acoustical Considerations

The acoustical performance of learning spaces is covered by a variety of codes and standards. This makes sense since acoustics inside classrooms determine whether students can understand their teachers and learn from them. Poor acoustics have also been associated with human health issues in both the short- and long-term. To ensure optimized acoustics design, professionals need to use the right combination of highly sound-absorptive ceiling panels,

Photos courtesy of NanaWall Systems

OPERABLE GLASS WALL CASE STUDY

Project: Farrell High School
Location: Staten Island, New York
Architect: Studio 16 - David Businelli, AIA, CEO

The Project: Monsignor Farrell High School, situated in New York City's southernmost borough of Staten Island, is one of the many schools adapting 21st-century learning spaces within their campus. Opened in 1961, the all-boys Catholic school's primary mission is to provide quality education for its students while challenging them to develop their talents and ideas.

The Challenge: The challenging strategy involved retrofitting the building with 21st-century school standards, along with forward-thinking classroom design and sustainable building materials. The first endeavor involved reimagining the library into a Learning Commons - a multiuse, flexible learning area for teachers and students alike. Before the renovation, library bookshelves took over the space where the seminar rooms now stand, halting any natural light transmission and diminishing visibility. Sound attenuation was also recognized as a paramount concern in this academic environment, especially in a multifunctional space like the Learning Commons.

The Design Solution: "One of the goals of the project was to bring the school into the 21st century," says Studio 16 Architecture architect and CEO David Businelli. "The Learning Commons was to be not only a fully functional, modern space that would be well utilized, but also an attraction for new students." As an alumnus of the school, Businelli was honored to reenvision the library where he read his first architecture book. Although the school's original vision included fixed metal and glass walls that would form two separate classrooms, the architect proposed a more dynamic design with acoustic glass wall systems to provide maximum flexibility of space while supporting sustainability standards.

The three sound-rated, aluminum-framed folding glass walls encompass a total width of about 80 feet. Each 9-foot-tall system is configured with a swing panel that facilitates ingress and egress when the acoustic glass wall systems are closed. In a unique configuration, a 12-panel folding glass wall system meets at the corner with another 7-panel system, creating a room-within-a-room configuration. The boxed area is then partitioned by a third 7-panel system in a T-intersection layout. This configuration allows for the utmost in flexibility—allowing for up to four different arrangements within the Learning Commons. This redesigned space is utilized as additional classroom space to hold lectures and seminars.

The Results: The dynamic interior acoustic glass wall systems maximize the space to allow for multiple activities to happen at once. "The operable glass panels, which can be moved left or right, allow teachers and administration flexibility on seminar room configuration," explains Businelli. In addition, he points out that sound is well-controlled. "The operable glass walls provide superior acoustic control. They are an integral part of the sound attenuation system, along with the LVT floor and the ceiling systems." In terms of lighting, Businelli observes "They allow for greater use of daylight farther into the building." For staff, this means better visibility and control of space. For students, natural light increases their productivity and overall retention."

robust walls, and sound- balanced floors, all working together. Acoustic ceilings are used primarily to absorb the sounds in the room. Walls that are built full height to the structural slab or roof above, and without holes or gaps, block outside noise from coming into the space. When rooms are above or below one another, the floor slab also plays a main role in sound isolation.

Many school buildings must now comply with the stringent acoustic requirements and performance levels in one or multiple standards, guidelines, or building rating systems. The table to the right compiles the absorption, isolation, and background sound level requirements from organizations such as the Collaborative for High Performance Schools (CHPS) and the Acoustical Society of America (ASA). Stone wool acoustic ceiling tiles can achieve highly absorptive Noise Reduction Coefficients (NRC) of 0.95 or higher, optimizing speech intelligibility and achieving the ultimate privacy in school buildings.

Images courtesy of Rockfon

Accepted Standards for Educational Facilities*			
	Background Sound Requires mechanical system noise to be below a maximum permissible level	**Absorption – NRC[6]** Requires sound absorbing finishes, such as acoustic ceilings, to control reverberation and noise	**Wall Insulation – STC[7]** Requires full-height, STC-rated walls between rooms to prevent noise transfer
American National Standard – Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools[11]	✔ 35 dBA	✔ Reverb 0.60 - 0.70	✔ STC 50 for Classrooms
Collaborative for High Performing Schools (CHPS)[12]	✔ 35 - 45 dBA	✔ Reverb 0.60 - 0.70	✔ Classrooms STC 43 (minimum) Classroom STC 50 (enhanced)
Leadership in Energy and Environmental Design (LEED)	✔ 35 dBA (preferred) 40 dBA (maximum)	✔ Ceiling NRC 0.70 (min) Reverb 0.60 - 0.70	✔ STC 50 for Classrooms
Acoustical Society of America (ASA) Technical Committee on Architectural Acoustics (TCAA)[13]	✔ 35 dBA / NC[8] 25 - 30	✔ Ceiling NRC 0.75 (min) Reverb 0.40 - 0.60	✔ STC 50 for Classrooms[17]
Green Globes Assessment Protocol for Commercial Buildings[14, 17]	✔ RC[9] 30 Classrooms	✔ Ceiling NRC 0.80 Reverb 0.60	✔ STC 50 for Classrooms
American Academy of Audiology (AAA)[15]	✔ Endorsed	✔ Endorsed	✔ Endorsed
American Speech Language Hearing Association (ASHA)[16, 17]	✔ Endorsed	✔ Endorsed	✔ STC 50 for Classrooms[17]

*Every facility is different, and any single room may need to exceed the guidelines in this chart, depending on purpose and its adjacent rooms. Values are current at the time of this publication but may change afterwa

This table indicates some of the common standards that address acoustics in schools with the ratings shown for compliance.

Acoustic Ceilings in Three Steps

A commonly available online tool helps architects optimize acoustic ceilings in school buildings by determining performance ratings for a space and selecting product options.

Step 1. Select the appropriate NRC rating for your ceiling panels based on published standards or experience. As the amount of sound absorption is increased inside a room, the reverberation time and noise level decrease. It also can reduce echoing. This improves speech intelligibility, allowing students to better understand their teachers.

Step 2. Select the appropriate STC rating for wall and floor/ceiling assemblies in order to keep out unwanted sound from adjacent spaces. Sound blocking starts with walls and floor slabs. If the adjacent room has a lot of people or equipment, and transmitted noise would interfere with sensitive activities being performed in the room being designed, then a high STC rating is needed. As the walls and slabs become more massive, the STC rating increases and the amount of noise getting through greatly decreases, making things much quieter.

Step 3. Ensure you have the proper background sound level. Quieter is not necessarily better. Some background sound is necessary to mask annoying or distracting noise and help achieve speech privacy. This background sound can be from music, nature, mechanical systems, or electronic sound masking (i.e., "white noise").

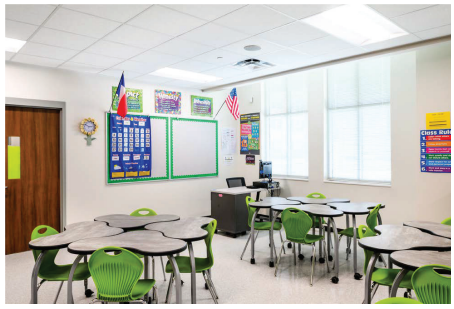
Speech Privacy Potential (SPP) is another performance indicator of acoustic privacy between two adjacent rooms and may be better than either STC or background sound (dBA) alone. SPP factors both steps #2 and #3 of the process above, together. The STC rating, plus the background sound level, should total between 75 and 80—any less and privacy may not be achieved.

INTERIOR CLIMATE CONTROL

In addition to attributes such as acoustics, a successful classroom environment that enhances learning includes the ability for pupils to feel comfortable during different seasons. This plays directly into the type of heating and cooling system that is used, and the ability for it to be responsive to different needs within a school.

Variable Refrigerant Flow (VRF) Systems

Conventional HVAC systems have served the needs of most school buildings for many decades, although with some variability in comfort and energy efficiency. Achieving the high levels of comfort, sustainability, and performance needed for current school design often requires going beyond the conventional. Considerable success in this area has been found in the use of Variable Refrigerant Flow (VRF) systems which operate in a zoned manner. Zones are defined as single or multiple room spaces that are conditioned to a set temperature and are operated independently from other rooms within the same structure.



The proper acoustical control of sound in schools needs to include the ceiling, walls, floors, and background sounds in each room or area.

VRF systems move conditioned refrigerant directly to the zone to be heated or cooled, allowing the temperature of that area to be more precisely controlled. To save energy, they can limit conditioning to selected zones that are in use. Inverter technology enables VRF systems to modulate capacity to match each zone's conditioning needs and maintain set points using minimal energy. If equipped with a branch circuit controller or heat-recovery module, VRF systems can simultaneously heat some zones while cooling others. With these features, VRF systems provide educational

Photos courtesy of Rockfon

ACOUSTIC CEILING CASE STUDY

Project: Mae Smythe and Red Bluff Elementary Schools (PISD)
Location: Pasadena, Texas

The Project: The Pasadena Independent School District (PISD) in Texas recently completed two major rebuilding projects to better serve its growing population of pre-kindergarten to fourth grade students. Both the Red Bluff Elementary School and Mae Smythe Elementary School buildings originally opened in the 1950s and improvements were made through the decades. After 60 years of use, as well as withstanding hurricanes, the cost of repairing and renovating these campuses exceeded the cost of building new ones. The district received funding to embark on a multiphase, comprehensive update to replace the aging structures with larger, newly constructed, contemporary buildings within their existing campus footprints.

The Challenge: To ensure an ideal learning environment, the PISD's goals for the new schools included healthy indoor air quality, energy-efficient operations, optimized acoustics, moisture and mold resistance, low-maintenance materials, and a modern, welcoming appearance. Since hurricanes, tropical storms, and humidity are as constant as the Texas heat, materials that resist the growth of mold, mildew, and potentially harmful microorganisms, but without the use of added antimicrobials, biocides or fungicides, were seen as most desirable. Furthermore, Class A fire ratings were required for this educational facility.

The Design Solution: Meeting all the facilities team's criteria, the school district selected acoustic stone wool ceiling systems as the basis of design for both schools and for future PISD projects. Throughout the two new schools, acoustic stone wool, 2-by-2-foot ceiling panels were installed in 15/16-inch exposed suspension systems. The stone wool ceiling panels naturally resist the growth of mold, mildew, and other microorganisms. Stone wool ceiling panels achieve their Class A fire performance, thanks to withstanding temperatures up to 2150°F, and do not create significant smoke that could obscure a safe exit in an emergency event.

Optimizing acoustics in the open shared areas, stone wool acoustic ceiling panels offer a noise reduction coefficient (NRC) of 0.85. This high level of sound absorption decreases reverberation and improves speech intelligibility for group communication. Using ceiling products with higher NRC ratings can also help with cost savings because fewer sound-absorbing products need to be installed to reach the goal level of absorption in the room.

The Results: Along with helping to keep students healthy and safe, the stone wool ceiling systems help support their wellness and create a comfortable, effective learning environment. Children At Risk named Red Bluff a Gold Ribbon School at the close of the 2020-21 academic year. In January 2021, Red Bluff also was honored by the nationwide program Healthier Generation, which presented the school with an award as one of America's Healthiest Schools.

buildings with efficient, personalized comfort. Since their size and output can be selected for specific locations, they can meet the needs of a wide variety of spaces within schools – classrooms, cafeterias, auditoriums, gymnasiums, offices, and other spaces, each with varied occupancies and unique conditioning needs. Furthermore, the quiet operation of VRF systems makes them ideal for environments like libraries and classrooms, where students need to focus on their studies.

Enhanced Ventilation

An important strategy for helping to create healthy learning environments is to provide proper ventilation to bring in fresh air while exhausting contaminants. In that regard, VRFs can very easily be used with dedicated outdoor air systems (DOAS) and energy recovery ventilation systems (ERVs) to provide the needed fresh air to the school in an energy-efficient manner. From a health and wellness standpoint, these systems help rid school buildings of toxins, odors, bacteria, and other potentially harmful contaminants. ERVs also improve HVAC system efficiency by preheating or cooling incoming outside air with energy recovered from the exhaust air. All of that adds up to a healthier, more sustainable indoor environment for students and staff. For architects, VRF systems with ERVs mean flexibility in design, quiet operation, and the ability to modify the systems as needs change during the design or life cycle of the building.

Attributes of VRF Systems

Schools realize numerous benefits by using VRF zoning systems combined with ERV-based ventilation systems. The improved thermal comfort and indoor air quality can help enhance learning environments, allowing students to learn more easily, while teachers and staff are kept comfortable, too. Such systems have been shown to help with operational costs and sustainability as well. VRF systems are all-electric and provide heat without burning fossil fuels. Schools motivated to reduce their carbon footprint and improve air quality in their communities choose VRF systems to support those objectives while improving comfort. For renovation projects, the quick installation time for VRF systems means schools can minimize disruption to the academic year when upgrading to this advanced heating and cooling solution.

This technology is ideal for the wide variety of uses, schedules, and activities that can occur in a single school building since everything can be zoned to suit this variability. Inverter-driven VRF systems use only the precise amount of energy needed to keep each interior zone at the desired temperature. This allows for customized operation while also enhancing energy efficiency and the related cost savings – energy is only used where it is needed and in the amount that is needed. Different unit styles and sizes of VRF systems are available to meet diverse comfort and aesthetic needs. Due to their compact and efficient nature, VRF systems also offer streamlined operation and maintenance, simplifying the work of facility staff.

Photos courtesy of Mitsubishi Electric Trane HVAC US

Variable Refrigerant Flow (VRF) indoor units blend easily into classrooms offering greater design flexibility, more precise comfort control, and ultra-quiet operation.

The compact, efficient nature of VRF systems allows for smoother operation, smaller footprints for equipment, and quiet operation.

RESTROOM SAFETY

School restrooms have garnered a good bit of attention lately, not only for health but also for safety, particularly in terms of gender identification and separation in some locations. Among the strategies that have been proposed and carried out in response, those that promote high degrees of privacy in toilet stalls appear to be most successful. Fortunately, there are products available to help architects achieve the needed separation in ways that offer design options and cost-effective designs.

Toilet Stall Privacy

Common toilet partitions in the United States typically do not extend all the way to the floor or to the ceiling. Similarly, the doors to the partitions fit loosely, often creating a gap between the door and the pilaster, producing unintended sightlines into the stalls. These gaps are often a function of small changes in wall distances, some improper installation, or even incorrect measurement on the front end. By contrast, European toilet stalls are routinely characterized by extended height partitions and doors that overlap with the pilasters to close and lock without any sightline gaps or crevices.

Manufacturers of toilet partitions are now offering extended-height metal partitions in the United States, along with door solutions pre-built into the door, that afford complete privacy in toilet stalls. Furthermore, these can be utilized without sacrificing aesthetics, since they offer a range of materials, colors, and finishes. This helps with creating a cohesive look in a school by using products for a restroom or locker room that have similar design sensibility and color palate.

Extended height partitions are available that have zero sightlines into the stalls and create a safer feeling with regard to the bathroom experience. Many different partition height options are also available, with different methods to eliminate sightlines. This privacy can be achieved by selecting from a variety of materials that also address appearance, functionality, hygiene, and durability. Solid plastic high density polyethylene (HDPE) or phenolic products are particularly appropriate for wet / humid environments like locker rooms or aquatic facilities, or even stadiums, where restrooms have to be hosed down completely from time to time. Powder-coated steel or stainless-steel partitions have been typically used for common areas where water and humidity are less of a concern. Similarly, plastic laminate partitions have been used as a cost-effective solution with a variety of design appearances that can transcend an institutional look by incorporating wood grain, colors, etc. To ensure a longer life for plastic laminate partitions, one company uses a special edge-banding process to guard against moisture penetrating the joints in the partitions. This also allows for an extended warranty on this product.

Photos courtesy of Mitsubishi Electric Trane HVAC US

VRF HEATING AND COOLING CASE STUDY

Project: Hollis Primary School
Location: Hollis, New Hampshire
Architect: Windy Hill Associates, New Boston, New Hampshire
Mechanical Engineer: John F. Penney Consulting Services, P.C., Chester, Vermont
Energy Consultant: DDH Energy Consulting, LLC, Concord, New Hampshire

The Project: Hollis Primary School (HPS) in Hollis, New Hampshire, has served its community for generations. Just as the school's dedicated teachers continually refresh the curriculum for students in pre-kindergarten through third grade, the community, led by the school staff, school board, parents, and the Hollis Energy Committee, recognized the need to modernize the building for comfort and sustainability.

The Challenge: HPS is housed within a brick masonry building built in 1952. Prior to its modernization, the facility had no insulation. The walls had an R-value of 1, equivalent to a single pane of glass. The uninsulated slab of the building was above grade and resulted in cold floors during low ambient outdoor temperatures. The heat provided by the oil-fired boilers provided minimal comfort. Additionally, on the south and east sides of the building, windows made up about 65% of the exterior envelope. This reflected 1950s-era design and was intended to maximize natural light but resulted in excess solar gain and heated masonry, which produced uncomfortable temperatures as high as 92°F well into November and December. These conditions challenged educators and their students.

The Solution: The Hollis school board formed the Hollis Schools Thermal Electrical Project (HSTEP) to identify the best way to improve comfort at the school while also increasing sustainability. "We have a lot of engineers in our town and a vocal, active community that values education," said Paula Izbicki, Principal at HPS. "All ideas and proposals were thoroughly vetted and questioned."

Working with HSTEP, the Hollis Energy Committee recruited Dick Henry, founding director of DDH Energy Consulting, LLC, based in Concord, New Hampshire, to draw upon his expertise in helping building owners, utility companies, and communities maximize energy efficiency and retrofit aging infrastructure. Henry ultimately recommended encasing the brick structure in 4 inches of spray-foam insulation, increasing the R-value to 31. They also recommended installing air-source VRF heat pumps for energy-efficient heating and cooling, powered by electricity from solar panels.

The Results: In this case, modernization meant continuity for the community. Rather than spending an estimated $17 million on a new school building, the town of Hollis successfully retrofitted the older facility to better serve the community and its students well into the future. In terms of comfort, the retrofit transformed HPS. Principal Izbicki comments, "We don't really think about the system. The kids are energetic and much happier. The learning environment has improved dramatically because it is so much more comfortable. And you can't really hear the new VRF units either unless you paid special attention as one was getting ready to blow air."

Photos courtesy of ASI Group

The use of taller, full-height partitions provides complete privacy in restrooms and can be selected from standard products to coordinate with the rest of the room design.

Full privacy is assured with manufactured components that match the rest of the system and are designed to cover any potential sightline openings.

Some school facilities have addressed the privacy concerns by adding or retrofitting pieces onto existing toilet partitions and stalls, often with unsatisfactory aesthetic results as well as additional material and labor costs. One company has solved this problem by integrating privacy components into the doors so that no retrofitting is needed and with no additional cost to the school The guiding principles of the integrated privacy design are to meet an occupant's need for total privacy while also being more aesthetically pleasing than using retrofitted privacy components that don't match the stall. The built-in privacy components completely close the gap on the latch and hinge side of the door to guarantee zero sightlines into the stall.

These components, color-matched to the rest of the stall, create a sense of continuity from the partition door to the pilasters. In addition, an occupancy indicator latch is now available as a standard feature. Some are also available with a uniquely designed stainless-steel pilaster shoe that simplifies the installation process. Altogether, these systems provide an attractive, durable solution that meets the demand for both old and new social boundaries.

Cyrus Boatwalla, director of marketing at the ASI Group, explains these guiding principles in more detail, "Our built-in need for privacy is laid bare in public washrooms, most of which are designed for multiple users and simultaneous use. Today, more than ever, our need to feel safe is paramount, and this can cause public washrooms to bring out deep-rooted fears, which may manifest in a visceral response. While some people may be mildly bothered by the thought of using a public washroom, others are paralyzed by the prospect—to the point that they cannot use the washroom while others occupy it." These observations are true for adults, but also for many students in schools, too, particularly those who experience anxiety or fear of bullying of any kind.

HYGIENIC RESTROOMS

Although the COVID-19 pandemic lingers on, most students and staff have returned to school buildings. However, everyone involved is generally expecting more from such high-traffic, shared facilities. A manufacturer's research study done with U.S. high school students in 2020 found that within the school building, the top three places that students are most concerned about coming into contact with germs are: school restrooms (63%); classrooms (50%); and the cafeteria (42%). Restrooms in particular seem to be the most scrutinized by students, teachers, and staff for being clean, hygienic, functional, and accessible. Furthermore, a related study found that 50% of high school students in the U.S. rate their school restroom facilities as poor or fair, while only 6% describe them as excellent. High school students' top suggestions for school restroom improvement are: 1) cleaner restrooms that are stocked more frequently with soap, paper towels, and toilet paper, and 2) restrooms in which everything is touchless – with reliable technology.

The results of these surveys are not surprising since restrooms are unique in that they are tight, enclosed spaces, have multiple touchpoints (about 10 in a single visit), and utilize water and paper products that can potentially create mess, slips and falls, and breed bacteria. The design question then becomes how does one create a hygienic and

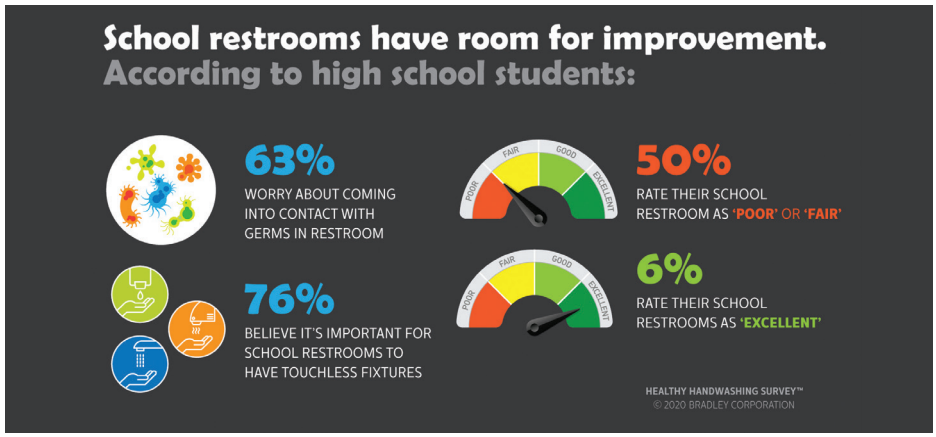


Photo courtesy of Bradley Corp.

According to high school students, there is room for improvement in school restrooms. Fifty percent of students in the U.S. rate their high school restroom facilities as poor or fair, while only 6 percent describe them as excellent.

safe environment equipped to handle everyday usage, curb cross contamination of germs and increase handwashing activity by students, faculty, administration, and staff? Relatedly, how can the restroom experience be improved to make it more appealing, accessible, and safe for its users?

Touchless Fixtures

One strategy to help with hygiene in school restrooms is to install touchless fixtures. Sensor-activated handwashing and drying equipment addresses infection control, hygiene, accessibility, ease-of-use, maintenance, consumer demand, and cost-effectiveness. Cross contamination of germs in restrooms can be reduced by using touch-free fixtures for everything from soap, faucets, hand dryers/towels, doors, and flushers. The hands-free concept is growing in popularity with restroom users and facility maintenance staff, especially in light of the pandemic.

When handwashing, easily activating soap and water with a simple hand motion -- without having to touch a handle, button or lever – keeps users from touching germy surfaces, and limits the spread of germs, fingerprint marks, and extra wear and tear. “Under any circumstance, using touchless fixtures helps to inhibit the spread of germs in restrooms and buildings,” says medical microbiologist Michael P. McCann, Ph.D., professor of biology, Saint Joseph's University. “The more we avoid restroom touchpoints, the healthier and easier our operations will be.”

Fortunately, as the demand for touchless fixtures has increased, the mechanicals used in sensor technology have been greatly improved. While some older touchless models include sensors that deliver spotty soap and water activations, current designs incorporate advanced sensing technology, ensuring continuous and reliable washing.

As for washroom cleanliness and safety, one of the latest product offerings is an all-in-one handwashing fixture. These innovative fixtures deliver touch-free water, soap, and hand drying all in one integrated fixture above the handwashing basin. They are also specifically designed to better contain water to keep it from dripping from hands onto the user, walls, and floors, thus helping to reduce messiness, slips, and falls.

Of course, the durability of touchless restroom fixtures is of paramount importance to educational facilities. In 2021, many schools experienced an uptick in vandalism, due to a destructive ‘Devious Licks’ challenge on TikTok, which encouraged students to record and post a video of themselves stealing or vandalizing school property. Unfortunately, bathroom equipment like soap dispensers, faucets and toilets were targeted. This makes the case for schools to use high-quality, durable restroom equipment that holds up to vandalism attempts.

Many soap and faucet sets have hidden sensors to discourage tampering. They are also made with durable cast-brass spout construction with popular PVD finishes that are highly resilient and withstand wear and tear. Similarly, electronic roll towel dispensers are designed with several anti-vandalism features, which also help improve maintenance. These dispensers control the amount of paper towel used, deterring vandalism and reducing waste. For example, sometimes people grab handfuls of towels from a dispenser, toss them in the trash or a toilet, leave them on the sink, or drop them on the floor. An automated towel dispenser delivers a set amount of paper, reducing excessive usage and saving time on refilling. Another anti-vandalism “time out” feature locks out the dispensing of paper towels after being activated three times in a row.

Reducing waste and maintenance time, in turn, saves money. By limiting the amount of product used, like paper towels, less time is spent on refilling and less money is spent on new product. Some handwashing models use a smart-sense soap system with LED light indicators to display low soap and battery, making maintenance more predictable and efficient. A multi-feed soap system can also be used with a large capacity 1.3-gallon (5.0 L) tank that can supply up to six soap dispensers at once, which is a time-saver and game-changer for maintenance staff. In all, today’s touchless restroom fixtures require less time cleaning, ordering, refilling, and restocking, saving money.

Jon Dommisse, vice president of marketing and corporate communications for Bradley Corp., reinforces the advantage of touch-free systems, noting, "Our research shows that two in three people use a paper towel to avoid touching restroom door handles, flushers, and faucet handles. This evasive action further demonstrates why touch-free restroom fixtures resonate so much with restroom users."

Photos courtesy of Bradley Corp.

Hygienic restrooms benefit from the use of touch-free fixtures that promote handwashing and contain water, soap, and drying functions all near the washing basin.

Using select surface materials on sinks, fixtures, walls, and accessories in a restroom help maintain good hygiene and cleanliness.

Hygienic Surface Materials

A related strategy for healthier restrooms is to complement touchless fixtures with surface materials that don’t support microbial

growth. For sinks and washbasins, using smooth and nonporous materials with seamless construction (like solid surface and natural quartz) helps prevent bacteria and mold accumulation and growth. These materials can be easily cleaned, disinfected, repaired, reused, and have a longer life cycle than laminated materials. These solid surface materials are generally quite sustainable and are cast-formed so they can be specified in many attractive shapes and forms. For multi-user restrooms, new washbasin designs made of solid surface material, with increased space between the handwashing areas, allow for social distancing while washing hands in a more hygienic environment.

For soap and faucet fixtures, there are popular and attractive finishes produced with physical vapor deposition (PVD), an advanced process that creates a molecular bond to the fixture, creating a resilient coating that will not corrode or fade. PVD coatings are not only a more sustainable way to finish metals than traditional electroplating, they are also inherently antimicrobial. A number of different PVD finishes are available from manufacturers for different models of soap and faucet fixtures.

Cohesive Restroom Design

There are many more products available for restrooms than ever before, so it is easy to end up with a mismatched or incoherent design. Finding a single manufacturer who can meet multiple restroom specialty needs can help in this regard since the entire restroom can be viewed holistically to create an overall positive experience for students and other users. Here, in particular, product selection is instrumental in achieving not only a successful design, but also in creating a long service life. When designing school restrooms, it can be a challenge to get multiple products from multiple manufacturers to work together to create a cohesive whole. By minimizing the number of manufacturers involved and looking for multiple pieces of equipment and accessories that come from a single source, there is a greater likelihood that a more coordinated design will be possible. In fact, some manufacturers already have groupings or "collections" of their washroom accessories that can be selected and specified.

Among the advantages of using a collection, consistency of material appearance and color is a strong one. Choices of accessories include stainless steel, white or black phenolic doors, as well as ones with a modern matte black, powder coating - all very durable and attractive. Consistency in terms of their ability to be cleaned and remain hygienic is also achieved this way.

Such attention to the permanent accessories can help with the coordinated, overall experience as well as influence the smooth, long-term operation and maintenance of restrooms. For example, soap dispensing systems often require a lot of time for maintenance staff to refill them on a regular, even daily basis. Products are now available in top-fill soap dispensing system that can refill up to six soap dispensers with one pour. That saves time, as well as ensuring that all dispensers are full, and hands are actually washed at school, thus preventing the spread of germs and disease in school environments.

Hand drying is critical for good hygiene, and hence, an important detail in restroom design. The common options are paper towels and hand dryers, and while each have their pros and cons, there is room for both, even in the same washroom. One manufacturer even makes a 3-in-1 unit that has a paper towel dispenser, waste receptacle, and a built-in high-speed hand dryer. While paper towels can generate waste and may be more expensive in the long run (since they are a consumable), there are instances where they are needed for uses besides hand drying, like cleaning up a mess in a washroom, or even using them to avoid touching surfaces that people don't want direct contact with.

By selecting washroom accessories that fit seamlessly with partitions in color, as well as with a collection of washroom accessories, designers have a complete palate to create their vision.

CONCLUSION

Designing schools requires attention to current concepts in learning, plus attention to health and welfare issues highlighted by the recent pandemic. Strategies such as flexible spaces, indoor/outdoor connections, and better acoustics help in that regard. Improved ventilation and thermal comfort are also key aspects. Attention to restroom and toilet design in the interest of better hygiene, health, and privacy is required. Altogether, designing with a focus on health and welfare is in everyone's best interest.

Photo courtesy of ASI Group

The use of multiple products from a single manufacturer helps to promote a more cohesive design, with coordinated washroom accessories, partitions, and other items, in a hygienic washroom.

Continues at ce.architecturalrecord.com

Peter J. Arsenault, FAIA, NCARB, LEED-AP
is a nationally known architect, and author of over 250 continuing education courses promoting better architecture in both performance and design.
www.pjaarch.com www.linkedin.com/in/pjaarch