



# HEALTHY SCHOOLS BY DESIGN

LPA



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# AGENDA

## 5 min | Design for Mind, Body + Spirit

- Health + Wellness Definitions

## 30 min | Health Impacts + Actionable Strategies

- Envelope: Thermal Comfort + IAQ
- Indoors: Acoustics + Noise Reduction
- Outdoors: Connection to Nature + Community

## 20 min | Bringing it All Together

- Breakout Activity to apply the research to design

## 5 min | Discussion | Q+A

- Additional Resources





## LEARNING OBJECTIVES

1. **Operationally define** health, wellness, and what makes a healthy or health-promoting school.
2. **Illustrate the impact** of learning environment design on health and other student outcomes.
3. **Understand the essential role of a multi-disciplinary planning and design team** (from school district facilities teams and educators to designers and researchers) to ensure that health and wellness design goals are considered early for all school projects.
4. **Apply multiple priority research-informed foundations of healthy schools to project designs**, highlighting specific actionable strategies (from design solutions to operations and maintenance) to minimize disease transmission and promote health & well-being in all school environments.



## THE “WHY”

- Providing a healthy environment may be as important as curating the appropriate teaching curriculum.
- **In recent decades...** discussion has gained momentum regarding the capacity of learning environments to improve student health and learning outcomes.
- **During the COVID-19 pandemic...** we've seen a noticeable increase in the importance and urgency of designing learning environments to promote and protect health.



# WHY NOW?

## Many are asking...

- What makes a **healthy** or **health-promoting** school?
- What defines **healthy**?
- How can physical learning spaces **impact** learners' mental well-being & physical health?
- What **strategies** should we target and prioritize to design healthy environments?





## DESIGN FOR MIND, BODY + SPIRIT

- Health + Wellness Definitions

# OPERATIONAL DEFINITIONS

**HEALTH:** *“a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.”* - World Health Organization

- Health remains the cornerstone of today's concept of *wellness*

**WELLNESS:** *“the active pursuit of activities, choices and lifestyles that lead to a state of holistic health [and well-being]”* The Global Wellness Institute

- A holistic model of health encompassing the interrelationships between multiple dimensions of wellness: physical, environmental, intellectual, occupational, spiritual, social, emotional, financial

**HEALTHY ENVIRONMENTS:** well-designed environments that promote and protect the health & well-being of all occupants throughout the life of the space

- A student's health, wellness, and ability to learn are significantly impacted by the **physical, social, and cultural environments** they spend time in

# HEALTHY SCHOOLS DESIGN FOR...



*“Wellness is a holistic integration of physical, mental, and spiritual well-being, fueling the body, engaging the mind, and nurturing the spirit.”*



# DEVELOPMENTAL STAGES

Students in different age groups have different needs based on their developmental stages. Therefore, when creating learning spaces for students, it's imperative to create spaces that support cognitive and social development appropriate to their age group.



## **PRESCHOOL**

Active Engagement

## **CRITICAL TO DEVELOPMENT**

- Free play
- Physical activity
- Social-emotional interaction
- Motor skill exercises
- Experiential learning

## **KEY SPATIAL TYPOLOGIES**

- Unstructured play
- Large group
- Medium group

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## **ELEMENTARY SCHOOL**

Assertiveness

## **CRITICAL TO DEVELOPMENT**

Self expression  
Leadership opportunity  
Social interaction  
Ability to showcase skills

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Medium group

## MIDDLE SCHOOL

Belonging

### CRITICAL TO DEVELOPMENT

Self expression  
Connection  
Sense of responsibility  
Choice and sense of agency

### KEY SPATIAL TYPOLOGIES

Structured play  
Athletics  
Large group  
Medium group  
Small group  
Individual

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Small group  
Individual

## HIGH SCHOOL

Reflection

### CRITICAL TO DEVELOPMENT

Self identity  
Connection | Collaboration  
Sense of responsibility  
Critical thinking

### KEY SPATIAL TYPOLOGIES

Athletics  
Large group  
Medium group  
Small group  
Individual



# DESIGN FOR THE MIND – LEARNING STYLES

Designing spaces that empower healthy minds starts with understanding the various ways in which students learn. By providing a variety of spaces that allow for each type of learning, we can ensure there is a space **where every student can learn best.**



VISUAL /  
SPATIAL



AUDITORY /  
MUSICAL



LOGICAL /  
MATHEMATICAL



KINESTHETIC /  
PHYSICAL



VERBAL /  
LINGUISTIC



SOLITARY /  
INTRAPERSONAL



SOCIAL /  
INTERPERSONAL

# DESIGN FOR THE **BODY** – ACTIVITY LEVELS

Designing spaces that empower healthy bodies starts with understanding the activity levels that interest different types of students. By providing a variety of spaces that allow for each type of activity level, we can ensure there is a space **where every student can benefit from physical activity.**



PASSIVE



ACTIVE



INDIVIDUAL



TEAM / GROUP

# DESIGN FOR THE **SPiRiT** – PERSONALITY STYLES

Designing spaces that empower healthy spirits starts with understanding the different personality styles that each individual has. By providing a variety of spaces that allow for each type of personality style, we can ensure there is a space **where every student can feel comfortable and welcome.**



SOLITARY /  
INTROVERT



SOCIAL /  
EXTROVERT

## PARTICIPANT POLL | LEARNING STYLES

***What type of learner are you?***



VISUAL /  
SPATIAL



AUDITORY /  
MUSICAL



LOGICAL /  
MATHEMATICAL



KINESTHETIC /  
PHYSICAL



VERBAL /  
LINGUISTIC



SOLITARY /  
INTRAPERSONAL



SOCIAL /  
INTERPERSONAL





## DESIGN GOAL

To design learning spaces that accommodate all learning styles, activity levels, and personality styles and promote overall mental, physical, and spiritual wellness according to each developmental stage.

**HEALTH IMPACTS**

**+**

**ACTIONABLE STRATEGIES**

**1 Envelope: Thermal Comfort + IAQ**

**2 Indoors: Acoustics + Noise Reduction**

**3 Outdoors: Connection to Nature + Community**



## HEALTH IMPACTS + ACTIONABLE STRATEGIES

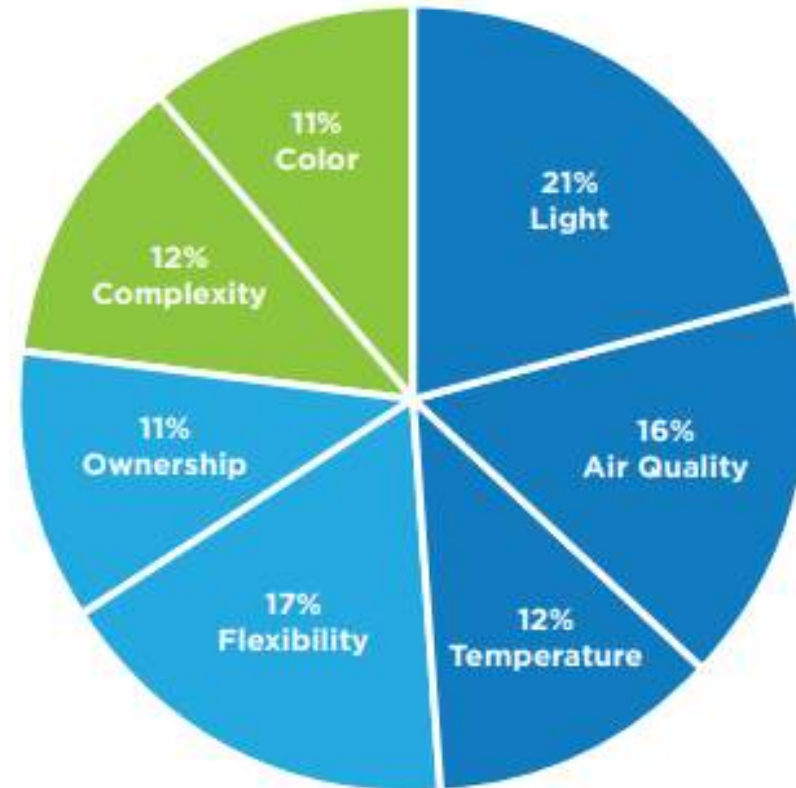
- **Envelope: Thermal Comfort + IAQ**
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# IMPACT | THERMAL COMFORT

## Design features impacting learning

- Naturalness
- Individualization
- Stimulation



Seven design elements explain 16% of variation in student progress. <sup>[6]</sup>

## IMPACT | THERMAL COMFORT

### “Poor” building facility conditions often include...

- Lack of adequate **temperature**, ventilation, lighting, and/or access to nature
  - **Heat** inhibits learning: Without air-conditioning, a 1° F hotter school environment reduces that schoolyear’s learning by 1%
  - Student performance on numerical exercises can improve significantly when **thermal sensation** is reduced from “slightly too warm” to “neutral” and **outdoor air supply** is increased
- Students scoring in lower percentile ranks than students in functional buildings
  - **Hot school days** disproportionately impact minority students

## IMPACT | VENTILATION

**Increased ventilation rates**  
are associated with...

### IMPROVED

- Attention
- Concentration

### REDUCED

- Respiratory health effects
- Student absence



# STRATEGIES | INDOOR AIR QUALITY

## **HVAC Measures**

*(Engineered Controls)*

- Optimize ventilation
  - 3 air changes per hour (at least 500 cfm)
  - HVAC systems w/air-side economizer &/or operable windows
- Install and maintain appropriate air filtration
  - MERV-13 filters or portable HEPA filter systems
- Monitor IAQ for carbon dioxide
  - Keep CO<sub>2</sub> below 800 ppm, evaluate if > 1100 ppm
- Supplement with ultraviolet germicidal irradiation (UVGI)

## **Administrative Measures**

*(Source Controls)*

- Keep infected individuals away from campus
- Follow Public Health guidance



## IMPACT | DAYLIGHTING

Proper **daylighting** can create a positive domino effect resulting in multiple improvements for students, including...

### REDUCED

- Headaches
- Depression
- Nearsightedness
- Eyestrain

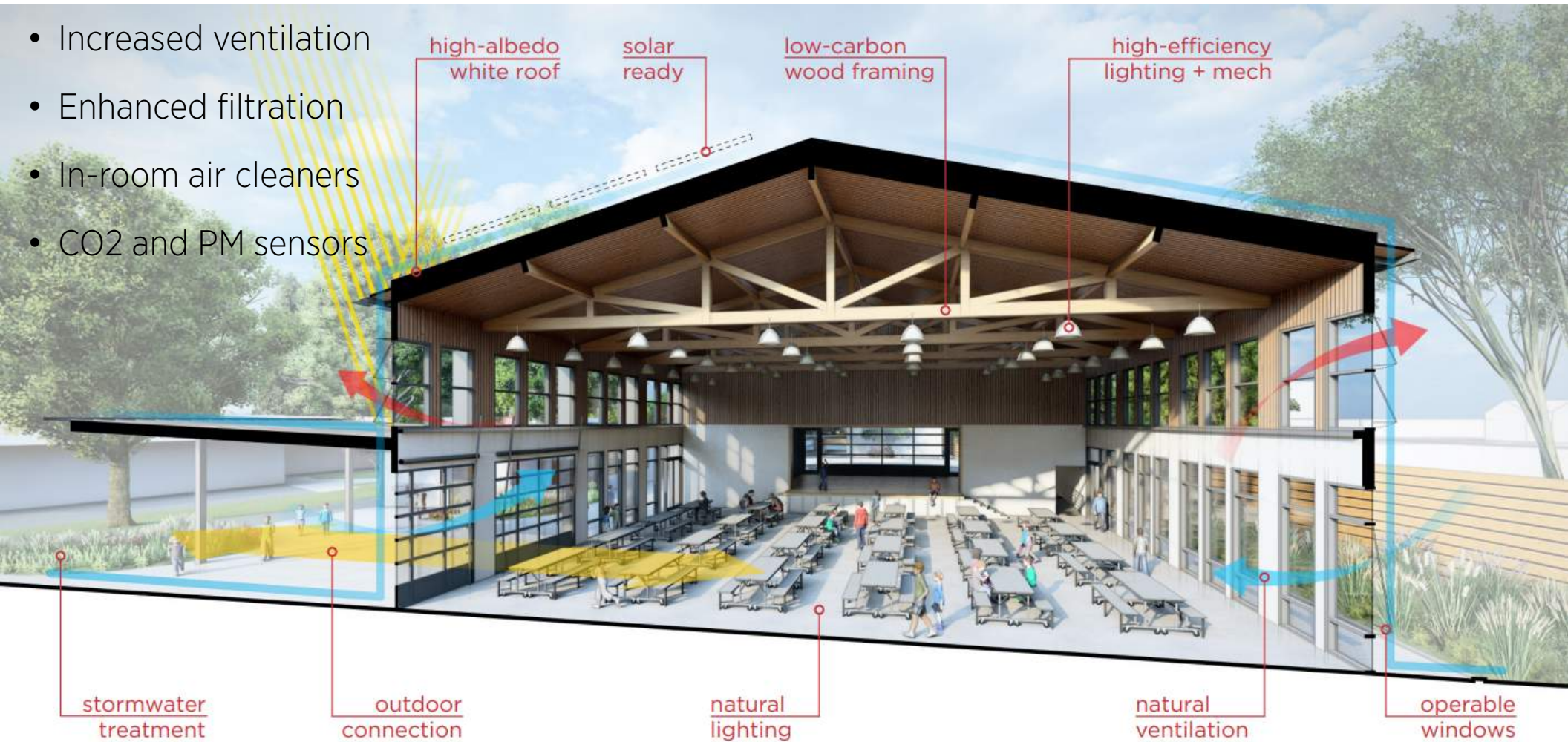
### IMPROVED

- Quality of sleep
- Alertness & concentration
- Recovery from stressful experiences
- Cognitive processing speed
- Test performance (standardized math & reading tests)



# STRATEGIES | NET ZERO HEALTHY SCHOOLS

- Increased ventilation
- Enhanced filtration
- In-room air cleaners
- CO2 and PM sensors







## HEALTH IMPACTS + ACTIONABLE STRATEGIES

- Envelope: Thermal Comfort + IAQ
- **Indoors: Acoustics + Noise Reduction**
- Outdoors: Connection to Nature + Community

## IMPACT | ACOUSTICS + NOISE REDUCTION

**Environmental noise exposure** has been linked to...

### POORER

- Academic performance (hard to hear or concentrate)
- Behavioral conduct
- Emotional symptoms
- Well-being

### INCREASED

- Stress & fatigue (trying to block out unwanted sound)
- Irritability
- Hyperactivity
- Blood pressure

**Children are still developing their comprehension, speech, memory and other cognitive processes. Excess noise can harm that development, which has a deeper impact on young students than on adults”**

(Harvard C-Change, 2021)

## STRATEGIES | ACOUSTICS + NOISE REDUCTION

Learning spaces need to **control or reduce...**

- HVAC equipment background noise
- Reverberation time in spaces that have an echo or hard surfaces
- Transmission of noise from room to room or from outdoors into the learning space



# STRATEGIES | REVERB CALCS FOR COMMONS AREA

Sa1 FLOOR & FURNITURE MATERIALS:				
MATERIAL DESCRIPTION		sq. m	$\alpha$ (sound coeff)	
CORK (Area taken of typical Gr1-5 Pod)	Sa1A=	39	0.02	1
Millwork Type B upholstered	Sa1B=	2.6	0.32	11
Furniture (hard surfaces) MDF	Sa1C=	12.7	0.1	4
	Sa1D=			0
	Sa1E=			0
	Total Sa1=			16
Sa2 CEILING MATERIALS:				
MATERIAL DESCRIPTION		sq. m	$\alpha$ (sound coeff)	
HD Techstyle DeepBox Ceiling	Sa2A=	48	1	48
	Sa2B=			0
	Sa2C=			0
	Total Sa2=			48
Sa3 WALL MATERIALS:				
MATERIAL DESCRIPTION		sq. m	$\alpha$ (sound coeff)	
Glass (exterior windows-large panes)	Sa3A=	28	0.18	5
Colorsonix Tackable Acoustic Panel	Sa3B=	14.3	1.05	15
Whiteboard	Sa3C=	12.7	0.01	0
	Sa3D=			0
	Total Sa3=			20

VOLUME				
		HEIGHT (m)	sq m	VOLUME
Occupied Pod Space		2.7	48	129.6
				0
				0
TOTAL (cubic feet)			48	129.6
FINAL CALCULATION				
VOLUME	V=	129.60		
FLOOR	Sa1=	15.8304		
CEILING	Sa2=	48		
WALLS	Sa3=	20.182		
Sum of Sa's	Sa=	84.01		
	Reverb Time (RT)			0.24836
	Goal			1.2 seconds





# STRATEGIES | ACOUSTICS ASSESSMENT

## **Acoustics rating scale** from *Blueprint for TOMORROW...*

2 = Excellent

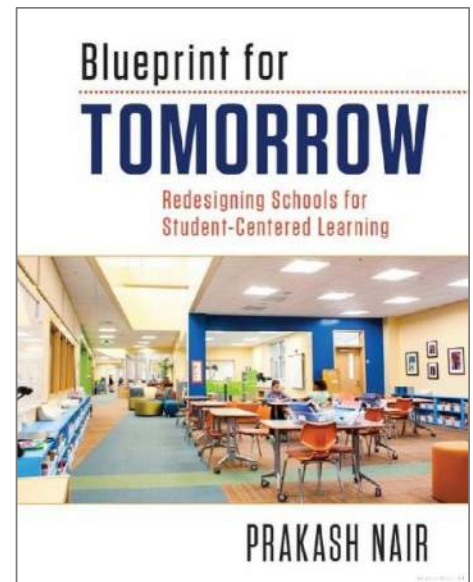
- Background noise is low, and there is an acceptable level of classroom “buzz.”
- Noise is absorbed by soft fixtures and furnishings.
- Appropriate layouts so that loud areas are not located near quiet spaces.

1 = Adequate

- Low level of background noise, but appropriate adjacencies have been created to ensure that loud activity areas are not located near quiet spaces.

0 = Inadequate

- Noise and echoing is distracting, and activity areas with different sound-level requirements are placed near one another.
- Because of the lack of good acoustic design, the fear of making too much noise often limits the students’ freedom to collaborate and actively work on projects.



## STRATEGIES | ACOUSTICS + NOISE REDUCTION

- Install double-pane windows
- Windows away from high-traffic streets or noisy surroundings
- Stack similar multi-floor spaces
- Design with various “zones”
- Design full-height partitions
- Install HVAC equipment on roof and away from quiet spaces
- Consider amplification technology
- Install acoustic treatments, baffles, ceiling systems, or wall panels
- Design with mixed textures and types of surfaces
- Incorporate flooring that absorbs sound





## HEALTH IMPACTS + ACTIONABLE STRATEGIES

- Envelope: Thermal Comfort + IAQ
- Indoors: Acoustics + Noise Reduction
- **Outdoors: Connection to Nature + Community**



## IMPACT | NATURE-DEFICIT DISORDER

### Lack of time outdoors linked to...

- Increased rates of obesity
- Higher levels of aggression
- Increased rates of depression
- Poor academic performance & attention spans
- Lower ability to cope with stress
- A lower sense of well-being



# IMPACT | PHYSICAL ACTIVITY IN NATURE

## **Regular physical activity**

(60+ mins per day) can help children and adolescents...

### REDUCE

- Anxiety & depression symptoms
- Risk of heart disease, Type-2 diabetes, high blood pressure, cancer, osteoporosis, and obesity

### INCREASE

- Cardiorespiratory fitness
- Bone and muscle development
- Healthy weight maintenance



## IMPACT | CONNECTION TO NATURE

**Nature-based learning environments** help students...

### IMPROVE

- Attention, engagement, focus, & cognitive functioning
- Connection with each other
- Sense of belonging
- Critical thinking skills
- Proficiency in problem solving
- Exhibit enhanced application of systems thinking





# IMPACT | COMMUNITY + LEARNING GARDENS

## **Garden-based learning** helps...

- Foster a sense of accomplishment, responsibility, & belonging
- Involve community members & parents
- Teach about growing, preserving, & consuming natural produce
- Students grow, eat, & learn about fresh, healthy food
- Improve children's nutrition with increased vegetable consumption
- Increase student recognition of, attitudes toward, preferences for, and willingness to taste vegetables



# STRATEGIES | CONNECTION TO NATURE + COMMUNITY

## Community projects help...

- Create a sense of belonging
- Build momentum to facilitate outdoor learning by starting small
- Empower children to see how they can shape the school environment



## STRATEGIES | SHADE

Include **shade structure** and/or **tree canopy** on  $\geq 50\%$  of site to...

- Protect users from sun exposure
- Provide visual respite and delight from indoor spaces
- Keep pavement, cars, & buildings cooler





## STRATEGIES | BIOPHILIC DESIGN

**Views** to the outside world & nature/  
green space...

- Provide visual eye rest from focused activity
- Help sustain & restore attention

**Bringing** nature indoors...

- Images of nature
- Aeroponic towers to use for science curriculum



## STRATEGIES | DAYLIGHTING + VIEWS

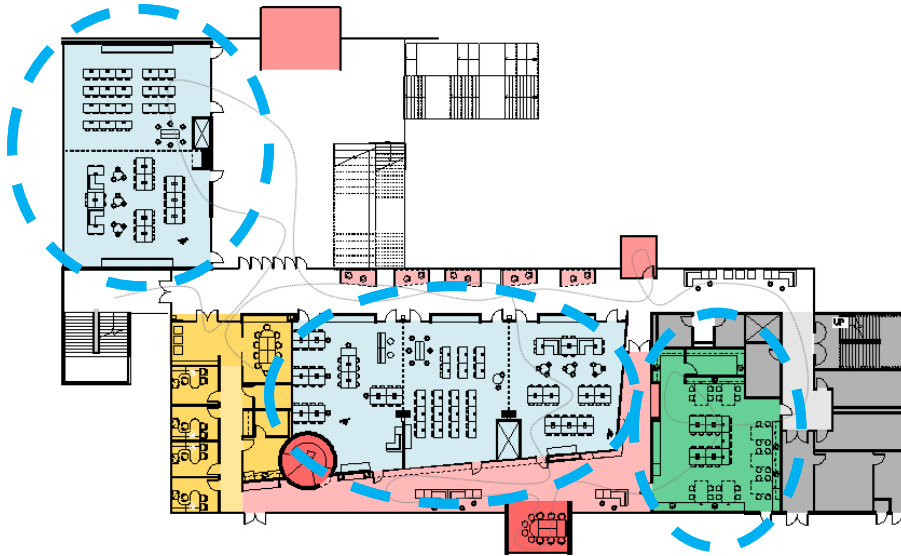
- Windows with vistas of nature
- Landscaping to enhance views and let in daylight
- Views unobscured by large furniture
- Skylights or solar tubes to draw natural light deep into spaces with no daylight
- Recessed lighting to not block natural light coming into the space
- Lighting systems to detect optimal natural light, adjusting artificial light when daylight in the space is sufficient
- Surface finishes that enhance the natural light by not absorbing the lighting source

**BRINGING IT ALL  
TOGETHER**

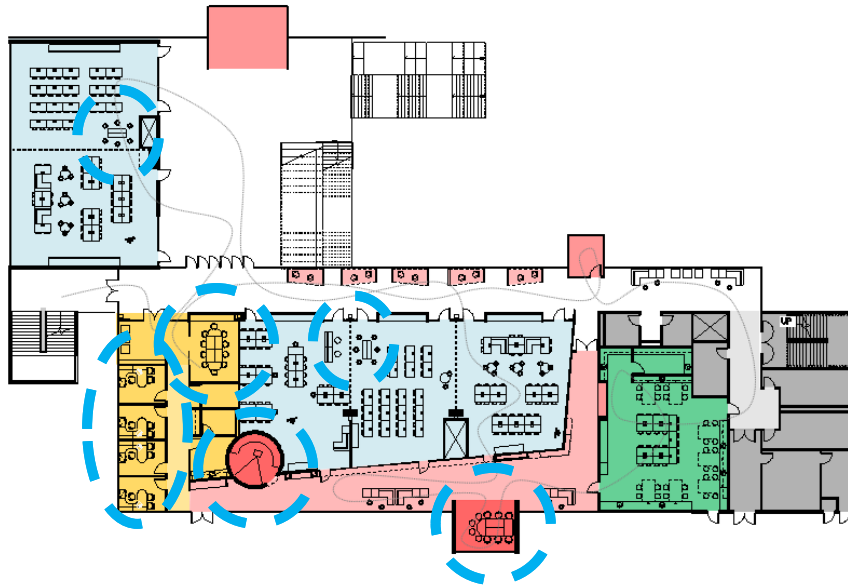


Application  
to  
INDOOR  
spaces

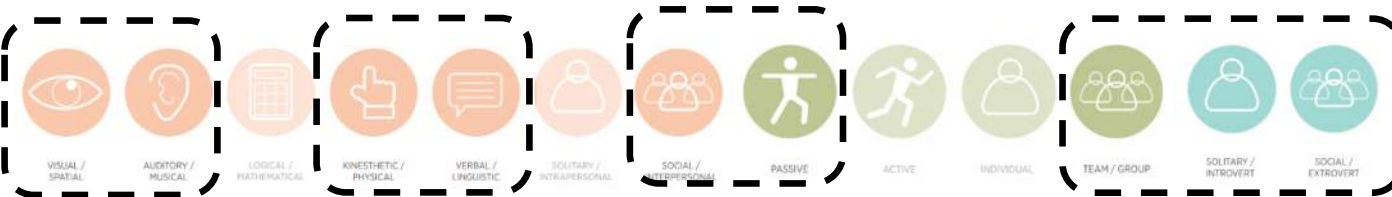
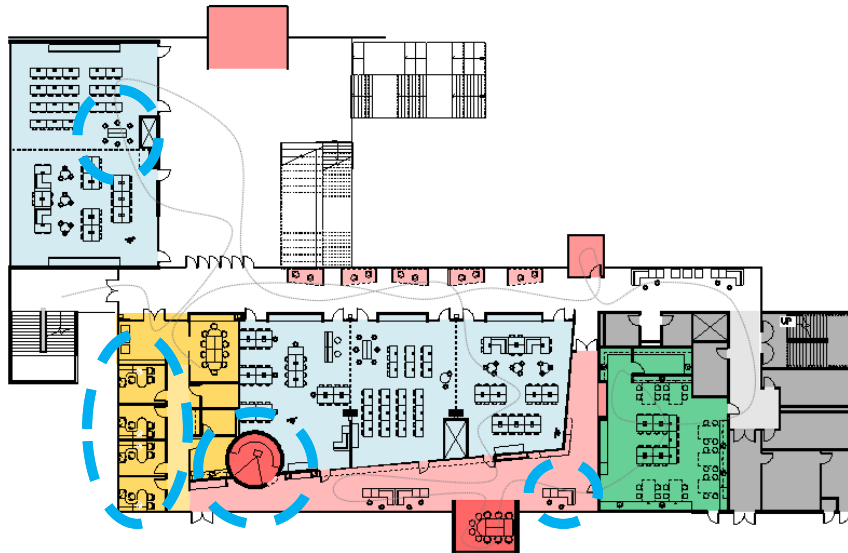
# LARGE GROUP SPACE - 10+ LEARNERS



# MEDIUM GROUP SPACE – 6-10 LEARNERS

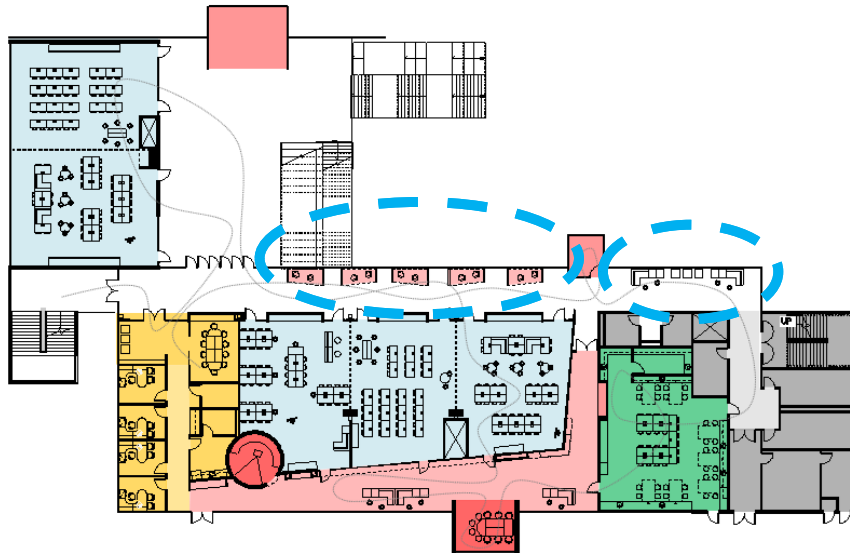


# SMALL GROUP SPACE - 3-6 LEARNERS





# INDIVIDUAL SPACE – 1-2 LEARNERS



Application  
to  
OUTDOOR  
spaces



# LARGE GROUP SPACE – 10+ STUDENTS

Shade for thermal comfort + creating a more intimately scaled space

Variety of seating to offer support for diverse physical abilities and empower learners with choice

Large space allows greater opportunity for physical movement and exploration and interpersonal connections

Vertical writing surface for learners to collaborate



# MEDIUM GROUP SPACE – 6-10 STUDENTS

Supports verbal learners with break out groups and social learning activities

Supports visual and auditory learners with a place for hands-on learning

Varied seating offers freedom of choice

A place for social interaction and teamwork





# SMALL GROUP SPACE – 3-6 STUDENTS

Self-guided group discussions or individual study

Strengthens direct, interpersonal relationships

Provides comfort to introverted students to support their engagement in collaborative activities



# INDIVIDUAL SPACE

Quiet space to learn alone or through observation of the surroundings

Sitting/walking in nature reduces blood pressure, heart rate, muscle tension, and production of stress hormones

Places to slow down and recharge help improve impulse control and self-regulation

Nature immersion to destress & reduce anxiety





# UNSTRUCTURED PLAY

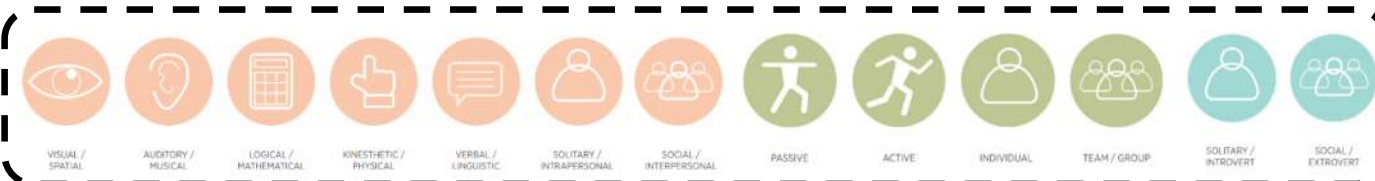
Encourages problem-solving and executive functioning

Encourages imaginative play

Supports freedom of choice to make outdoor exercise a lifelong habit

Supports social interaction through sharing, collaborating, and working through disagreements

Supports introverted students who prefer individual play



# STRUCTURED PLAY

Promotes teamwork,  
following directions, and  
problem-solving,  
movement

Builds strength,  
endurance, balance, and  
coordination

Aids students in setting  
and respecting  
boundaries

Promotes self-regulation  
and self-advocacy

Supports extroverts who  
like team activities



# BREAKOUT ACTIVITY



# ACTIVITY | HEALTH-PROMOTING SPACES X LEARNING STYLE

## INDOORS + OUTDOORS





# DISCUSSION

Q + A

# REFERENCES

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## ADDITIONAL RESOURCES

1. Questions to take back to District and school administrators – to guide space modifications and/or future designs
2. Robert Dillon books, webinars, etc.
3. Green Bronx Machine website
4. Mariana will add several AFTER 9/19 DEADLINE

We can make the pdf for 9/19 go up to Q&A then we have time to work on the other reference slides and this one.

# OUTDOORS REFERENCE: SUPPORTING MIND BODY SPIRIT

## Large



### MIND

Large spaces allow for flexibility to accommodate multiple learning styles. Spaces holding an entire class allow for teacher-led instruction for auditory and social learners. Writing surfaces and places for experimentation can be incorporated to aid visual learners. Movable furniture and space to move enhances kinaesthetic learning.



### BODY

Large group gathering spaces allow for greater physical movement and exploration throughout the space.



### SPIRIT

Providing a place for large groups to celebrate, be social, or learn together is important for students in their socio-emotional development.

## Medium



### MIND

More formal collaborative spaces for groups of 6-10 students are great for break-out groups and social learning activities. Elements within the space can allow for verbal learners to lead discussions and visual and auditory learners to engage in more hands-on activity.



### BODY

Group collaboration is improved in the outdoor environment where students are free to maneuver around the space, alter seating arrangements and feel more relaxed than within the regimented walls of a building.



### SPIRIT

Outdoor learning has been shown to benefit communication, social interaction, and teamwork among peers.

## Small



### MIND

Spaces with furniture or seating where students in groups of up to six can collaborate and discuss together. Small group spaces are best for social and verbal learning through self-guided group discussions, but can also be used for more formal learning.



### BODY

Small group spaces can offer flexibility in casual seating arrangements that foster physical activity.



### SPIRIT

Smaller group spaces allow introverted students the comfort to think through ideas and engage in more collaboration than in larger group settings.



# OUTDOORS REFERENCE: SUPPORTING MIND BODY SPIRIT

## Individual



### MIND

Quiet spaces with seating where an individual can learn on their own, or small groups of students can study together. Seating set into the landscape give additional opportunity for students to learn through observation and exploration of their surrounding environment.



### BODY

10-50 minutes spent sitting or walking in nature reduces blood pressure, heart rate, muscle tension and the production of stress hormones



### SPIRIT

Quiet and reflective spaces spread throughout campus allow students to destress, connect with nature, and slow down to recharge. They also improve impulse control and self-regulation. It's important to provide these comfortable, mindful spaces to help students manage stress and anxiety.

## Unstructured Play



### MIND

Unstructured play without clear rules or objectives helps students learn problem solving, utilize executive functioning like planning and executing goals and controlling impulses and encourages imaginative play. The student is in control of their play to benefit their own specific learning type.



### BODY

Unstructured play promotes exercise and movement that is fun and engaging. When students can choose how they play they are inclined to do it more often and gain the benefits from outdoor exercise.



### SPIRIT

Unstructured play teaches social interaction through sharing, collaborating, working through disagreements and respecting others space. It gives students a sense of freedom and control. Introverted students benefit from the opportunity for individual play.

## Structured Play



### MIND

Structured play is instructor-led and has clear rules and objectives. It can be a sport like basketball or a game like freeze-tag. It helps students learn to work as a team, follow directions and problem solve by hearing instruction, mimicking others and moving their bodies.



### BODY

Structured play builds strength, balance and coordination and helps students stay active. Students who play outdoors tend to play harder and longer, burning more calories and reducing the occurrence of obesity.



### SPIRIT

Structured play helps students set and respect boundaries and promotes self-regulation and consideration for others around them. Extroverted individuals benefit from being part of a team.

## INDOORS REFERENCE: SUPPORTING MIND BODY SPIRIT

Large

Medium

Small

Mariana to do this after 9/19

## INDOORS REFERENCE: SUPPORTING MIND BODY SPIRIT

Individual

Unstructured Play

Structured Play

Mariana to do this after 9/19

## KP Notes from Robert Dillon podcast ([Spaces4Learning](#))

### *Managing Schools and Classrooms to Promote Student Wellness*

#### Evidence-based design for wellness in schools includes...

- Daylight
- Nature-inspired design
  - Biophilic design
- Opportunities for movement, active learning, changing postures throughout day
  - e.g., ability to stand, sit, rock, walk, etc.
- Student choice, control, agency, empowerment, autonomy
  - Where to sit, when you can get a drink of water, places for respite and privacy, etc.
  - Variety of zones and movable furniture
  - School should be “done” WITH students, not TO them – ask how spaces are/aren’t working for them
- Minimal clutter
- Welcoming, comfortable spaces that help feel a sense of belonging, ready & eager to learn, engaged, satisfied
- Spaces equipped with resources
  - e.g., Technology – Are there enough screens in the room? Are they visible to all students?
- Support for different dimensions of wellness
  - e.g., ask teachers, “What does emotional or physical wellness feel like to you?” And how can you design to support that?
- Spaces for supportive wraparound services
  - e.g., private areas for social workers and third-party professionals; ample room in school health/wellness clinics for multiple students



## From Proposal

**PRIMARY Core Competency which the presentation addresses:**

- **Educational Facility Pre-Design Planning:** *Manages a master planning process that combines educational planning, facilities assessment and utilization, demographic research, capital planning and educational specifications with a community-based vision to establish a plan for learning environments. This includes the ability to translate existing or aspirational instructional models to specific programming and spatial relationships.*

**SECONDARY Core Competency which the presentation addresses:**

- **Design of Educational Facilities:** *Acts as a resource to the design team in providing ongoing guidance and support to ensure that the emerging and ultimate design aligns with the established community vision, education goals, future programming, written design standards, best/next practices and education policy.*

**Addressing the Core Competencies:** *Please describe with specific examples how you will address the core competencies.*

- It is imperative that the processes of pre-design planning and design of educational facilities use participatory design strategies to engage the full range of users/stakeholders to set data-informed health and wellness design goals for every school project. This inclusive design, engagement and research process will be addressed in this session. Discussion will include who needs to be at the table to inform priorities, goals, and needs as well as what health-promoting design strategies can best produce a positive impact on end users, communities, and the environment.

**Audience Engagement Strategies:** *Please describe how you intend to engage the audience in a facilitated discussion. What strategies and/or technology will you use to ensure dynamic interaction and active participation.*

- The audience will be engaged in interactive discussion facilitated through “table topics” and “thought starter” prompts and/or a game show-style quiz activity. If possible, depending on the composition of the group attending the session, there will be an effort to pair up designers and school representatives for some of the discussion topics and sharing of knowledge and strategies.