Idealized Learning Environments

An Investigation of K-5 Classroom Design to Improve Student Academic Performance

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1 Introduction

Capstone Introduction

Research Question

How can K-5 learning environments be designed to improve student academic performance?

Hypothesis

Learning environments can be designed to improve student academic performance by applying flexible design strategies that meet student's individual preferences while also accommodating pedagogical variations.

2 Literature Review

Literature Review Overview

Metrics of Student Achievement

Pedagogical Approaches to Teaching

Design Variables of Student Learning

Other Variables of Student Learning

Literature Review Conclusion

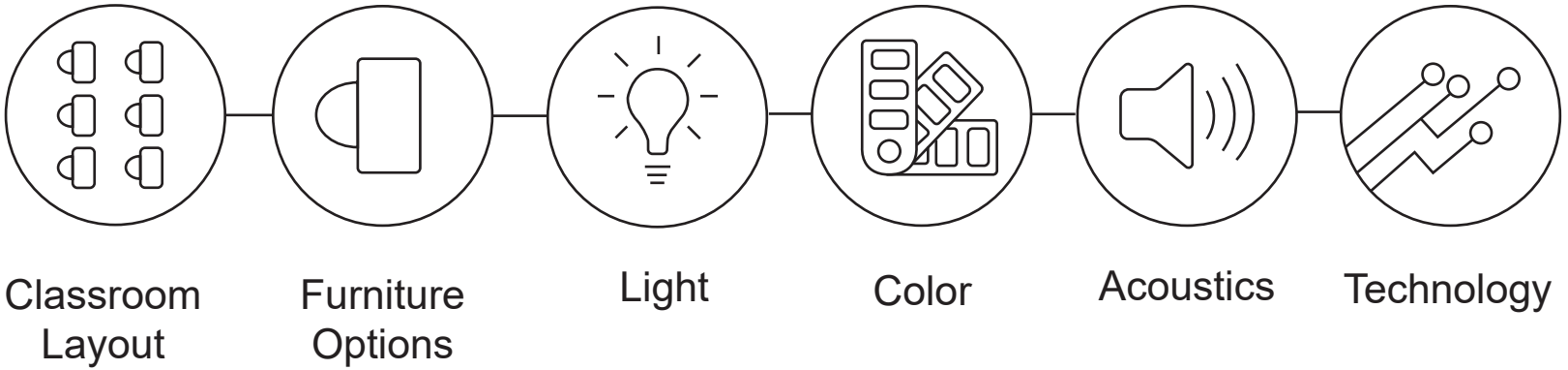
Metrics of Student Achievement

Student Engagement	Active student engagement is intrinsic to the learning process and includes emotion, cognition, and behavior. Learning engagement is defined as a student's commitment to learning, their interest and self-driven willingness to be cognitively engaged in the learning process.
Indicators of Engagement	Time-on-Task Concentration Motivation Classroom Behavior

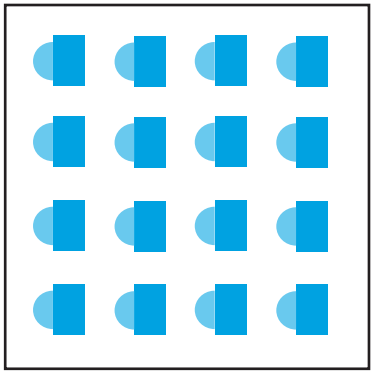
Pedagogical Approaches to Teaching

Teacher-Centered Pedagogy	Traditional method Students play a passive role and learn primarily through listening to lectures.
Student-Centered Pedagogy	Customizable teaching method tailored to best support each learning activity. Suitable for group work and individual work. Students play an active role.

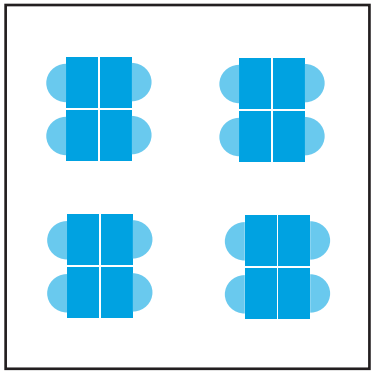
Design Variables of Student Learning



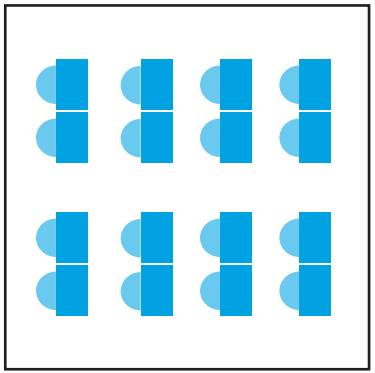
Classroom Layout



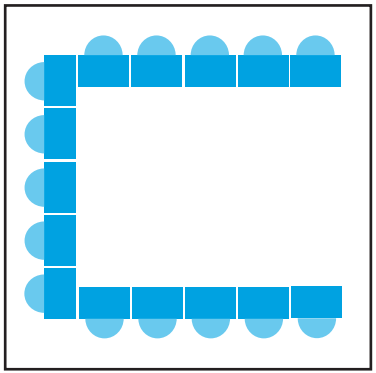
Row Seating



Small Group



Pairs Seating



Horseshoe Seating

Furniture Options

Student Seating Option:
Traditional Chair

Student Seating Option: Wobble Stool

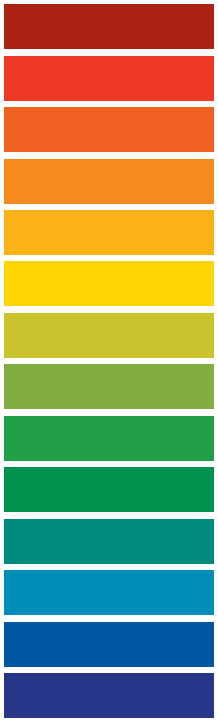
Student Seating Option:
Stability Ball Chair

Student Seating Option: Backless Lounge Seat (left), Lounge Seat with Back Support (right)

Lighting

Artificial Light and Natural Daylight

Color



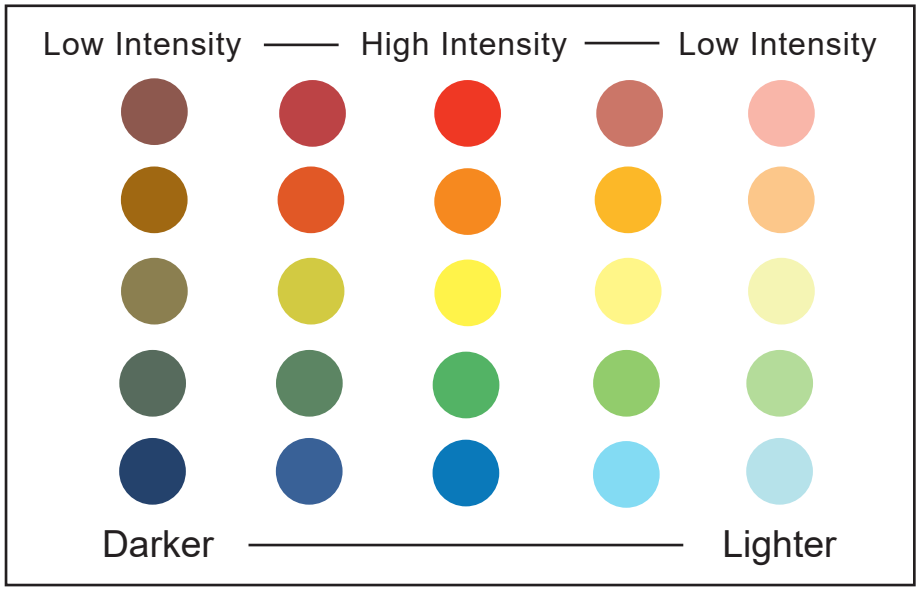
Red
- Stimulates Cognitive Processing
- Motivation

Orange
- Engagement
- Excitement

Yellow
- Happiness
- Comfort

Green
- Calm
- Productivity

Blue
- Focus
- Productivity



Range of High Intensity Bright Colors to Lower Intensity Lighter and Darker Colors

Acoustics

Acoustic Cloud

Acoustic Baffles

Technology

Tablet

Laptop

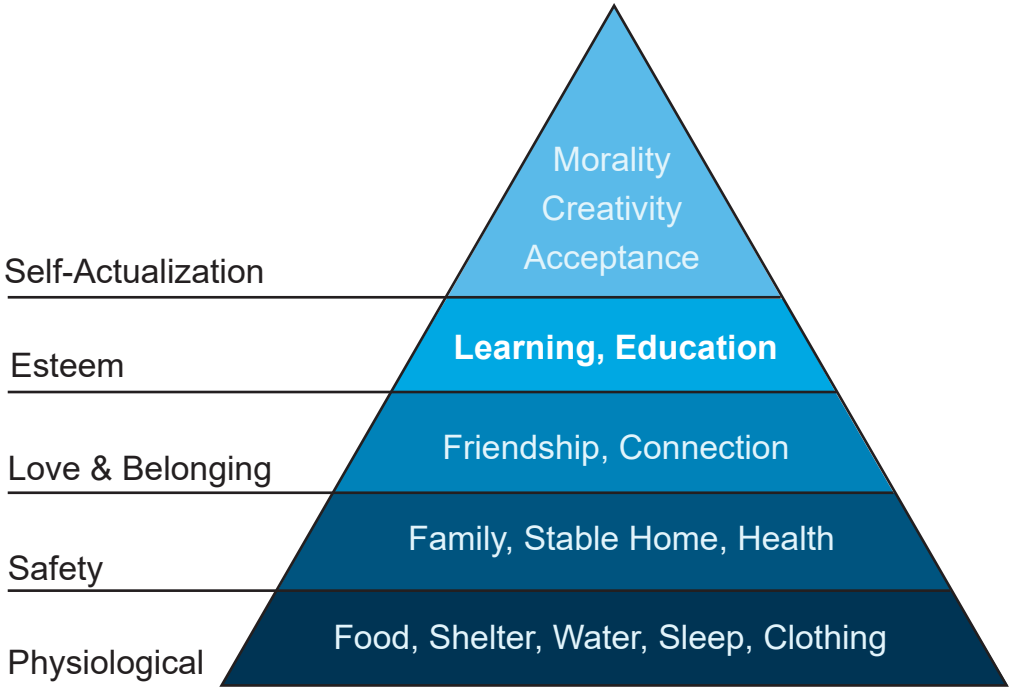
Smart Board

Mobile Charging Outlet

Furniture with Charging Outlet

Voice Amplifier

Other Variables of Student Learning



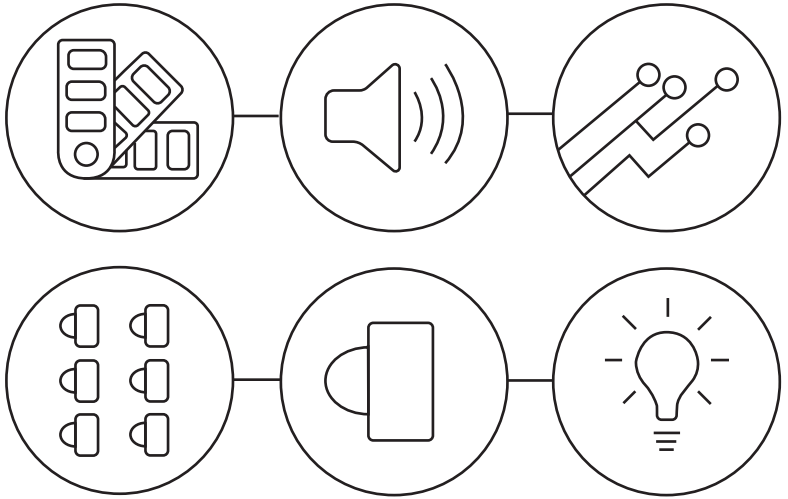
Maslow's Hierarchy of Needs

Literature Review Conclusion

Uniting Pedagogy with Education Design to Improve Student Academic Outcomes

Student- Centered Pedagogy

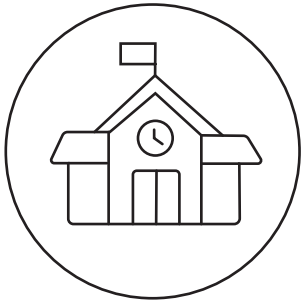
Teacher-Centered Pedagogy



2 Research Agenda

Research Instruments

Survey



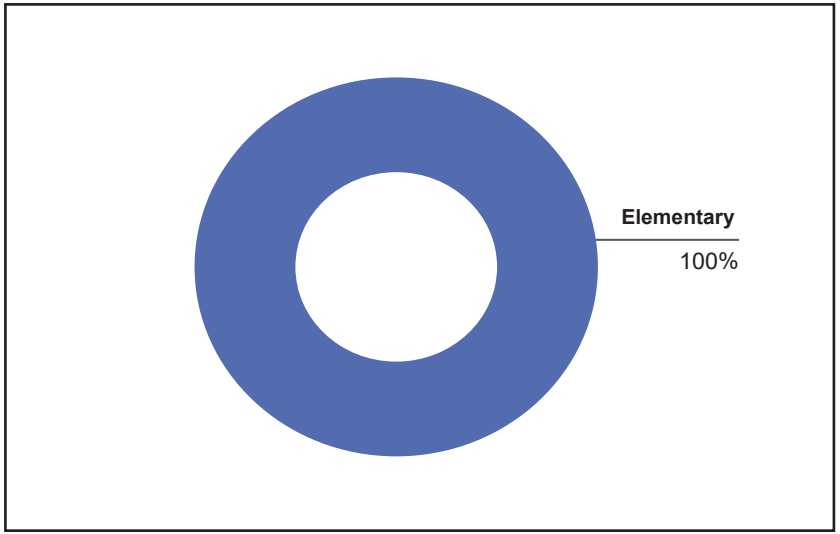
Site Visit

Interview

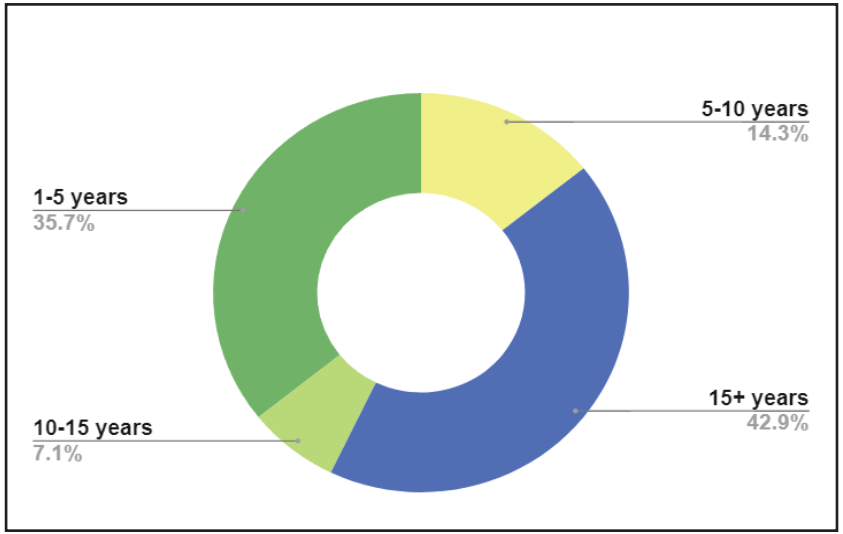
Case Study Analysis

Survey

Which grade level do you teach?

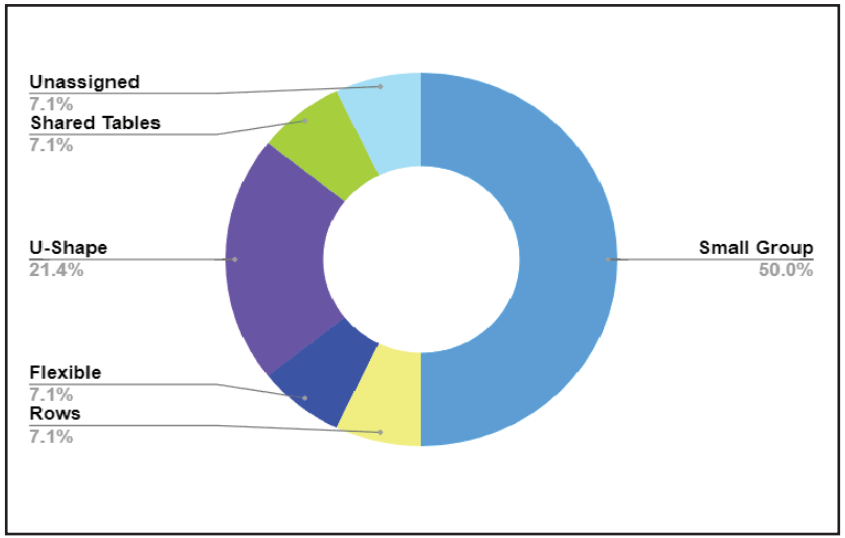


How long have you been teaching for?

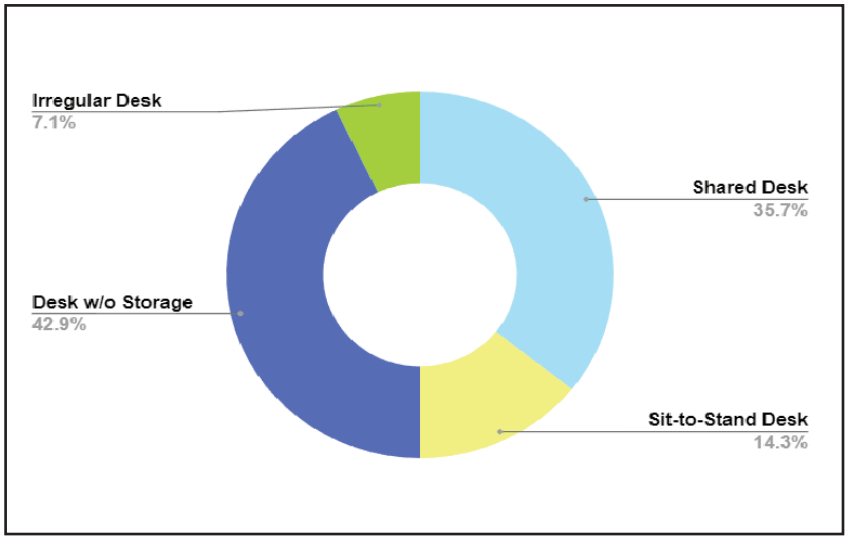


Survey

Which seating arrangement do you think most engages your students in academic activities?



Which desk option do you think would best suit the majority of your students during formal instruction?



Survey

Which element of your classroom design is the most useful in supporting your ability to engage students?

Comfortable and flexible furniture

Calm colors to prevent over stimulation

Well-controlled acoustics

Technology Integration

What change to your classroom do you think would most improve student performance?

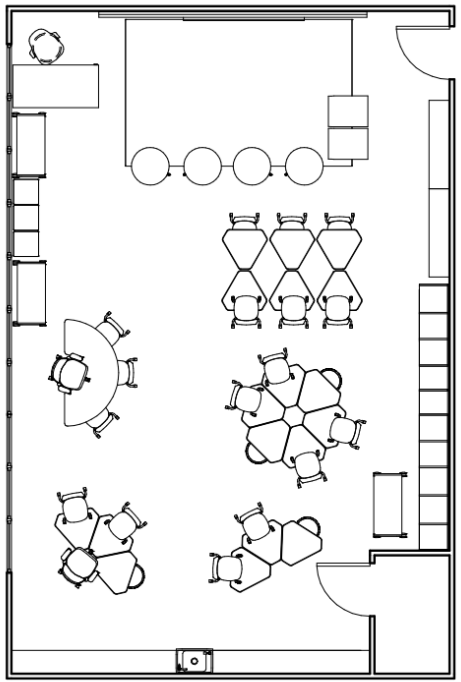
Open floor space

Increased flexibility

Flexible seating choices

Increased storage and organization

Site Visit



NOT TO SCALE

First grade classroom in Rochester, NY

Received flexible student furniture six years ago

Furniture floor plan of first grade classroom described from the interview shows the classroom layout present on day of site visit

Lightweight flexible furniture allows classroom to be easily adapted based on learning needs

Site Visit

Flexible Student Furniture of First Grade Classroom

Interview

Traditional Chair

Chair on Wheels

Lounge Seat

Bounce Chair

Wobble Stool

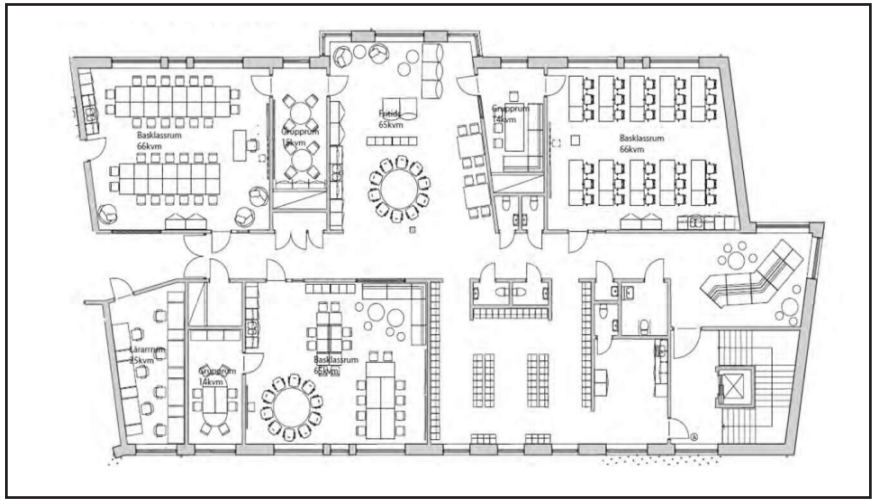
Case Study Analysis

Analysis of educational infrastructure in the City of Malmö, Sweden

1. The influence of the environment on learning based on a strict relationship between pedagogy and architecture, examining three key principals: type of space, connectedness, and flexibility

2. The reciprocal nature of the interaction between the student and the learning environment

3. The whole-school approach in which learning takes place everywhere and is not limited to classroom



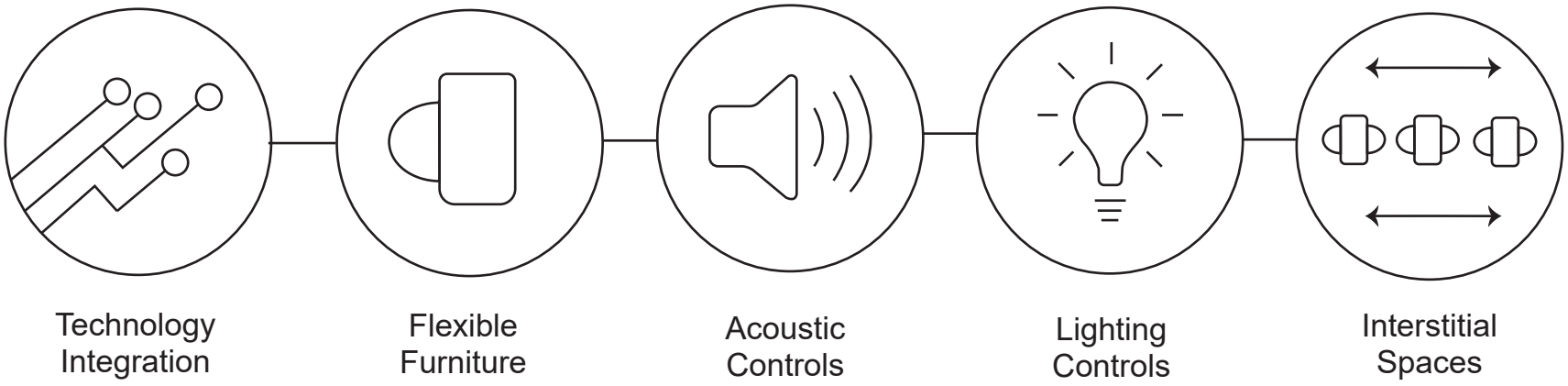
Floor plan of Elementary School in Malmö, Sweden, with Classrooms, Gruppum, and Informal Learning Spaces

Case Study Analysis

Gruppum, or Group Learning Space

Informal Learning Space for Students to Work in Groups or individually

Research Agenda Conclusion



3 Creative Agenda

Creative Agenda Introduction

Project Statement

Through the application of research collected from the literature review and research agenda, **two elementary school classrooms** and **interstitial spaces** will be designed using an evidence-based design solution **to improve student's academic performance** by increasing student engagement and ability to focus on task while minimizing distractions.

Project Scope

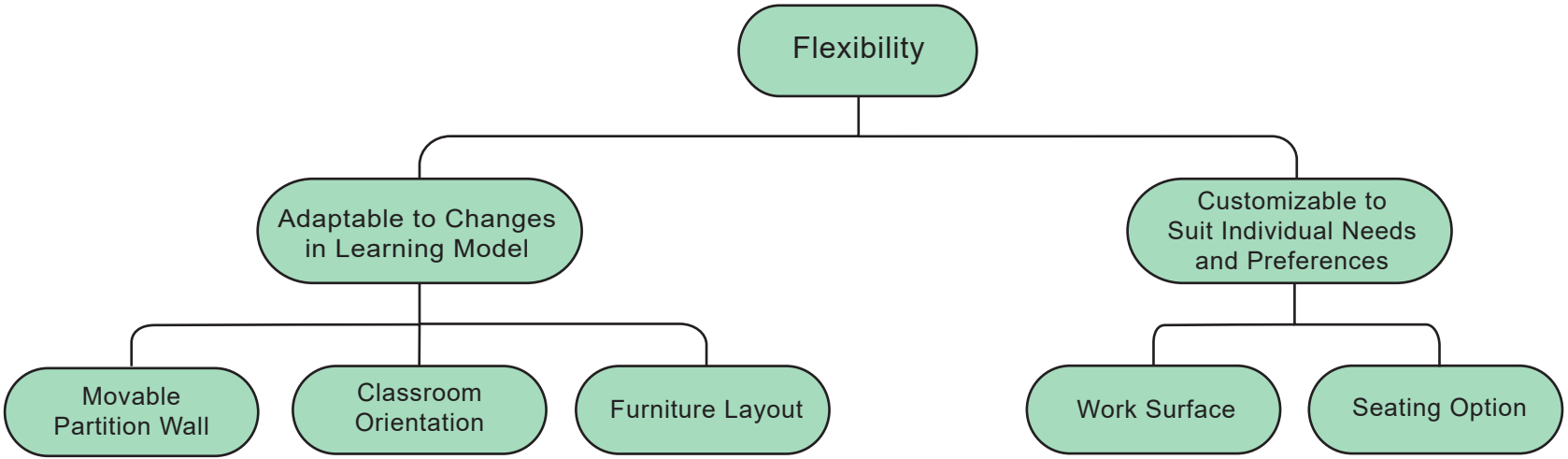
The Capstone project will include **two elementary school prototypical classrooms and interstitial spaces.** The first classroom will prioritize the needs to younger elementary students from **Kindergarten to second grade**. The second classroom will prioritize the needs of older elementary students from **third to fifth grade.**

Design Concept

Concept Statement

For too long, classrooms have embodied a static learning environment designed to suit an inflexible learning model. As pedagogy has evolved to include student-centered learning, classroom design must adapt to prioritize the evolving needs of students. These flexible learning environments will pivot to meet both student and teacher's individual needs and preferences through simple modifications to increase engagement and time-on-task while minimizing distractions.

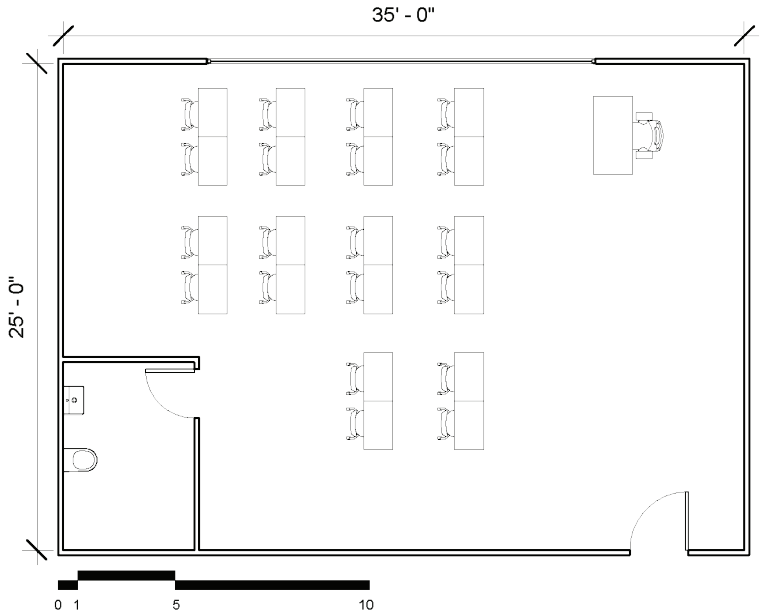
Design Concept



Flexibility Concept Application Diagram

Kindergarten - Second Grade Classroom

Programming



Typical Kindergarten Classroom

Typical Classroom Size		
Grade	Minimum Square Footage	Max. # of Students
K	900 sqft	20
1-2	770 sqft	20
3-5	770 sqft	23

Typical Classroom Sizes in New York State

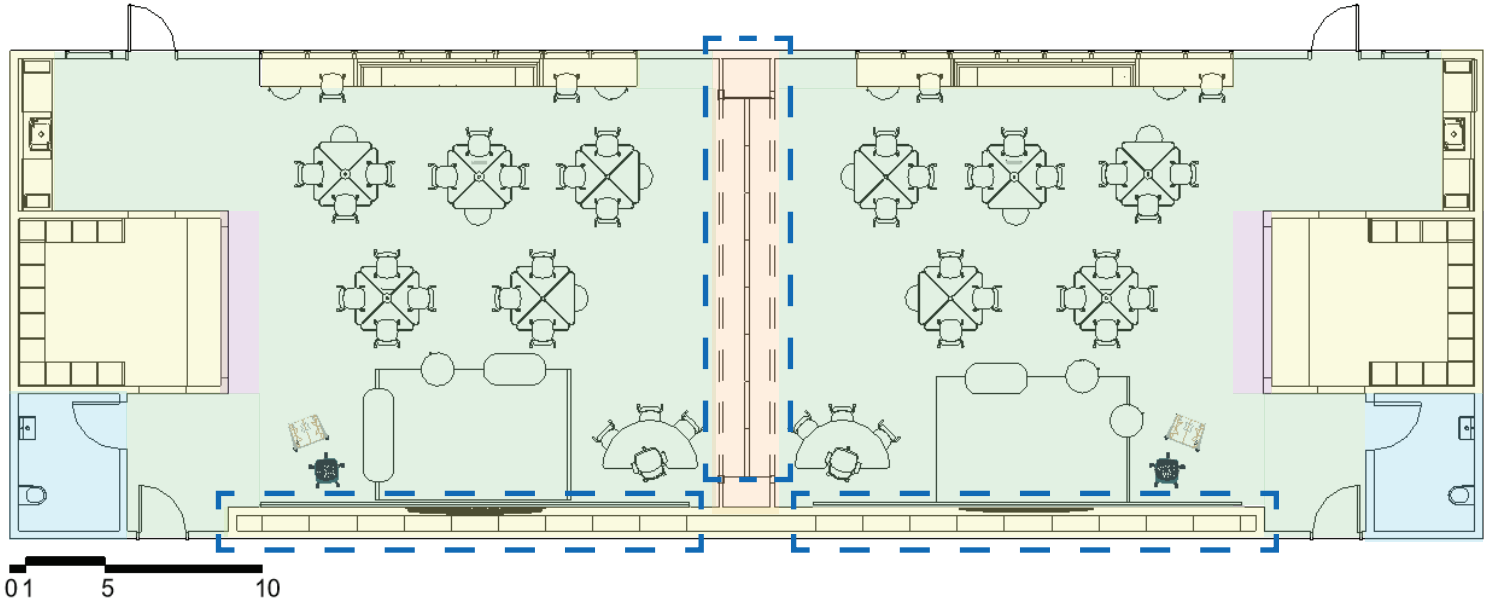
Programming

Zone	Required NASF	Quantity	Total NASF
Student Work Stations	15	20	300
Teacher Station	60	1	60
Student Storage	6	20	120
Teacher storage	25	3	75
Open Floor Space	80	3	240
Play Area	50	1	50
Toilet Room	60	1	60
Hand Washing Sink	20	1	20

Area Subtotal	925
Departmental Factor	1.25
Gross SF	1156

Kindergarten - 2nd Grade Programming chart

Floor Plan



Legend

Presentation Wall

Flexible Space

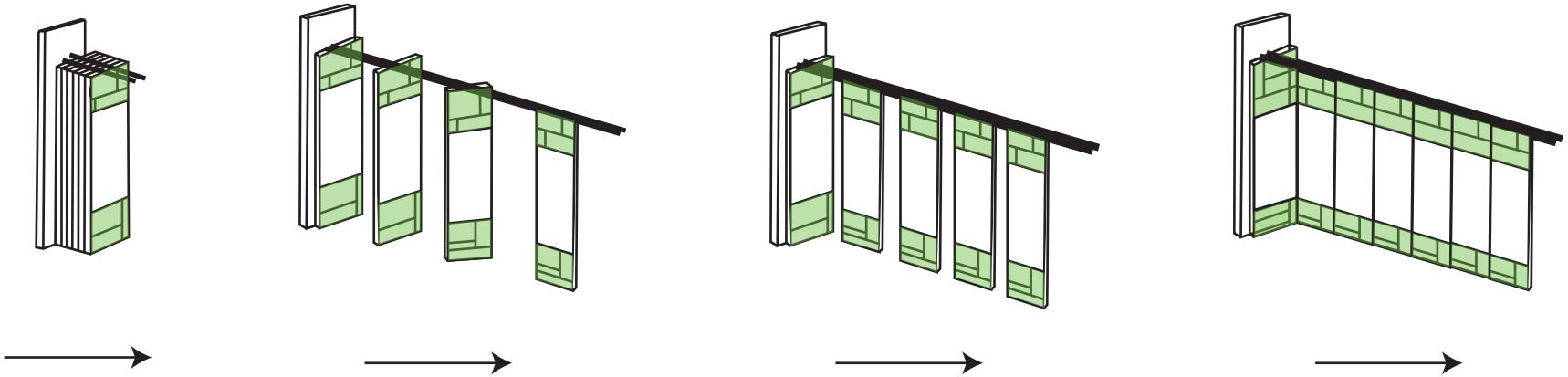
Movable Partition

Storage

Play Wall

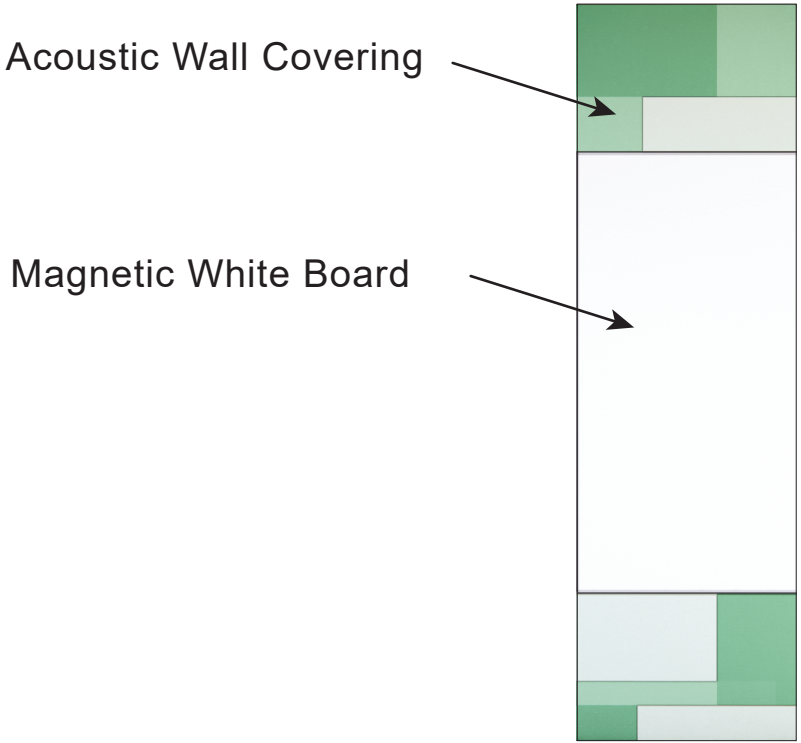
Toilet Room

Partition Wall Diagram

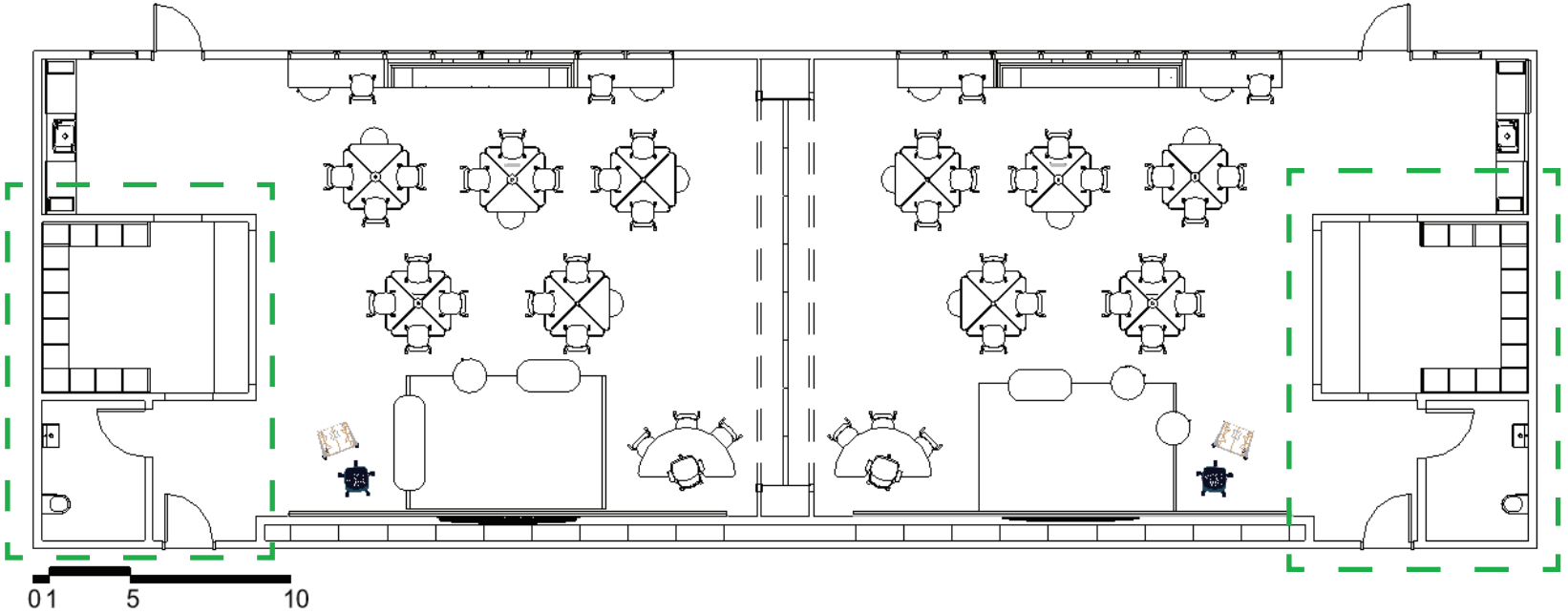


Movable Partition Wall Diagram

Partition Wall Diagram



Utility Spaces

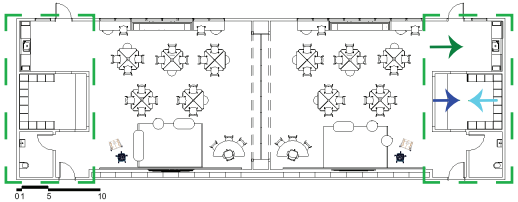


Utility Spaces

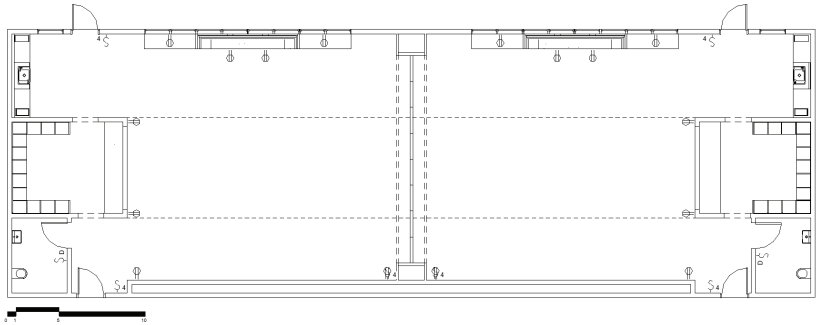
Hand Washing Sink with Storage and Mobile Waste Bins

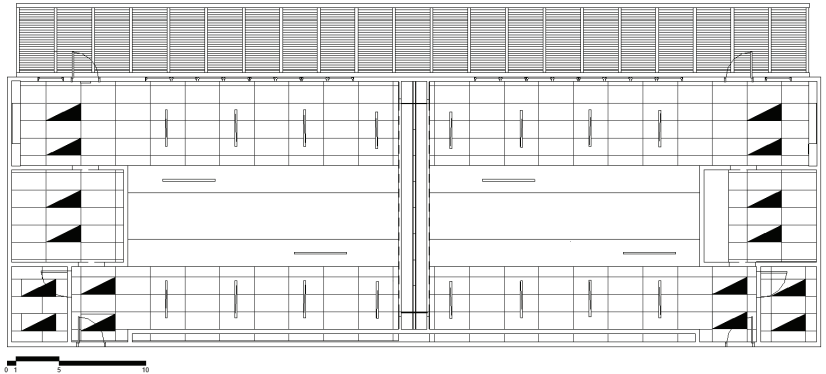
Bench Seat with Storage

Student Storage



Reflected Ceiling and Lighting Plan





Legend

Corelite Bridge Recessed 2’ x 4’

Neo-Ray LED Acoustic Luminaire

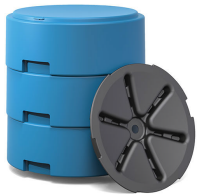
Focal Point Seem 2 LED Recessed

Furniture and Finish Selections

Smith Systems Height Adjustable Wing Desk

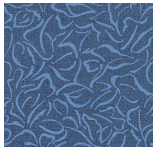
Smith Systems Half Moon Activity Table

Smith Systems Numbers Mobile Chair

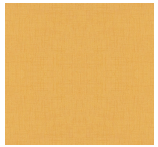


Smith Systems Oodle: Stackable Rocking Stool

Arc Com Upholstery Fiji Berry #2



Arc Com Upholstery Arabesque sapphire



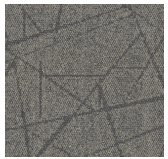
Arc Com Upholstery Dynasty Sunflower

Sherwin Williams Jay Blue

Sherwin Williams White Snow

Benjamin Moore Leprechaun Green

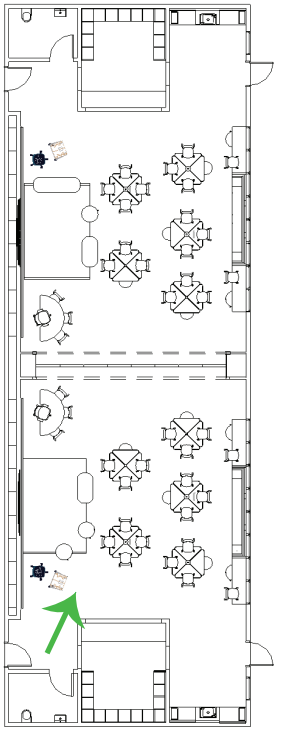
Light Wood-Toned Laminate



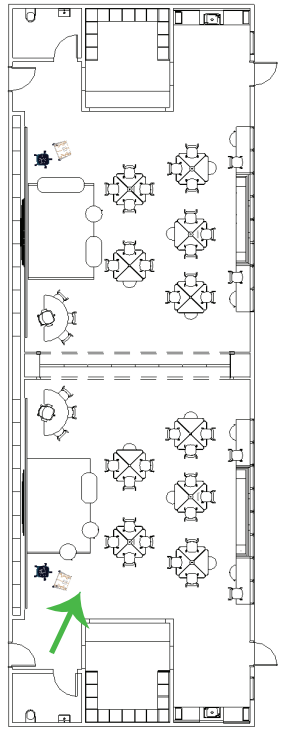
Interface Carpet Tile

Armstrong Biome LVT

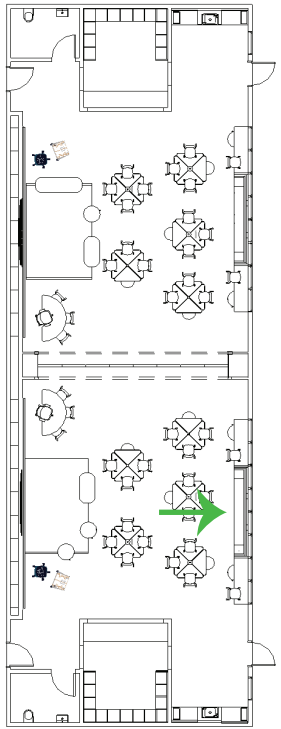
Kindergarten - Second Grade Classroom



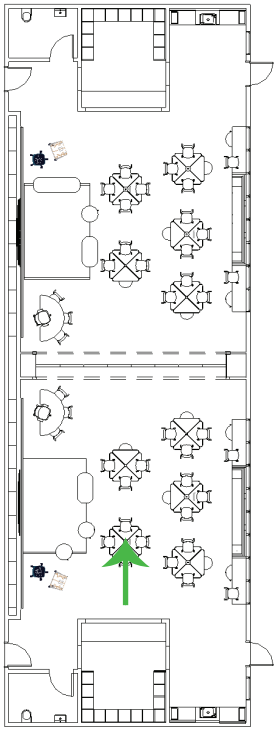
Secondary Presentation Wall



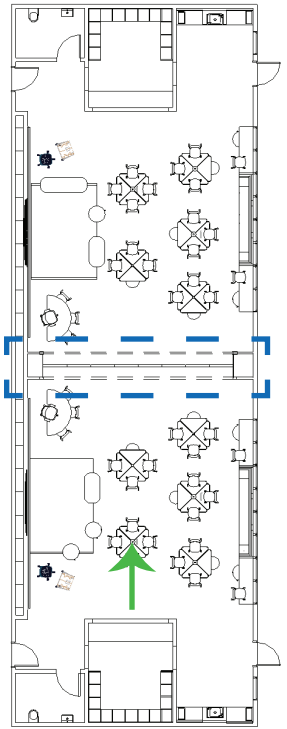
Built-in Reading and Work Wall



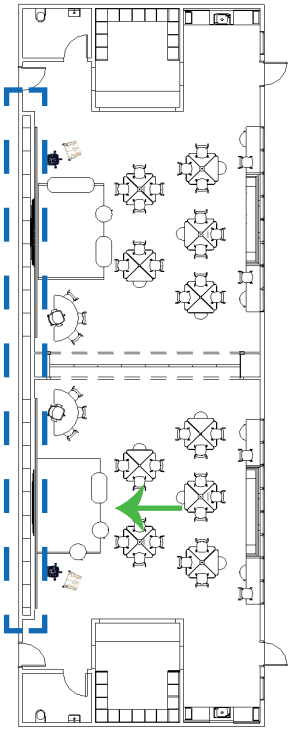
Kindergarten - Second Grade Classroom



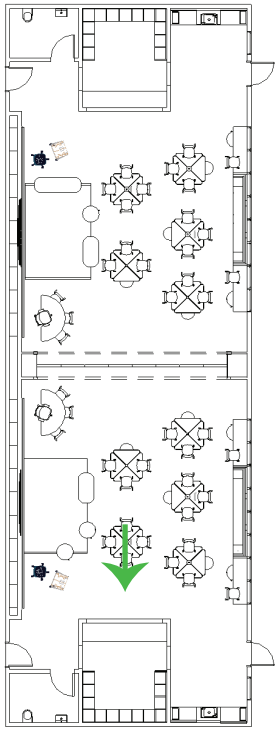
Secondary Presentation Wall



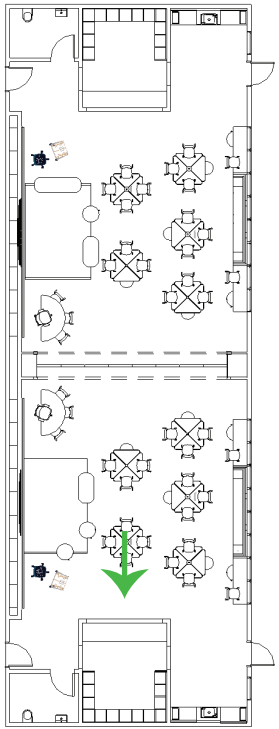
Primary Presentation Wall



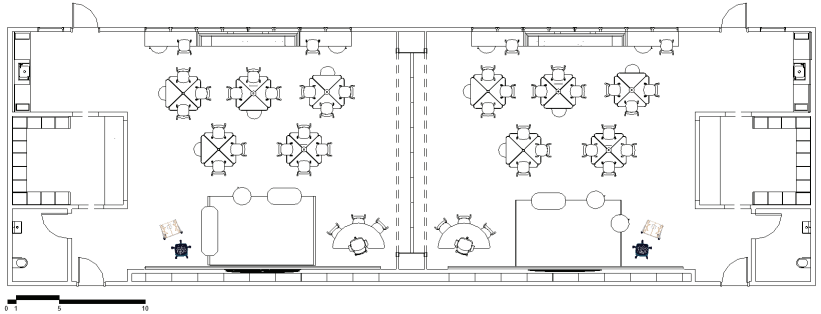
Student Play Wall



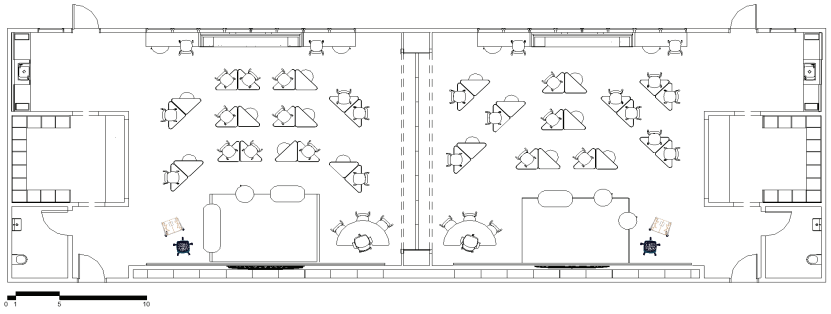
Student Play Wall



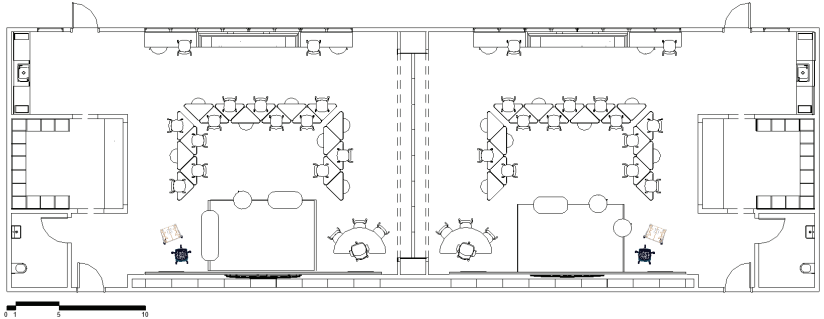
Furniture Layout Options



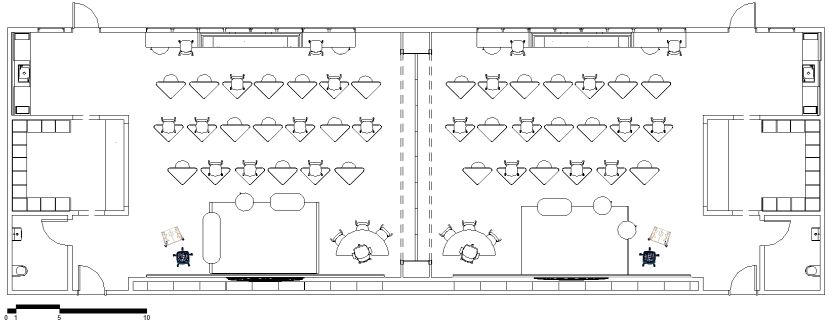
Student Centered Layout Option: Small Groups



Teacher Centered Layout Option: Pairs



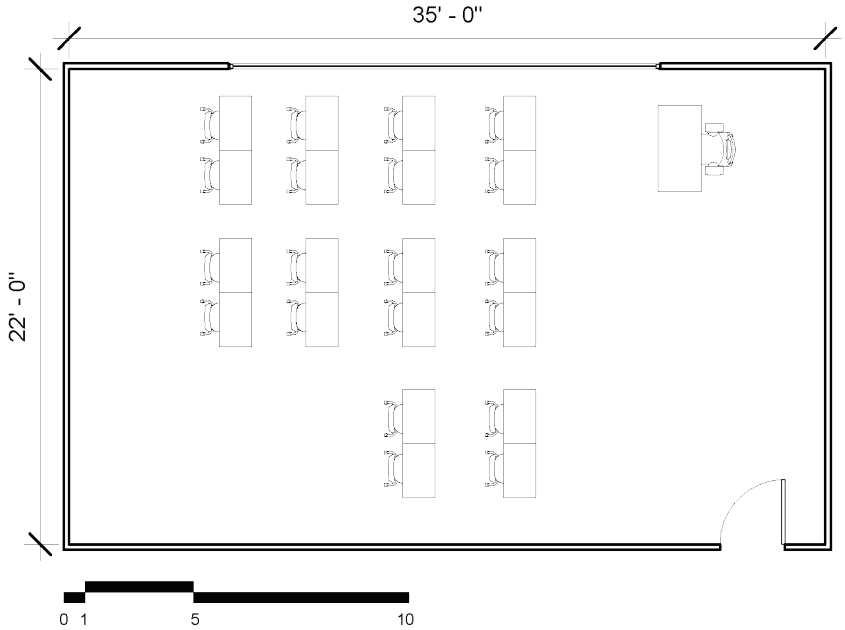
Student Centered Layout Option: U-Shape



Teacher Centered Layout Option: Rows

Third - Fifth Grade Classroom

Programming



Typical 3rd-5th Grade Classroom

Typical Classroom Size		
Grade	Minimum Square Footage	Max. # of Students
K	900 sqft	20
1-2	770 sqft	20
3-5	770 sqft	23

Typical Classroom Sizes in New York State

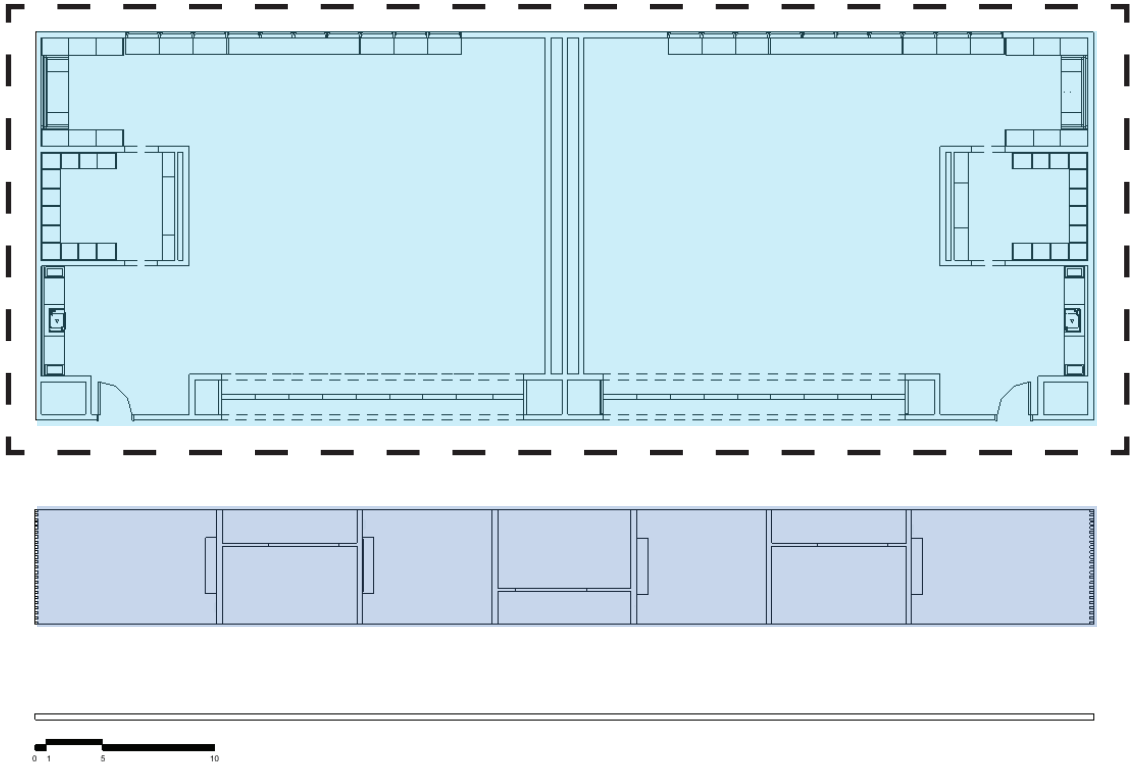
Programming

Zone	Required NASF	Quantity	Total NASF
Student Work Stations	15	20	300
Teacher Station	60	1	60
Student Storage	6	20	120
Teacher storage	25	3	75
Open Floor Space	80	3	240
Reading Corner	110	1	90
Hand Washing Sink	20	1	20

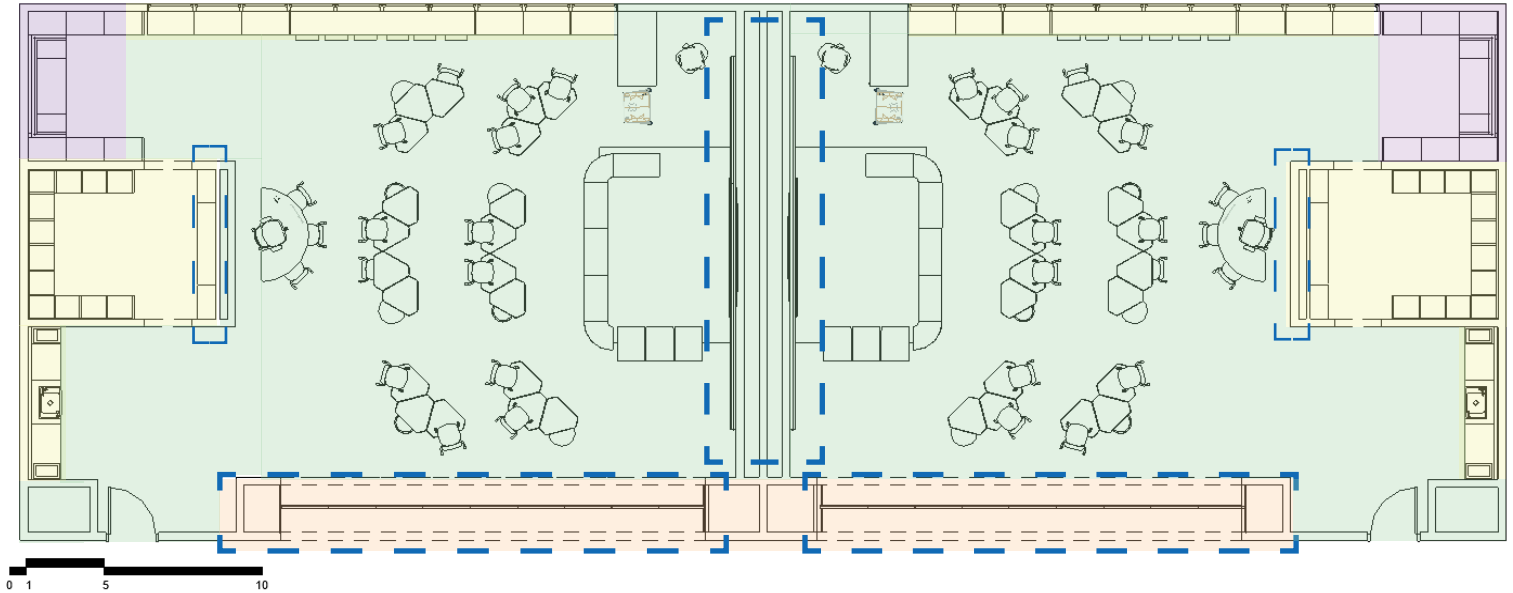
Area Subtotal	925
Departmental Factor	1.25
Gross SF	1156

3rd-5th Grade Programming chart

Classroom and Corridor Floor Plan



Floor Plan and Furniture Plan



Legend

Presentation Wall

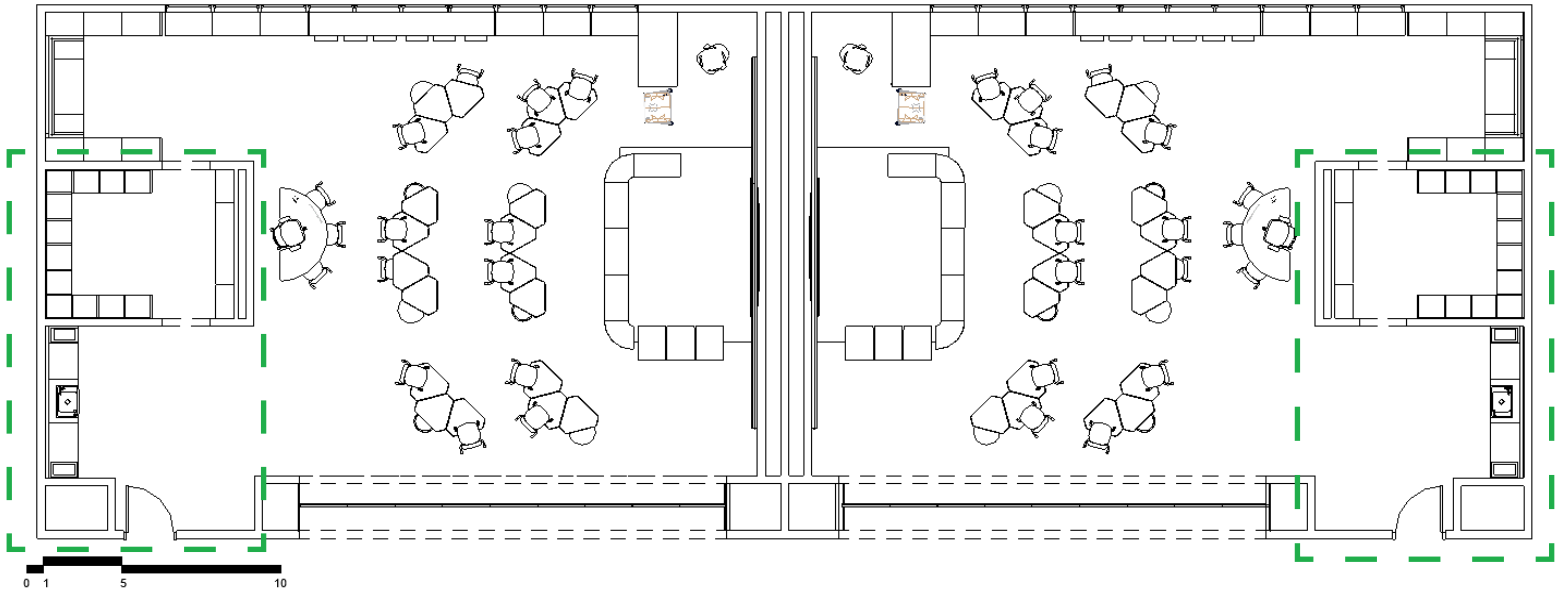
Flexible Space

Movable Partition

Storage

Reading Corner

Utility spaces



Legend

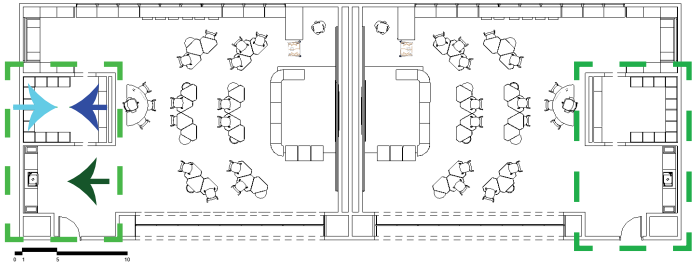
Utility Space

Utility spaces

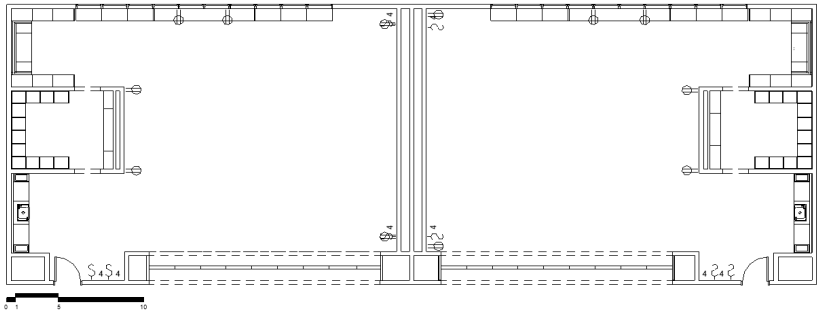
Sink, Storage and Mobile Waste Bins

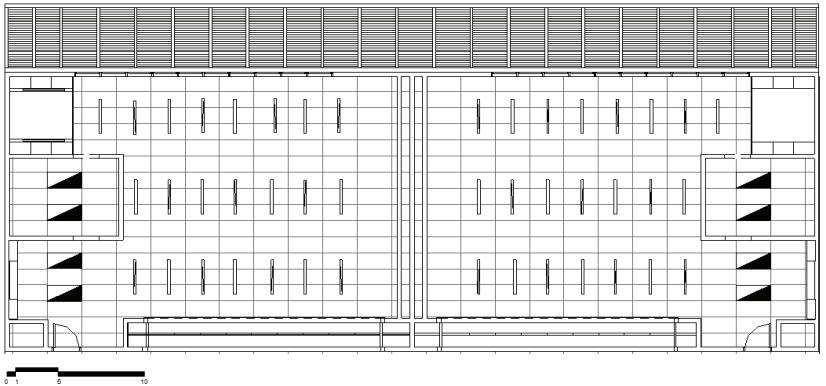
Teacher Storage and Student Mail Boxes

Student Storage



Reflected Ceiling and Lighting Plan





Legend

- Corelite Bridge Recesses 2’ x 4’
- Neo-Ray LED Acoustic Luminaire
- Focal Point Seem 2 LED Recessed

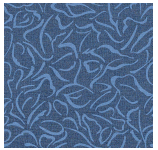
Furniture and Finishes

Smith Systems Height Adjustable Diamond Desk

Smith Systems Half Moon Activity Table

Smith Systems Oodle: Stackable Rocking Stool

Arc Com Upholstery Ambiance Aquamarine



Arc Com Upholstery Arabesque sapphire

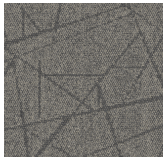
Sherwin Williams Jay Blue

Sherwin Williams Vast Sky

Smith Systems Numbers Mobile Chair

Smith Systems Flowform Soft Rocker

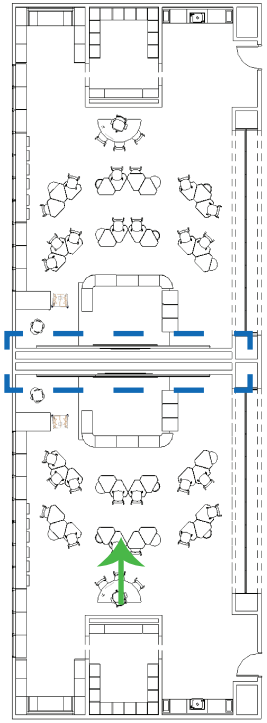
Smith Systems Flowform Tapered Cylinder Stool



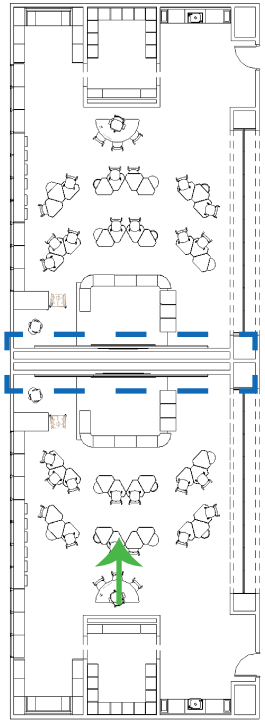
Interface Carpet Tile

Armstrong Biome LVT

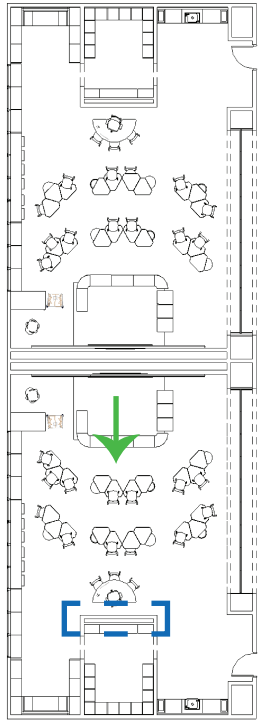
Primary Presentation Wall



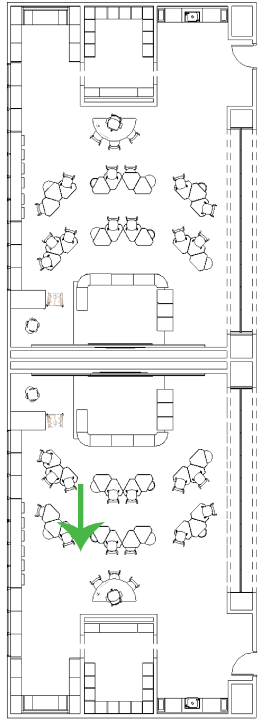
Primary Presentation Wall



Secondary Presentation Wall



Secondary Presentation Wall



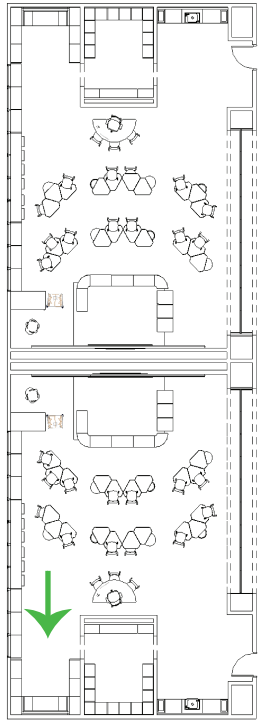
Reading Corner

Task Lighting

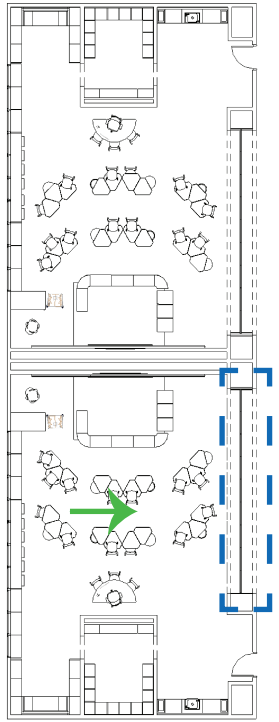
Book Storage

Built-In Upholstered Bench

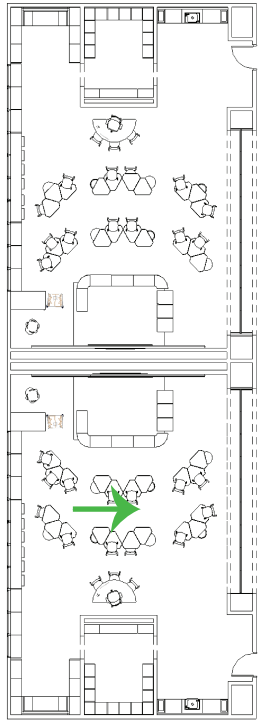
Nature Mural



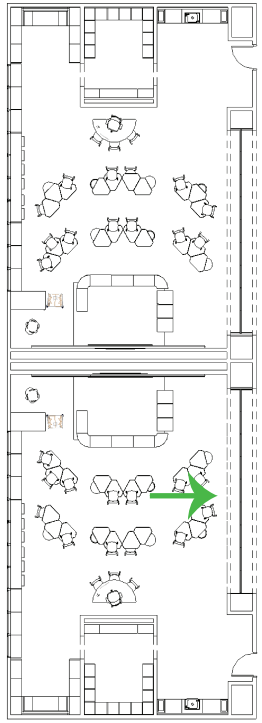
Secondary Presentation Wall



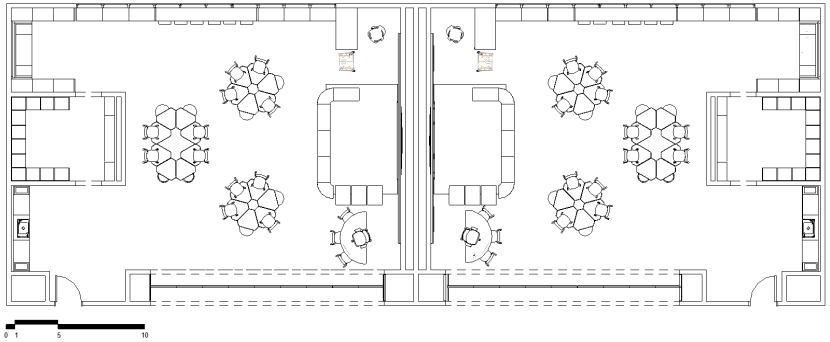
Third - Fifth Grade Classroom



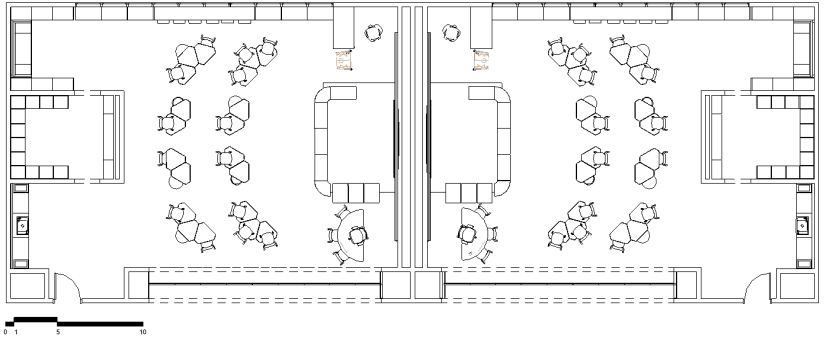
Third - Fifth Grade Classroom



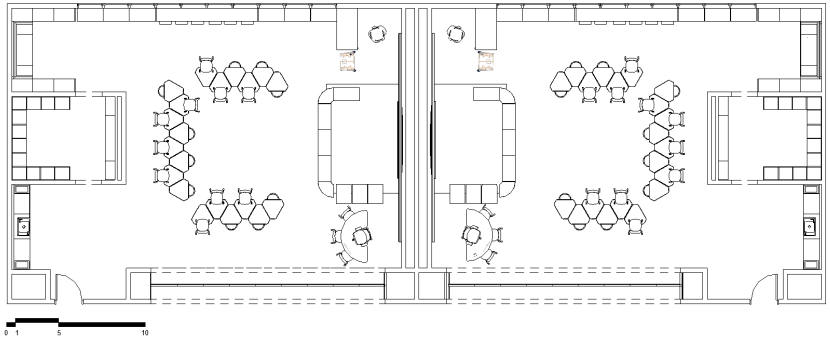
Furniture Layout Options



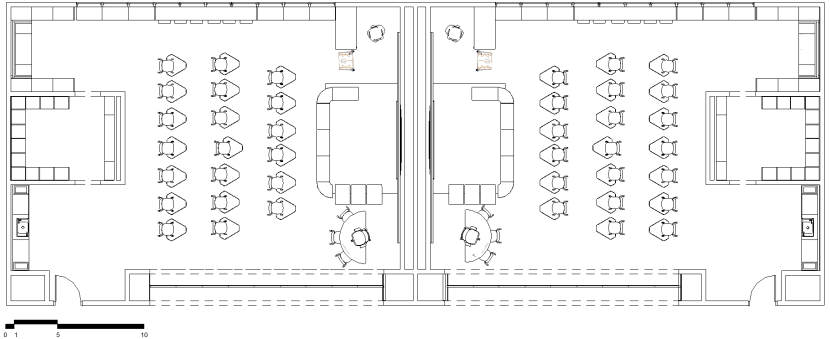
Student Centered Layout Option: Small Groups



Teacher Centered Layout Option: Pairs



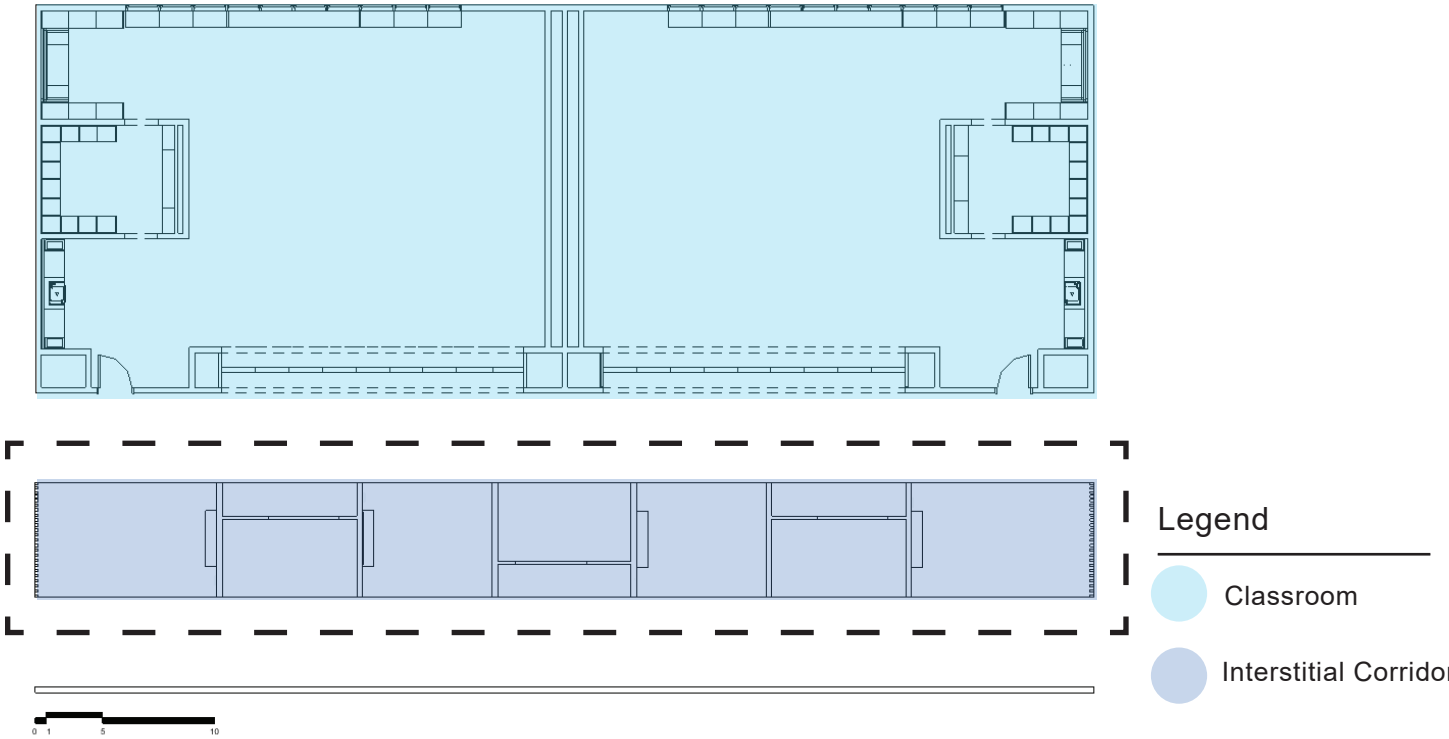
Student Centered Layout Option: U-Shape



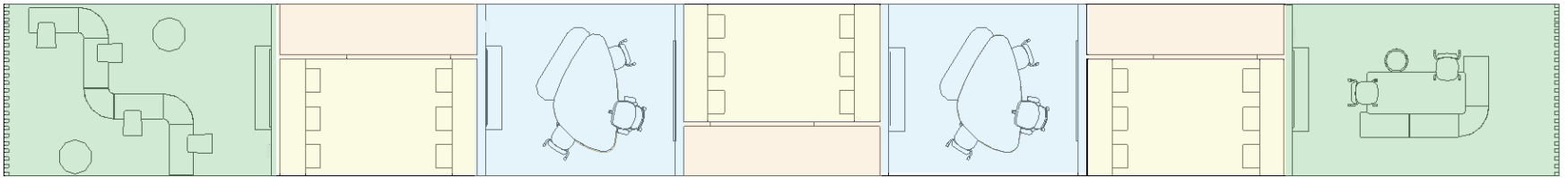
Teacher Centered Layout Option: Rows

Interstitial Corridor

Classroom and Corridor Floor Plan



Corridor Floor Plan



Legend

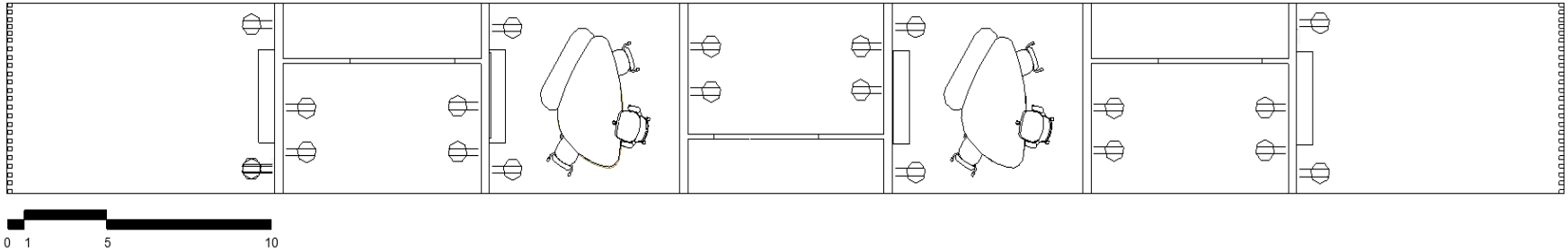
Large Group Space

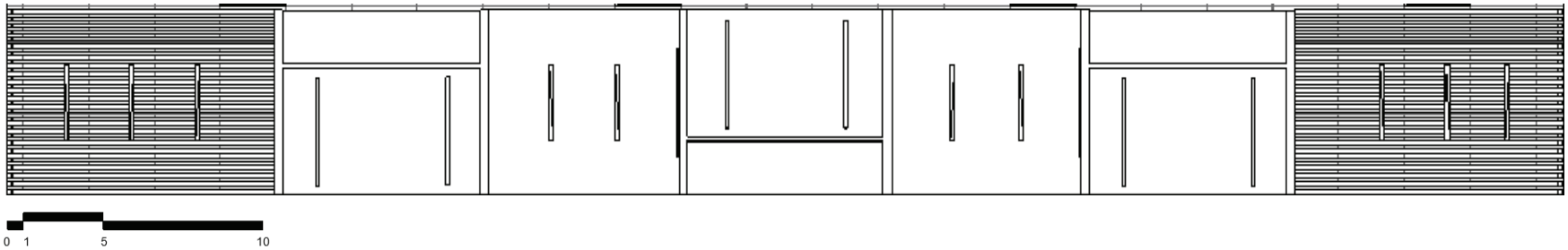
Small Group Space

Reading Nook

Individual Space

Corridor Reflected Ceiling and Lighting Plan



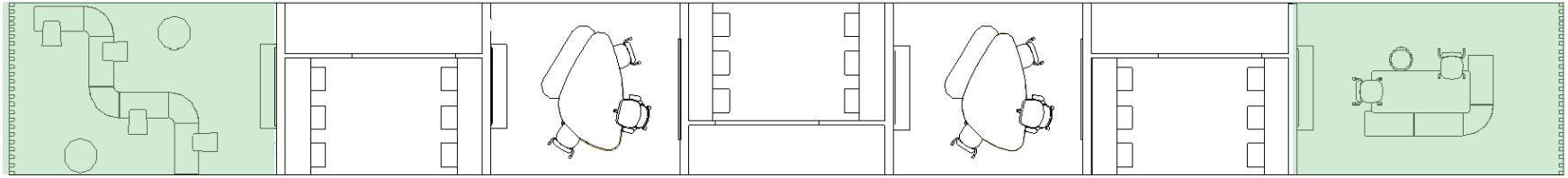


Legend

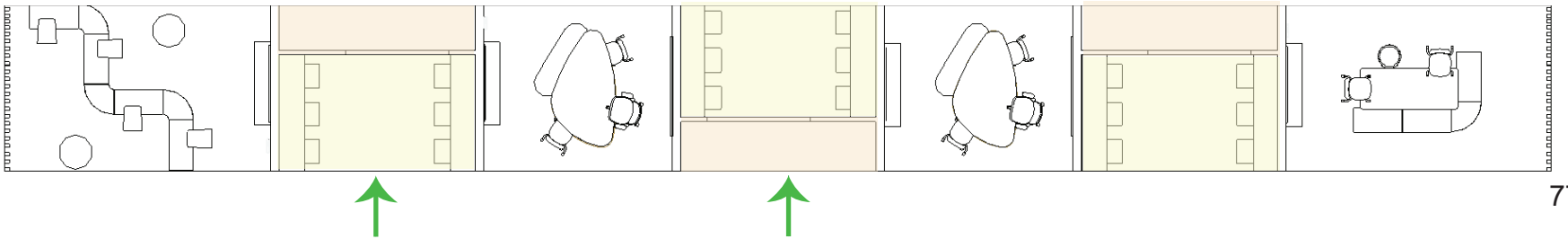
Neo-Ray LED Acoustic Luminaire

Focal Point Seem 2 LED Recessed

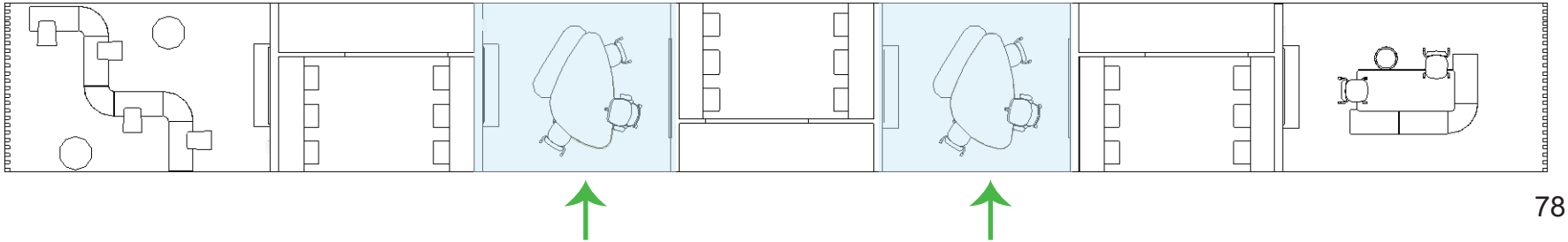
Large Group space



Independent Work Space

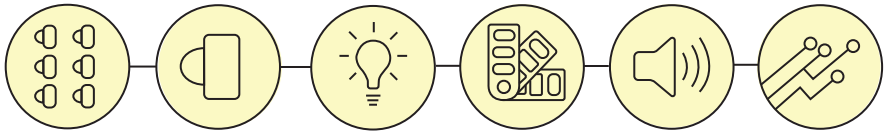


Small Group Space



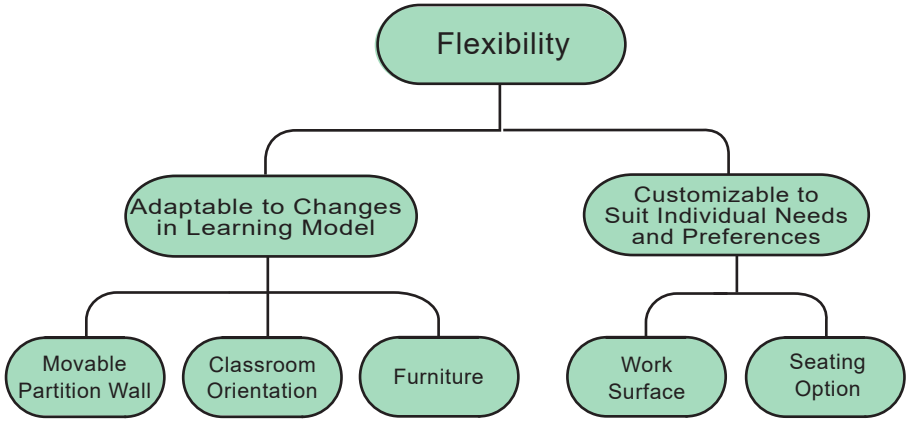
5 Conclusion

Capstone Conclusion



Design Variables Identified in Literature Review

Design Variables Identified in Research Agenda



Capstone Summary Diagram

Thank You

Capstone Researcher | Stephanie Buckingham

RIT | Rochester Institute of Technology