500 Healthier Kids + Better Learning Environment = Benefits
55 million students and 5 million faculty of America’s population 20%
spend over $35,000,000,000,000 in tax dollars annually
DIRECT SAVINGS FOR AN AVERAGE GREEN SCHOOL

$47,880
Annual Direct Energy Savings Per School

$95,760
Annual Total Direct Savings Per School
ENERGY & WATER COSTS

STUDENT HEALTH & TEST SCORES
Learning benefits of green schools = \{ +3\% \text{ increase in productivity, learning, & performance} \text{ and } -3\% \text{ decrease in teacher turnover} \}
Day Lighting
Ventilation
Healthy Learning Environment
65 years old

aging schools
declining population
disproportionate enrollments
250,000 units on order
$15 billion industry

*USGBC survey, May 2010*
PI's: Judi Heerwagen and Sergio Palleroni

Project Team:
Sergio Palleroni
Judi Heerwagen
Peter Dusik
Judith Gonzalez
Carey Griffin
Janet Hammer
Huanan Hu
Margarette Leite
Loren Lutzhenhiser
David Sailor
Jeff Schnebel
Gro Hagelund
James Woods

Key Principles
The planning grant will support rethinking both new school and renovation of existing schools in the urban context. Three key principles will guide this effort:
- Sustainable design should be the foundation for achieving the hallmarks of children's negative, physical and psychological development.
- Schools should be embedded in the social and economic fabric of the community and should provide a sense of citizenship around learning, one which enhances both health-related and educational needs.
- The school itself and environmental stewardship should be a central component of the curriculum throughout the school years, from kindergarten through high school. Sustainable design provides a rich milieu for the development of scientific as well as critical thinking.

How this Differs from Current Green School Efforts.
Current sustainable school design focuses largely on bricks and mortar. It addresses the physical building and not on how the school should be designed to promote child development and community engagement while also achieving environmental goals. If, however, we begin with what the child needs in order to thrive, then we start in fundamentally different places. We work backwards from this large goal to look at how every aspect of the physical environment can contribute to - or inhibit - that goal at different ages.

We also integrate others - teachers, parents, health professionals, economists, business partners - in addressing how the Green School of the Future can work with the community and dissolve the barriers that separate "learning" from "life.

Beginning with the Child.
In addressing the needs of children and school design, we will go well beyond the current narrow approach that looks at test scores or the key indicators of green school benefits. Performance on standardized tests is just one of many valuable developmental outcomes. Studies of research in the social sciences and medicine show that features of the physical environment can have strong effects on children's health and learning, both positive and negative. Our goal is to identify and substantiate the beneficial contributions of the school context and the physical environment on health and learning and to eliminate the negative.

Brief
The planning grant will focus on developing a multi-stage approach to create and test new approaches to sustainable schools. At the heart of this effort is a strong belief that school design and operations needs an essential refocus. Schools should no longer be conceived as containers for learning that disconnect children from their communities and the environment. The Green School of the Future is envisioned as an essential component of the community and one that uses the building and its grounds to teach concepts of social, economic and environmental sustainability.
our call to ACTION

LEARNING ACTIVISM
April 9-10 2010

Portland American Institute of Architects, in conjunction with Portland State University’s Department of Architecture and in support of Portland Public Schools, will be hosting a Symposium that looks at the growing role of the citizen architect. This movement redefines the traditional practice of architecture to include tangible service to the public good. Meet the visionary leaders of this shift, take part in discussions with other community-minded designers and be an activist, if only for a day. Presentations and forums will conclude with a group design Charrette to address one of the real needs in Portland’s schools.

$50.00 for AIA members; $60.00 for non-members
100 free tickets available for UO and PSU students
Scholarships generously provided by Architects Without Borders
Register at http://www.aiaportland.com/

Friday, April 9th FORUMS
Location: Shattuck Hall Annex, Portland State University

Panel 1: Activism within the Profession
8:30-10:00
1 CEU
Dawn Otte – Holt
John Peterson – Public Architecture
Moderators – PSU and UO student

Panel 2: Learning Activism through Education
10:15-11:45
1 CEU
Rachel Hughes – University of Arborvis professor
Danny Wicker – Rural Studio
Moderator – PSU and UO student

Panel 3: In the Trenches with Communities in Need
1:00-3:00
2 CEUs
John Blumenthal – Architects Without Borders – Oregon
Margarette Leite & Sergio Pallaroni – BASIC Initiative/Adopt a School Program, PSU professors
Moderator – PSU and UO student

Saturday, April 10th CHARRETTE
Location: Shattuck Hall Studio, Portland State University

Portland Public School District, like many school districts, struggles with shifts in enrollment at its neighborhood schools. The most common solution for temporary enrollment increases is to install modular classrooms. While PPS invests in improvements, the products that are available and economical have a long way to go to be the high quality learning environments our students deserve. What if there was a better way to design truly modular, scalable, sustainable, beautiful, and affordable temporary classrooms that also provide a great learning environment? Join us as we work together to brainstorm solutions to a problem faced by school districts across the country.

Charrette Schedule
8:00-3:00
5 CEUs
PSU Student Research Presentation
Modular Building Presentation (Paul McKeen)
Description of Charrette Options
Break into Groups

Topic Options:
1. New Modular design options for PPS
2. Existing Modular – What do we do with them?
3. Permanent Modular

Register at http://www.aiaportland.com/
School & Community involvement:
- Invention Convention
- Surveys
- Design charrettes
- Interviews with students
- PTA meetings
- Seeoutdoorclassroom.blogspot.com

Design FORUM
TAKING THE DISCUSSION OUT TO THE SCHOOLS
How do we communicate with our client?

Enter the classrooms

Organize meetings with parents and teachers

Advertise in on-line newsletters, posters, blog sites, word-of-mouth

Show up at events
small actions can build consensus for the larger vision.
participation needs to be sustained to build lasting consensus
Project Team:
Sergio Pallarini
Judith Haerwagen
Peter Dusicka
Judith Gonzalez
Corey Griffin
Janet Hammer
Huafan Hu
Margarita Leite
Loren Lutzenhiser
David Sailor
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- Sustainable design should be the foundation for achieving the hallmarks of children's cognitive, physical and psychological development.
- Schools should be embedded in the social and economic fabric of the community and should provide a new sense of citizenship around learning, one which builds a moral body, shared effort, and education for life.
- The school itself and environmental stewardship should be a central component of the curriculum throughout the school years, from kindergarten through high school. Sustainable design provides a rich milieu for the development of skills such as ethical thinking.

How this Differs from Current Green School Efforts.
Current sustainable school design focuses largely on buildings and energy. It addresses the school building and not on how the school should be designed to promote child development and community engagement while also achieving environmental goals. In contrast, we begin with what the child needs in order for them to start in a fundamentally different place. We work backwards from the larger goal of how every aspect of the physical environment can contribute to, or inhibit, that goal at different ages.

We also integrate others - teachers, parents, health professionals, scientists, business partners - in addressing how the Green School of the Future can look outwards to the community and disperse the barriers that separate "learning" from "life."

Beginning with the Child.
In addressing the needs of children and school design, we will go well beyond the current narrow approach that looks at test scores as the key indicator of green school benefits. Performance on standardized tests is but one of many valuable developmental outcomes. Ongoing research in the social sciences and medicine show that factors of the physical environment can have strong effects on children's health and learning. Both negative and positive. Our goal is to identify and substantiate the beneficial contributions of the school context and the physical environment to health and learning and to eliminate the negative.
Thermal Comfort in Laurelhurst Elementary

Abstract

The thermal conditions of two classrooms at Laurelhurst Elementary School are measured and analyzed in conjunction with ASHRAE Standard 55-2004: Thermal Environmental Conditions for Human Occupancy. One classroom is in the original school building and the other is a temporary portable structure. The main building classroom is found to be much more closely adhere to standard 55-2004 than the portable classroom. Students experience acceptable conditions 85% of the time in the main building classroom as opposed to 43% of the time in the portable classroom.

Introduction

The classroom environment has long been suspected to influence student performance. Studies show that students commit few errors and are generally more attentive in learning environments that adhere to ASHRAE thermal comfort standard 55-2004 (Wargocki & Wynn, 2007), (Schneider, 2002), though some data are more loosely correlated (Mendell & Heath, 2005). ASHRAE Standard 55-2004 specifies the combination of indoor thermal environmental factors, namely temperature, humidity, thermal radiation, and air speed, that will produce conditions acceptable to a majority (about 80%) of the occupants within the space (ASHRAE, 2004).

Laurelhurst Elementary School consists of an original building, built in 1923, two annexes, built in 1951 and 1968, and a portable classroom structure, in use temporarily while parts of the main building are renovated. The use of temporary portable classrooms by Portland Public Schools is becoming more common, both for construction situations and to relieve overcrowding. The original building and the portable classrooms have two very different heating systems. The original building is heated by large wall mounted radiant panels, while the portables are heated by a roof-mounted forced-air system. The purpose of this study is to compare thermal comfort in the older, original classrooms with the newer, portable classrooms, to determine whether the portables offer an acceptable learning environment.

Method and Site

ASHRAE Standard 55 lists six primary factors to consider when evaluating thermal comfort: Metabolic rate, clothing insulation, air temperature, radiant temperature, air speed, and humidity. The ASHRAE recommended and experimental measurement procedures are listed in Table 1. Additional guidelines are:

- Measurements should be taken where the most extreme values of thermal conditions are estimated or observed.
- Heating period (winter) measurements should be taken when the indoor-outdoor temperature difference is not less than 30% of the difference used for design and when sky conditions are cloudy to partly cloudy.
- Simulation of test personnel by occupants is recommended.

<table>
<thead>
<tr>
<th>Factor</th>
<th>ASHRAE 55 Measurement Protocol</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic Rate</td>
<td>Estimate mean values 0.5 to 1 hour before temperature measurements.</td>
<td>Assumed 1.2 met, typical for sedentary office or classroom activity.</td>
</tr>
<tr>
<td>Clothing Insulation</td>
<td>Estimate mean values 0.5 to 1 hour before temperature measurements.</td>
<td>Assumed 1.0 cip, typical for cool weather.</td>
</tr>
<tr>
<td>Air Temperature</td>
<td>Measure at 4, 24, and 43 inch heights at locations where occupants are known or expected to spend their time.</td>
<td>Measured using HOBO U12-012 datalogging temperature and RH sensors in 6 locations per room at 24 inches and one location per room at 43 inches.</td>
</tr>
<tr>
<td>Radiant Temperature</td>
<td>Measure at 24 inch height for seated occupants.</td>
<td>Measured at 24 inches in the interior classroom using an infrared thermometer.</td>
</tr>
<tr>
<td>Air Speed</td>
<td>Measure for minimum of 3 minutes duration at same height and location as air temperature measurements.</td>
<td>Neglected, sensors not available.</td>
</tr>
<tr>
<td>Humidity</td>
<td>Measure in one location in the occupied zone, unless large humidity variations are suspected.</td>
<td>Measured (with air temperature) by HOBO U12-12 sensors.</td>
</tr>
</tbody>
</table>

1. The 4 inch measurements were neglected due to concerns of tampering or damage to the sensors.
2. The portable classroom had no radiant heat sources and was not measured.
<table>
<thead>
<tr>
<th>Number of research papers prepared</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of graduate students involved</td>
<td>22</td>
</tr>
<tr>
<td>Number of undergraduate students involved</td>
<td>32</td>
</tr>
<tr>
<td>Number of sustainability events held</td>
<td>6</td>
</tr>
<tr>
<td>Number of sustainability courses developed and/or taught</td>
<td>Three (two in architecture and urban studies, one a capstone)</td>
</tr>
<tr>
<td>Number of proposals submitted for external funding</td>
<td>One, to HUD, three more in process</td>
</tr>
</tbody>
</table>
| Number of external partnerships formed (please list the organizations/institutions) | >AIA (Portland and Oregon)  
>Albina Bank  
>Portland Public Schools (PPS)  
>David Douglas Public School District  
>Parkrose School District  
>Visual Online Solutions and Zen Freese (donation of film production of “PSU & AIA Rethinks Modular Schools” and documentation of public Symposium and Charrette  
>Council of Educational Facility Planners International  
>Modern Building Systems  
>Blazzer Industries  
>KPFF Engineering |
| Number of internal partnerships formed | 8 department formal collaboration relationships  
5 departmental research relationships |
WHERE NEXT?

public / private collaboration in the creation of a prototype project
Learning from the solar decathlons and industry
The Learning Activism Symposium featured a day-long design charrette that focused on the development of well designed, sustainable and affordable modular classrooms.
film on the charrette

• http://schools.basicinitiative.com/