Bringing Nature Indoors

How wood in schools can nourish learning

By Joe Mayo

Schools are formative environments where children's identities grow and take shape. While many factors affect a student's learning, healthy physical environments can play a big part. As designers, how do we create nourishing environments where children can learn and thrive?

Educational Benefits

Studies have shown the positive benefits that air, acoustics and daylight have on learning, but recent evidence suggests the material quality of a space also impacts the creation of healthy learning environments. Blank walls do not elicit much in the way of a psychological or emotional response, but patterning and texture in natural materials can. Human minds understand wood texture as non-living, but still associate it with representations of living things. School interiors that feature wood bring nature indoors, which provokes positive psychological responses similar to how trees elicit biophilic responses. Wood in classrooms has even been shown to reduce stress and heart rates in students; it is calming, but also engaging without being a distraction.

When wood is used in finishes, environments are enriched both visually and tactilely. Such complex environments have been shown to increase performance on intelligence tests, while other studies have shown that people judge spaces more favorably when wood is present, perceiving wood interiors as warm, inviting and relaxing. A Japanese study further showed wood had influenced physiological and psychological health more positively than other materials.

At Wilkes Elementary School on Bainbridge Island, Wash., wood comprises almost all interior surfaces.

At Gray Middle School in Tacoma, Wash., glue-laminated timber beams were salvaged from a demolished building, sanded and reused in the new school's roof structure.

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in," said Wilkes Elementary Principal Sheryl Belt.

Sustainability Benefits

Wood can also benefit school communities when used as a building's primary structure material. It can be less expensive to construct and has lower embodied energy and better environmental traits than other standard structural materials. At Gray Middle School in Tacoma, Wash., glue-laminated timber beams were salvaged from a demolished building, sanded and reused in the new school's roof structure. The timber beams are prominently displayed inside classrooms as a reminder of the region's timber industry. They also underscore the district's commitment to the environment to reusing and recycling materials whenever possible.

At Arlington Elementary School, also located in Tacoma, wood is being used to construct all exterior walls and seismic force resisting elements in a cost-effective strategy to build the new 55,000-square-foot building. Structural wood costs averaged $12 per square foot less than the steel and concrete being used to construct another school in design at the firm at the same time, which was similar in size, scope and location.

At Finn Hill Middle School in Kirkland, Wash., Mahlum pushed the use of timber and energy-efficient design by using Structural Insulated Panels (SIPs) made from wood sheathing and rigid insulation. The SIPs comprise the building's walls and roof, supported by glue-laminated timber beams. This design creates a continuous wrapper of insulation and dramatically reduces the amount of energy required to operate the school. This approach also realized a quick, well-coordinated construction sequence.

In addition to light wood framing, a new mass timber structural material called cross-laminated timber (CLT) is gaining popularity. Mahlum is using CLT in a series of three new classroom buildings in Washington State. The classrooms are a pilot project funded by the state to study CLT's design and construction potential.

"Demonstrating the effectiveness of CLT could stimulate the market for this innovative wood product in Washington State, create opportunities for manufacturing, encourage the use of locally produced wood and build rural jobs," said Debra Delzell, PE, a project manager for Washington State's Department of Enterprise Services.

For the classroom buildings, all loadbearing walls are constructed from CLT that is left exposed on the interior. As a result, interior spaces teach students about building materials and sustainability, while creating supportive and stimulating learning environments. The CLT is supported by long-span wood roof trusses, which will allow classrooms to be organized in a variety of ways as needs change over time.

In architecture, the image of what is considered "modern" has been rigid since the turn of the last century, referring primarily to concrete, steel and plastics. But as science and evidence-based design evolve, we learn more about the complexity of wood: its cellular structure is quite advanced, it is able to generate chemical extractives and it balances humidity. All of these properties make wood very "modern" and a material of choice for both aesthetics and sustainability.

The therapeutic effects of trees and nature are well understood outside our buildings, yet inside our buildings wood and other natural materials can be used to create healthy, enriched, biophilic environments. When wood is used inside buildings, our senses are activated and perceptions heightened. Studies even suggest that surfaces made of wood can induce healing. As more emphasis is put on healthy materials, wood will be an increasingly relevant material for its sustainability and physiological attributes.

Case Study: Washington Latin Public Charter School

In June 2016, Washington Latin Public Charter School, which serves grades 5-12 in Washington D.C., officially opened its new gymnasium addition, the first cross-laminated timber (CLT) building in the District of Columbia. CLT was chosen not only for its aesthetics and sustainability, but also for its speed of construction. Fully engineered pre-fabricated panels served as the building structure, exterior sheathing and interior finish, eliminating waste at the construction site and ensuring the project used less material overall. The project was required to meet LEED certification and the CLT construction provided a completely air-tight envelope with tightly fitted overlapping joints. In preliminary estimates, the construction cost was consistent with that of a conventional steel frame project.

Mahlum Architects, with offices in Seattle and Portland, Ore., has used wood in school environments for many years to create aesthetically appealing spaces and to capitalize on wood's inherent sustainability qualities. At Wilkes Elementary School on Bainbridge Island, Wash., wood comprises almost all interior surfaces: ceiling screens, glue-laminated beams, tongue and groove roof decking, window casements and interior relites, windows or translucent panels above doors or high in a partition wall intended to allow natural light to penetrate deeper into a building. The effect is a warm, enriching, and open environment that connects classrooms out to the dense forest beyond.

"There is a tone of learning here that permeates the building that I have not felt in other buildings I've worked

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