Invisible Factors Affecting Achievement at Your School

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CESA 10 – Facilities Management
Who is CESA 10?

- Non-profit educational agency
- All standard educational services PLUS
  - Leading Edge Ed Tech Department
  - Statewide Facilities Management
    - Environmental Health and Safety
    - Energy Management
    - Owner’s Representative
    - Behavioral Based Energy Management Services
    - Performance Contracting

Efficient buildings, safe people, healthy environments, sustainable change
A Question and an Answer

• Are school facilities in your state (Wisconsin) seen as an expense or an investment?

• “The school facility is much more than a passive container of the educational process: it is rather, an integral component of the conditions of learning.” Lackney and Picus
Review of Maslow’s Hierarchy

- **Physiological**
  - breathing, food, water, rest

- **Safety**
  - safety and security of self and family

- **Love**
  - belonging, friends, family, partner

- **Self Esteem**
  - achievement, respect

- **Self Actualisation**
Facilities Management Philosophy

Efficient buildings, safe people, healthy environments, sustainable change
Maslow – Adjusted for Facilities

Monberg, Kacan and Bannourah: “Transcendent Schools for the 21st Century”
Hierarchy of Needs for Learning Environments of the Future

Level 1 – Facility Needs
Safe, secure, weather-tight and code compliant

Level 2 – Program Needs
Appropriate space to curriculum and pedagogical approach

Level 3 – Student Centered Needs
Optimized to meet ideal environmental needs of students, reducing stress increasing choice

Level 4 – Community Needs
Reflective of neighborhood values

Level 5 – Facility Actualization
Fully integrated teaching and learning tool

Level 6 – Transcendence
School inspires other communities to achieve similar results

Monberg, Kacan and Bannourah: “Transcendent Schools for the 21st Century”
What does the research say?

  - Negative correlation between age of facility and Student Achievement
  - Focus on elements facility does not have.

- Lackney and Picus (2011) – School Facilities – Overview, Maintenance and Modernization Of

- Monberg (2011) – Transcendent Schools for the 21st Century
At the beginning of the 21st century, the mean age of school building in the United States as forty-two years, with 28% of school buildings built before 1950.

Issues – acoustics, indoor air quality, water quality, energy usage, abatement of asbestos, radon, other hazardous material – more recently safety and security
What are the factors?

- Safety –
- Adequate Ventilation
- Thermal Comfort
- Air Quality
- Lighting / Daylighting
- Acoustics
Prequalifying Statement

• If you are building a new building – many of these things are “built in”.

• The architects and designers are way ahead – codes are driving much of the concerns

• Truth is – most of us are not building new buildings – we need a sense of what to watch out for in our existing buildings and improve! Many current buildings are out of compliance!!
Safety

• Feeling of Security – “Am I Safe”
• Potable Water – Good water quality
• Adequate lavatories
• Fire and Security Systems
• Good Communications System
Adequate Ventilation

- Positive correlations between high CO2 concentrations in the classroom and the low performance of students on academic tests
- Provide proper amount of outside air (7.5 CFM) per person per classroom.
- Recommended levels – 350-400ppm
- Maximum levels – 700-800ppm
- Symptoms – Drowsiness, Eye Irritation, Brain starts to shut down
Air Quality

- American Lung Association (2008) – 14.4 million days of school were lost by students due to asthma
- Mold, Dust, Bacteria
- VOC’s – carpet, paint, stains, etc...
- Cleaning products
- Pollution (test carpets) was absent – math scores improved by 3.8%, logical reasoning by 3-4%
Thermal Comfort

- Thermal comfort is really the appropriate temperature and relative humidity (RH)
- Effective temperature range of 67° to 73° F is desirable.
  - Does building have Air Conditioning?
  - Proper space requirements being met?
Thermal Comfort

• 15% less work is performed at 75° than 68°F @50% RH
  – Definite increase in body temperature and pulse rate
  – Marked fall in vasomotor tone – Brain shuts down

• 28% less work is performed at 86°F @ 80% RH than 68°F

• Recommendation is 68° to 70°F with RH @ 50%
Lighting / Day-lighting

• Parameters around lighting
  – Color Temperature (3500°K, 4100°K, 5000°K)
  – Color Rendering Index (1 – 100)
  – Intensity (Lumen – output from a source)
  – Density of Light on a Surface (Footcandle or Lux)
    • “What the light meter reads.”
Lighting / Day-lighting

• Probably not a surprise - positive correlation between Good Lighting Quality and high student achievement
• Also not a surprise - where lighting was less than acceptable level, students did not perform well
• A more recent study of schools with Day-lighting scored 20% higher on Achievement tests than those without day-lighting
• Day-lighting improved student attendance
• Full spectrum artificial lighting also saw a decrease in absenteeism
Lighting / Daylighting

• **Recommendation for classrooms**

  High Color Temp (4100ºK +), High CRI (80+), 30-35 Footcandles

Incorporate Day-lighting whenever possible
• **Common Belief**
  – The common belief is that it is important to improve acoustics in spaces used by children with hearing problems

**Problem or Situation**

– In many classrooms in the US, speech intelligibility rating is 75% or less
– This means that listeners with normal hearing can only understand \( \frac{3}{4} \) of what they are receiving
Acoustics

Who is affected - Everyone?

• Children with learning disabilities – not hearing

• Young children – language development
  - Unable to predict from context

• English as a second language
Acoustics

• Solution – Reduce Volume or Increase Absorption
  – Evaluate classroom / space for appropriate sound absorption
  – Floor tile vs carpet
  – Plaster wall or ceiling vs. Fiberglass wall panel or glass fiber ceiling (acoustical tile)
Reverberation Time (RT) factor below (.5) (Sabine)
So WHAT?

- Age of Facility (older is bad – but why?)
- What can we do about it, where do we start?
- What does our (community) future look like?
- Develop Understanding of the Situation
- Understand “OUR” circumstances and SET “OUR” uniques GOALs!!!
- Get Help WHEN YOU NEED IT!
Get Help – Audit/Design

• Engineers and project managers work with building staff to understand your needs
• Audit facility to get a complete understanding of shortfalls
• Determine optimal solution
• Use experience writing specifications, competitive bids, reviewing bids
• Identify any environmental hazards
## Prioritization Matrix

### District Wide Summary

<table>
<thead>
<tr>
<th>Priority</th>
<th>Inspection Item</th>
<th>System Type</th>
<th>Functional Condition</th>
<th>Safety/Compliance</th>
<th>Project Cost</th>
<th>Annual Savings</th>
<th>Total Points</th>
<th>Description of Inspection Item and/or Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Roofing upgrade (54/66/95)</td>
<td>Building Envelope</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>Building section 4 and 5 - roof rating low.</td>
</tr>
<tr>
<td>2</td>
<td>Replace Unit Vents (1954/66/95)</td>
<td>Mechanical</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>2</td>
<td>17</td>
<td>Unit vents are on/off at teacher discretion - inefficient and may not be up to code</td>
</tr>
<tr>
<td>3</td>
<td>Replace Electric heating in hallway with hot water</td>
<td>Mechanical</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>Replace existing electric heat with 2 gas fired RTUs to serve hall areas</td>
</tr>
<tr>
<td>4</td>
<td>Gas pipe venting near outside intake for classrooms</td>
<td>Misc.</td>
<td>0</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>15</td>
<td>Operational issue to be investigated with utility, safety concern</td>
</tr>
<tr>
<td>5</td>
<td>Replace Furnaces with efficient furnaces including electrically commutated motors (ECMs)</td>
<td>Mechanical</td>
<td>10</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>14</td>
<td>Install new furnaces with ECM's and condensing technology</td>
</tr>
<tr>
<td>6</td>
<td>Replace windows</td>
<td>Building Envelope</td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>13</td>
<td>Windows in Office, English room &amp; Guidance office are single pane and allow infiltration</td>
</tr>
<tr>
<td>7</td>
<td>Replace pipe insulation</td>
<td>Misc.</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>12</td>
<td>Pipe insulation in classrooms needs replacement</td>
</tr>
<tr>
<td>8</td>
<td>Install heat ducting to kindergarten restroom</td>
<td>HVAC Control Measures</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>12</td>
<td>Kindergarten restroom was never ducted to have heat</td>
</tr>
</tbody>
</table>

An added value in CESA 10’s scoping audit.
1. Focus on individual student learning so that each student can reach his/her highest academic potential related to college and career readiness

2. Create a culture that is responsive to meeting the academic and social needs of the education community

3. The district will work proactively to maximize safety for each individual as pertains to school grounds and daily operations

4. Continue to refine communications between various stakeholders

5. Increase parent/community involvement and support of our schools
“Education is not the filling of a pail, but the lighting of a fire.”

W. B. Yeats

Image reproduced from Educational Facility Planner, Volume 45: Issue 4, pg 14.
http://media.cefpi.org/efp/EFP45-4Monberg.pdf
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Insight from an Ex-President
Contact Information

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Questions?
• CESA 10 is local
• Offices statewide
• We know Wisconsin schools
You will hear about CESA 10’s:

- In-House Expertise
- Transparency
- Cost Effectiveness/Fairness
- Customized Flexible Solutions

CESAs: By Schools, For Schools
Efficient buildings, safe people, healthy environments, sustainable change
Why use CESA 10 for PC?

Experience

• CESA 10 has significant experience with GUARANTEED savings

• Staff have been managing energy projects and helping schools for decades

  ➢ PC Experience
  ➢ Mechanical and Electrical Engineers
  ➢ Experienced Project Managers
  ➢ In-House Environmental Services