

# New York State Chapter CEFPI November 2013 Conference

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## **Presentation Outline**

- Why the physical environment of schools is important
- Psychological processes related to learning
- Research findings
- Student efficacy and building attributes
- Building design research

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## **Why the physical environment of schools is important**

Factors related to student learning

Bronfenbrenner's Bio-ecological Theory

$$D = f(PPCT)$$

P = Person, P=Proximal Processes, C=Context, T=Time

What can the school control?

Instruction

The building

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**Psychological Processes Related to Learning**

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**Cognitive fatigue:** the inability to maintain sustained attention

**Attention/Distraction:** the ability to stay on task

**Motivation:** the desire to learn

**Emotional affect:** attachment to place

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## Cognitive fatigue

Highly complex environments (too many colors, textures, displays)

IAQ

Lighting

Space for activities

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## Attention/Distracton

Noise

Crowding

Complexity

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## Motivation

Control - ability to manipulate the environment

Access – not just ADA

Exploration – support curiosity



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## Emotional affect

Personalization

Building maintenance

Crowding

Noise

Complexity

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## Research Findings

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## Physical features of the environment

acoustics/noise

density/crowding

classroom/building design

building age and condition

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## Acoustics/Noise

Effects of chronic exposure to noise

- difficulty completing complex tasks

- difficulty in concentrating

- indiscriminate tuning out of stimuli

- negative effects on standardized measures of achievement (reading) for school-age children

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Additional effects of noise exposure in school settings

decreased tolerance for frustration

elevated blood pressure levels in children

increased self reports of stress in children

increased mental and voice fatigue in teachers

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## Sources of noise in schools

### External

airport traffic

road traffic

train traffic

### Internal

Mechanical systems, lighting

Furniture

Other people, activities

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**Density:** Objective measure of people and space

**Crowding:** Subjective measure of too many people or not enough space, difficulty controlling social interactions often resulting in cognitive fatigue or attention overload

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## School size

smaller schools promote pro-social behaviors  
more participation in activities and leadership  
roles

fewer acts of violence (per student)

academic achievement, conflicting evidence



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## Classroom

negative effects on learning, especially complex or difficult material

negative effects on behavior

higher levels of distraction, cognitive fatigue

less pro social behavior

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## Classroom

Class size – group size

increased academic achievement for class sizes less than 17

Class size – square feet per child

fewer sq. ft. per child related to poor academic achievement, more acts of aggression and disruption

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## Classroom Layout

Arrangement of furniture

cluster arrangement supportive of student interaction

rows supportive of paying attention

arrangement should support lessons

implications for classroom size/design

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## Classroom Design

displays support lessons/complexity/fatigue

sufficient storage/complexity/emotional affect

ambient environment/light, HVAC/attention/  
emotional affect

space for personalization/emotional affect

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**Student efficacy and building attributes**

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## School building quality

School building quality \***predicts** student academic achievement

Studies with good controls

SBQ → Attendance → Achievement

SBQ → Climate → Attendance → Achievement

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## Elementary School

School building quality predicts academic performance(STS) and student lateness

Student perception of building quality predicts self-worth and academic performance (STS)

Perceived classroom quality best predictor of scholastic competency and self-worth

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Children's perception of SBQ best predicted by

bathroom quality

classroom quality

cafeteria quality

hallway quality



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**Perceived classrm quality best predictor of**  
perceived self worth  
perceived scholastic competency

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## Secondary School

School building quality predicts academic performance (GPA)

Perception of school building quality predicts academic performance (GPA)

SBQ and PSBQ predicts students' rating of self-efficacy

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**Students' perception of SBQ best predicted by**

hallway quality

classroom quality

bathroom quality

library quality

cafeteria quality

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## Student perception of SBQ and GPA

hallway quality

cafeteria

library

## Student perception of safety related to

scholastic competence

behavioral conduct

self-worth

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## Summary

Students' perception of school building quality mirrors objective measures

All areas of the school are important to students

School building quality is related to academic achievement and students' self-perception

Perception of safety is especially important

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Case Study – School Design



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## Goal

New elementary school design intended to promote more student engagement and teacher collaboration

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Abbot Downing Elementary School  
 Concord, NH  
 First Floor

0' 20' 40' 80'





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- Classroom
- Common Space
- Administrative
- Toilet
- Support



Christa McAuliffe School  
 Concord, NH  
 First Floor



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## Student engagement

I try hard to do well

I enjoy learning new things

Class is fun

In class I work as hard as I can

When we work on something I get involved

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## Perception of School Building: classroom, hallway, library

How much do you like....

How much does noise in....

How crowded do you feel in....

How easy is it for you to read or work by yourself in

How easy is it for you to talk privately in.....

How safe do you feel in.....

How dirty or messy is .....

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## Findings

### Engagement

School A - No difference between years 1 & 2

School B – Significant difference – improvement  
in student engagement in year 2

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## Student Findings

### Perception of School Building & Library

School A – No overall difference

- Like library better in year 2

- Less likely to never go to library

- More likely to either go alone or w/class

- More likely to work w/other

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## Student Findings

### Perception of school building and library

School B – Student perception of overall school building improves in year 2

- Less likely to never go to library

- More likely to either go alone or w/class

- More likely to work w/other

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## Teacher Findings

### Survey, Logs and Syntax analysis

Overall improvement in support for collaboration  
due to design

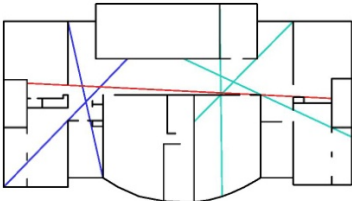
Logs – no design effects on informal communication

School B – Interaction increased but must exercise caution

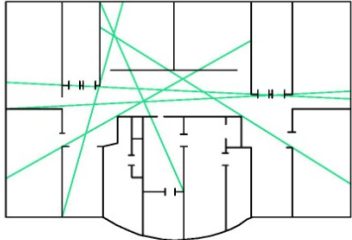


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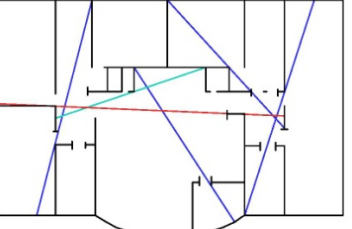
School C<sub>2</sub> Axial Maps



Basement

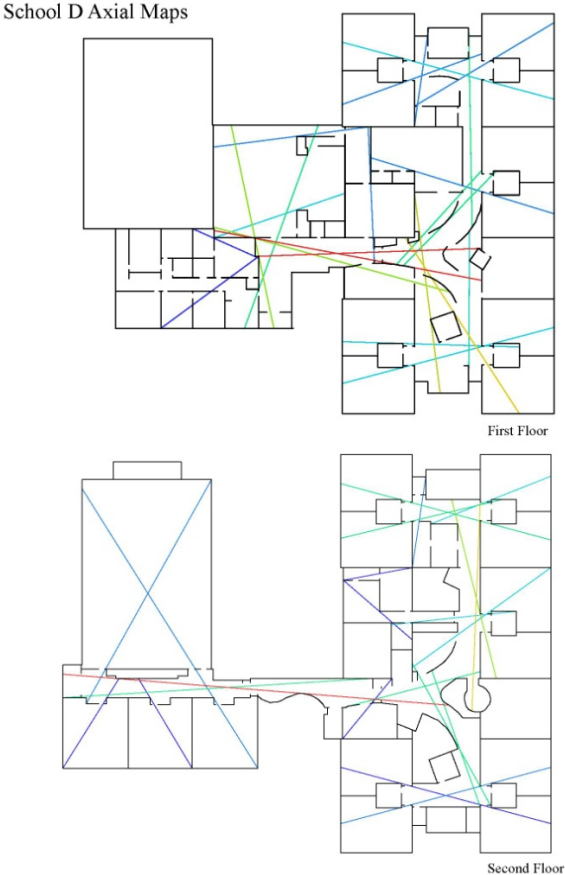


1st Floor



2<sup>nd</sup> Floor

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## Case study summary

School design can affect students' perception of school work and the building

School design may be related to teacher behavior

Additional research is needed (controls and larger samples)

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## **Conclusion**

**Physical environment of schools matters**