Linking Architecture And Education For Learning

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“SUSTAINABILITY AND RESEARCH”
APROPOS TO WELLS COLLEGE

This topic seems to relate well to the goals of the Center for Sustainability and Environment, which are:

1. To support faculty in incorporating sustainability content and to undertake related research projects.

2. To develop the campus as a “living-learning” laboratory that reinforces models of sustainability.

3. To be a hub for the community in co-creating a more sustainable campus environment.
Presentation Organization

- History of Personal Research
- Acoustics
- Air Quality
- Autism
- Classroom Size
- Color
- Community
- Daylighting
- Furniture
- Security
- Technology
- Thermal Comfort
- Sustainability
Effects of Specially Designed Environments Based on Developmental Needs of Young Children
Arizona State University Interdisciplinary Study

History of Personal Research
Elements within the Modified Classroom Based on Multisensory Interaction, Concept Formation, Language Development, Creativity and Aesthetic Decision Making Capability

- Geometric Environment
- Soft Role Playing Environment
- Mirrored Environment
- Water and Sand Play
- Museum and Display

History of Personal Research
Results – Two Populations One English Speaking the other Bilingual Four Year Olds – Trend Analysis

- Increased concept formation with elements of design
- Increased language acquisition
- Increased English as a second language
- Movement to parallel to integrated play
- Increased creativity in artwork
- No significant in aesthetic judgments
- Students did not want to leave environment…. parents had to drag them out to go home

History of Personal Research
Monte Vista Kindergarten
First and Second Grade Results

• Affected teachers delivery of curriculum
• Showed the difference between professionalism and holding down a job
• Teachers would stay late to write individual lesson plans for the next day
• Fostered independent students
• Children maintained and cleaned the room every day

History of Personal Research
History of Personal Research
Organized by what affects the:

Body, Mind, Creative Spirit

Needs, Problems and Solutions for each topic that follows
Educating the WHOLE STUDENT

Maslow’s Hierarchy of Needs translated to Habitability levels
Man, woman and child - symbiotic relationship with the environment

Maslow’s Hierarchy of Needs

Self-actualization
Aesthetic
Cognitive
Esteem
Belongingness and Love
Safety
Physiological

SPIRIT
(Includes Cultural Values)

Taylor-Preiser Habitability Levels

Psychological comfort and aesthetic satisfaction
Functional
Health and safety codes
Developmental Rights Translated into Habitability Needs (Architectural Settings)

**DEVELOPMENTAL RIGHTS**

**Body**

- Safety and Security
- Multi-sensory Interaction
- Gross Motor Development
- Fine Motor Development
- Wellness and Nutrition

**HABITABILITY SETTINGS**

**Health and Safety**

- Protection / Visibility
- Materials / Colors
- Fitness / Nature Trail
- Studio
- Food Courts / Gardens
Developmental Rights Translated into Habitability Needs (Architectural Settings)

**DEVELOPMENTAL RIGHTS**
- Cognition and Creativity
- Digital Literacy
- Effective Communication
- Critical Thinking

**HABITABILITY SETTINGS**
- Studio
- Smart Labs
- Publishing / Graphic Arts
- STEM / STEAM
Creative Spirit

- Creative Self Expression
- Cultural Pluralism
- Valuing
- Stewardship
- Self and Social Development

Functionality

- Art, Music, Dance, Drama
- School Museums
- Galleries (hallways)
- Gardens / Greenhouses
- Breakout Spaces
Acoustics

**BODY**  “H and S-Stress” from noise causes high blood pressure and a lack of hearing.

**MIND**  External noise lowers achievement, affects test scores, and causes loss of concentration.

**SPIRIT**  Noise causes distractibility, chaos and affects the teacher’s ability to effectively deliver curricula.
Acoustics
Acoustics
Acoustics
Air Quality

**BODY**  Poor air can cause irritated eyes, headaches, fatigue, asthma, tooth decay, drowsiness and can affect concentration.

**MIND**  Lack of fresh air can stunt intellectual growth, memory, testing.

**SPIRIT**  Bad air circulation, the lack of fresh air (windows) and light can be oppressive.
Air Quality

MOLD
Air Quality

Ziger Snead Classroom of the Future with Multi Functional Window Wall

- Transmits and modulates light
- Transmits and modulates sound and light
- Transmits and modulates cool air
- Transmits and modulates fresh air
- Transmits and modulates light
- Transmits and modulates light, views, and information
- Transmits and modulates fresh air

New Classroom Window Wall
Air Quality

Frequent Maintenance and Measurement of HVAC

Individual controls and zoning to save energy.
Some people say to provide sensory stimulating environments – others say no.

Talent of autistic students can be facilitated with environmental exposure.

Environments where the arts, music, dance should be provided.

Stephen Wiltshire
Autism

What are the best learning environments for autistic children?

Is multi-sensory stimulation the best way to go?
Autism
Autism

Sensory and Neurological Issues:
- Limit daylight and exterior views
- Keep ceiling heights low
- Keep spatial volumes small
- Use restrained details
- Use subdued colors
- Reduced acoustical levels

VERSUS
- High ceiling heights
- Large spatial volumes
- High levels of daylight
- Plenty of views to the outside
- Bright colors

Who is right? Research needed……
Classroom Size

**BODY**  Constructivist ways of learning require more room to move around; activity centers; and more space

**MIND**  Beneficial for cognitive and non-cognitive ability plus technology costs reduced. Small teamwork is beneficial.

**SPIRIT**  Relationship between students and teacher is the most important variable
Classroom Size
Classroom Size
Color

**BODY** Research needed on effects of color therapy on bodily functions.

**MIND** Theories of color also affect cognitive function.

**SPIRIT** Response to colors are individual.
Color
Color

Johann Wolfgang von Goethe and the Waldorf Schools
Color

Left eye
Optic (II) nerves
Optic chiasm
Uncrossed axon
Crossed axon
Optic tracts
Thalamus

Left brain
Right brain
Primary visual areas in occipital lobes of cerebral cortex

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Color

Baker-Miller Pink
(#FF91AF)
Community Schools

**BODY**  Health Centers, food service, dental care, nature and exercise trails

**MIND**  Libraries, day care centers, government, technology studios for the community, life long learning

**SPIRIT**  Performing arts center, art, music, dance and drama
Community Schools

- Arts
- K-12
- Health Center
- Library
- Child Care
- Senior Center
- Food Distribution
- Fitness Center & Sports

Nexus for All Citizens
Daylighting

**BODY**  Natural lighting increases student attendance, provides sufficient vitamin D, and reduces tooth decay.

**MIND**  Natural lighting increases test scores by 9-15%. John Ott, *Health and Light* – Full spectrum lighting or solar star lighting with sunlight (no electric).

**SPIRIT**  Natural lighting has a calming effect and connects occupants with the natural world, improving morale.
Daylighting
Daylighting

Effects on intellectual development and wellness of occupants especially in Alaska where it is dark half of the school year.

Skylights help to not only bring new life to a room, but also improve our health and happiness.
Daylighting

John Ott author of “Health and Light” did many studies on classrooms like this and healed hyperactive children with full spectrum lighting.
Furniture

**BODY**  Risk posture and ergonomics, physical comfort, health and safety

**MIND**  Needs to support current functions, needs to support project based learning, technology

**SPIRIT**  Aesthetic environments improve learning and school attendance
Furniture

Flexible and Deployable Furniture
Furniture

Flexible and Deployable Furniture
Furniture

Flexible and Deployable Furniture
Furniture

Flexible and Deployable Furniture
Furniture

Flexible and Deployable Furniture
Furniture

Different concept but is it better?
See American National Standards Institute Guidelines for furniture design and safety

Also see National Association for the Education of Young Children (NAEYC)
Security

**BODY**  Bodily safety against fire, earthquakes, terrorism – needs more research

**MIND**  Better learning when a child feels safe and loved

**SPIRIT**  Relationship of steward values. Less vandalism in well kept aesthetically pleasing schools
Security

Tougher Security on the Way for Schools
How does this affect school design?
Technology

**BODY**  Fine motor skill enhanced through typing and touch screen, design to eliminate eye strain

**MIND**  The digital world changing the way students learn, increased academic achievement and technology literacy

**SPIRIT**  Faster, better learning, economic implications, aesthetic environments
Integrated Curriculum CONTEXT- Born to be WIRED!
How does technology become a strategy?
Technology

Cognitive and Behavioral Sciences – John Eberhard
Technology

Academy of Neuroscience for Architecture - John Eberhard
Sugata Mitra
Experiment and Research in India and Elsewhere
Aim for the future and 21st Century skills: technology, stewardship, sustainability, and caring for one another.
Thermal Comfort

**BODY**  Physical thermal comfort necessary for learning

**MIND**  Performance and achievement affected by temperatures above 74 degrees F

**SPIRIT**  Teacher morale, control temperature, increases job satisfaction
Thermal Comfort
Need for a New Paradigm - The Need for New Thinking

The teacher as the designer of the mind! The architect as the educator of creativity and aesthetics.

Role Reversal for Change
Philosophical Framework

In order to change the architecture of our learning environments we need to first start with a Philosophical Framework

WHAT IS REAL, TRUE, ETHICAL, AESTHETIC?

• Idealism
• Realism
• Experimentalism
• Existentialism / Phenomenology
• Ecoism / Ecosophy (Arne Naess)
• Metaphysicalism

What is the philosophy behind your design?

Design Determinants
Learning Processes, Styles and Multiple Intelligences

Howard Gardner

- Visual/Spatial
- Verbal/Linguistic
- Logical/Mathematical
- Bodily/Kinesthctic
- Musical/Rhythmic
- Interpersonal
- Naturalistic
- Spiritual

Design Determinants
Integrated Curriculum CONTENT

ENVIRONMENT
Represents Laws and Principles in the Universe

Math
Life Science
Physical Science
Social Studies
Language
Art
Music
Dance & Phys Ed
Philosophy

Numbers
Numerals
Sets and logic
Time
Measurement
Geometry

Cycle
Change
Metamorphosis
Effect
Rhythm

Motion
Energy
Matter
Change
Culture
Race

Syntax
Grammar
Description
Comparison
Color
Line
Form
Space
Texture
Rhythm

Harmony
Scale
Rhythm
Interval
Body
Time
Space
Form

What is real?
What is true?
What is good?

Balance as Symmetry/Asymmetry
Balance in Nature
Physics of Structure
Balance of Power
Reason/Logic
Balanced Argument
Compositional Balance
Tonal/Atonal Balance
Physical Balance
Balance as Equilibrium

Design Determinants
Integrated Curriculum CONTENT
RUBRIX Cube: An Interdisciplinary Model (RUBRIC) for Education

Design Determinants
# Integrated Curriculum CONTENT

<table>
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<th>Architectural Element</th>
<th>Enhanced Design Potential</th>
<th>Educational Implications (concepts)</th>
<th>Active Learning (ATA Taxonomy)</th>
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</table>
| **Natural Lighting**  | - Fenestration for energy conservation  
- Operable windows  
- Southern window treatment  
- Orientation and siting of building  
- Solar/Passive solar  
- Greenhouse  
- Durable blinds  
- Perforated shades  
- North light is beneficial for art studios  
- Skylights  
- Clerestory  
- Light shelves up high  
- Controls for natural light such as shades, louvers, remote control blinds, etc.  
- When you maximize daylight, you minimize the need for applied decoration  
- Use of courtyards  
- Placement of furniture for maximum benefit | Shadows, light, dark Solar System  
Reflection  
Refraction  
Absorption  
Cardinal directions  
Day, night  
Seasons  
Physics (light)  
Vision, eyes  
Temperature  
Weather  
Art (sun prints, window views, tracing, elements of art)  
Botany  
Green architecture  
Mechanics (window, solar design)  
The R factor  
Cultural implications (Native American site orientation, role of sun in religions, writing about the sun)  
Spatial concepts (inside, outside, up, down, open, closed, etc.) | **Observation and Multisensory Discovery:** Use vision tools (lenses, prisms, magnifiers, mirrors) to play with natural light.  
**Data Collection:** Keep a daily record of the weather; track the path of the sun throughout the school year; observe and draw the movement of shadows on school grounds; track sunlight coming in windows.  
**Concept Formation:** Diagram how the eye works.  
**Problem-Solving:** Plan and host a solar picnic. Design solar ovens and use them to cook hotdogs.  
**Valuing:** Find examples of natural light and windows in art. Discuss. Then create your own window art.  
**Stewardship:** Design a pamphlet for parents that shows how your school uses natural lighting to save energy. Take photos. |

**Design Determinants**
Integrated Curriculum CONTENT - Subject Matter, Content, and Learning Processes are Constant. Context for Learning Differs!

What does change is the context for learning!

Design Determinants
Integrated Curriculum CONTEXT - Subject Matter, Content, and Learning Processes are Constant. Context for Learning Differs!

GEOGRAPHIC SITE

CUTURAL DETERMINANT

Design Determinants
Imagine as a Child

“Visualize a proposed school from a student’s perspective – the poignancy of that point of view may help transform a proposal into a built project.”

- The Third Teacher / Cannon Design

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Imagine as a Child

“Visualize a proposed school from a student’s perspective – the poignancy of that point of view may help transform a proposal into a built project.”

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Design Determinants
Begin with aesthetics and a philosophical frame of reference.

Design Determinants
Begin with aesthetics and a philosophical frame of reference.
Develop and use curriculum content and the developmental needs of learners as organizing criteria for school facility design.
Design and learn from the built, natural, and cultural environment as a three-dimensional textbook.
Teacher Centered vs. Student Centered
Aim for the future and 21st Century skills: technology, stewardship, sustainability, and caring for one another.
Aim for the future and 21\textsuperscript{st} Century skills: technology, stewardship, sustainability, and caring for one another.

Design Determinants
Foster ecological stewardship by nurturing the individual, community, and world.
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McDonough
Foster ecological stewardship by nurturing the individual, community, and world.

Design Determinants
Foster ecological stewardship by nurturing the individual, community, and world.

“You can’t teach or learn in ugly.” – Eeva Reeder

Design Determinants
Foster creative problem solving: ARTS and DESIGN

Design Determinants
How can traditional architectural elements come alive for the learner?

- Halls
- Gallery spaces
- Break-out spaces
- Doors
- Walls
- Windows
- Ceilings
- Floors

- Learning landscapes
- Roofs
- Furniture
- Gathering areas
- Stairs
- Scale
- Cultural diversity
“Break Out” Spaces

Design Determinants
Windows

Design Determinants
Floors

Screens and visual technology: places to view immediate current news. Total use of floors, walls, and ceilings to create an optimal volumetric learning environment.

Design Determinants
From Playground to Learning Landscape

Design Determinants
From Playground to Learning Landscape

Design Determinants
Gathering Areas, Stairs, and Centralized Spaces

Design Determinants
Embracing Cultural Diversity

Isleta Headstart, Cherry-See

Design Determinants
Architects have the interdisciplinary knowledge and creative problem solving skills to take the LEAD in reforming education in America and elsewhere.
Architects must take a PRO-ACTIVE role to change education through design, and lead the way to a new kind of educational training that considers the STUDIO MODEL as the nexus of learning, thinking, and creating.
Architects need to have an interest in education **BEYOND THE DOLLAR**. Their desire for creative beauty must permeate a new way of educating through the environment. Remember: YOU are an educator.
Architects should perpetrate the philosophy of METAPHYSICAL THINKING from physical reality of the transcendental or going beyond what is perceptible by the senses. What are the ideas embedded in the built, natural, and cultural environment from math, science history, ecology, art...?
Honoring Children and their Creativity
Reflective Thinking and Presentation of Ideas
Sustainability

- Passive Solar
- Geothermal
- Wind Power
- Composting Soil
- Composting Toilets
- Green Walls / Roof
- Vertical Gardens
- Water Collection / Rain Barrels
- Outdoor Showers
- Permeable Pavement
- Green Houses
- Productive Vegetable Gardens
- Orchards
- Rain Garden
Embracing new ways of knowing.
The learning environment is key to establishing a comprehensive advantage to learners in the information age.
GLASS ELEVATOR WITH VIEW TO LAKE CAYUGA

Quadiacci Pavilion, Milwaukee Art Museum
Sanitago Calatrava
“I’ve had one hour to save the world, and I spent 55 minutes defining the problem, and I leave you 5 minutes to find the solution.” – Albert Einstein & Anne Taylor
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