



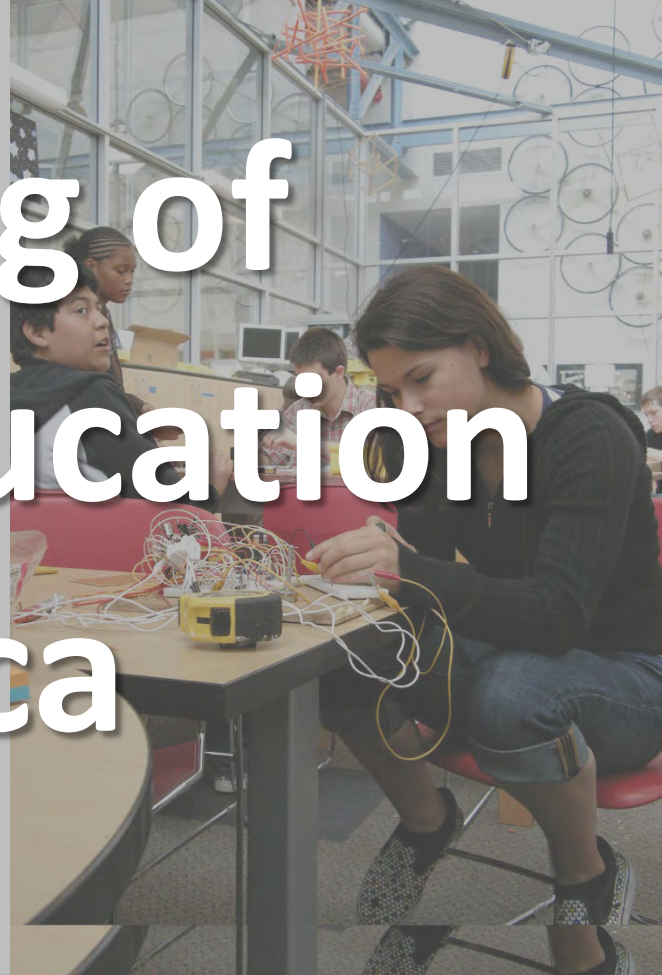
CTE, PBL and STEM at Work in Education



AGENDA:

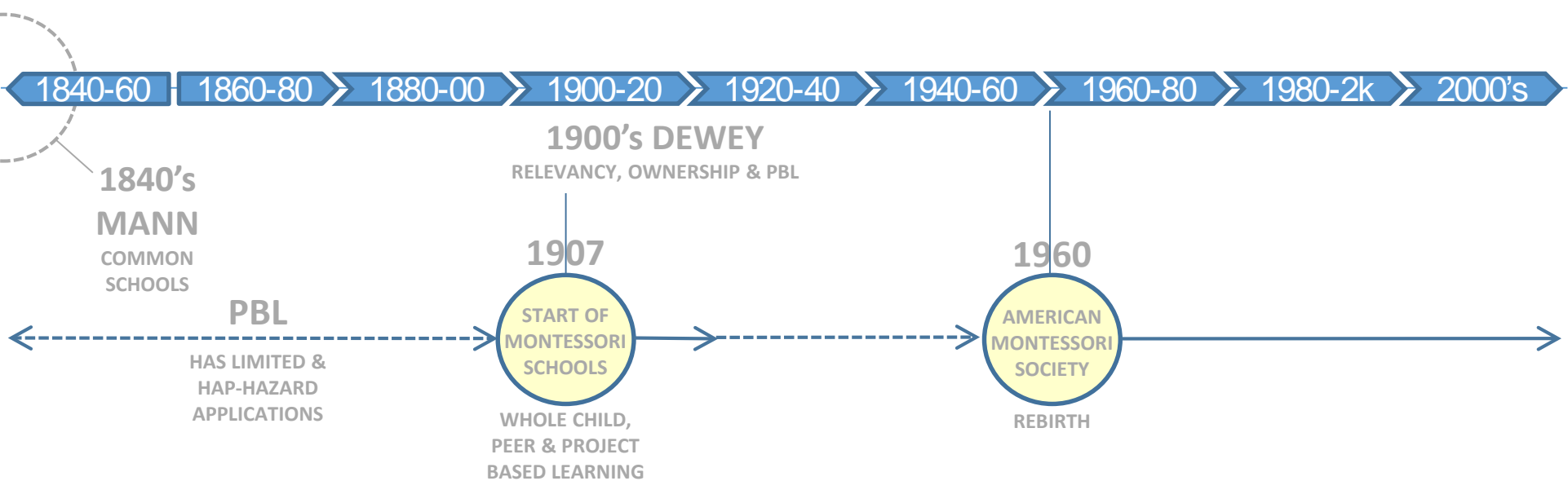
1. History and Background
2. 21st Century Learning Activity
3. Integrated CTE Example - Essex Tech
4. Small Table Discussion
5. Future Ready Schools

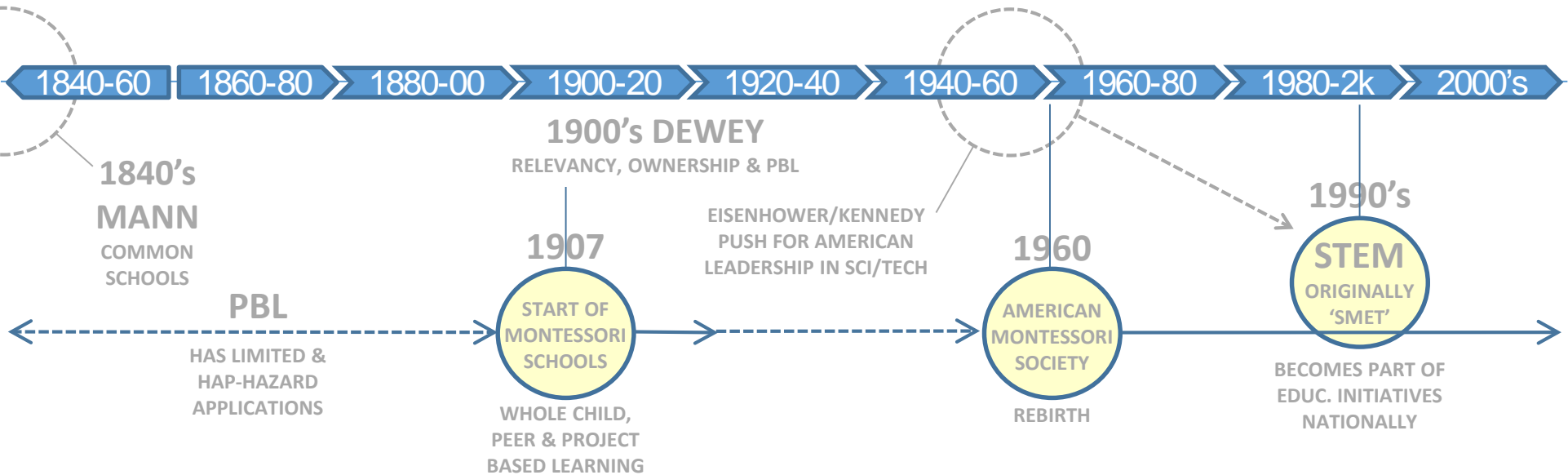
The Shaping of Vocational Education in America

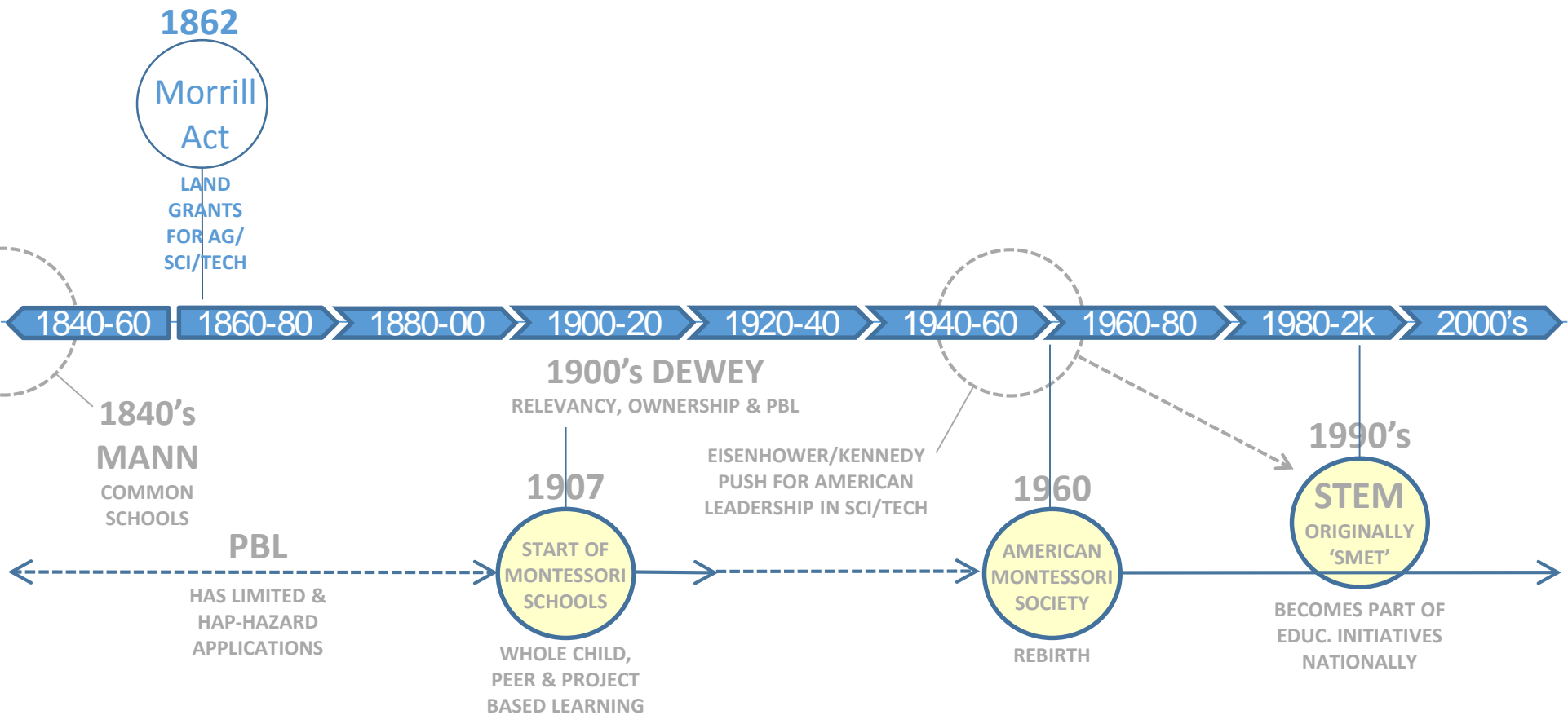


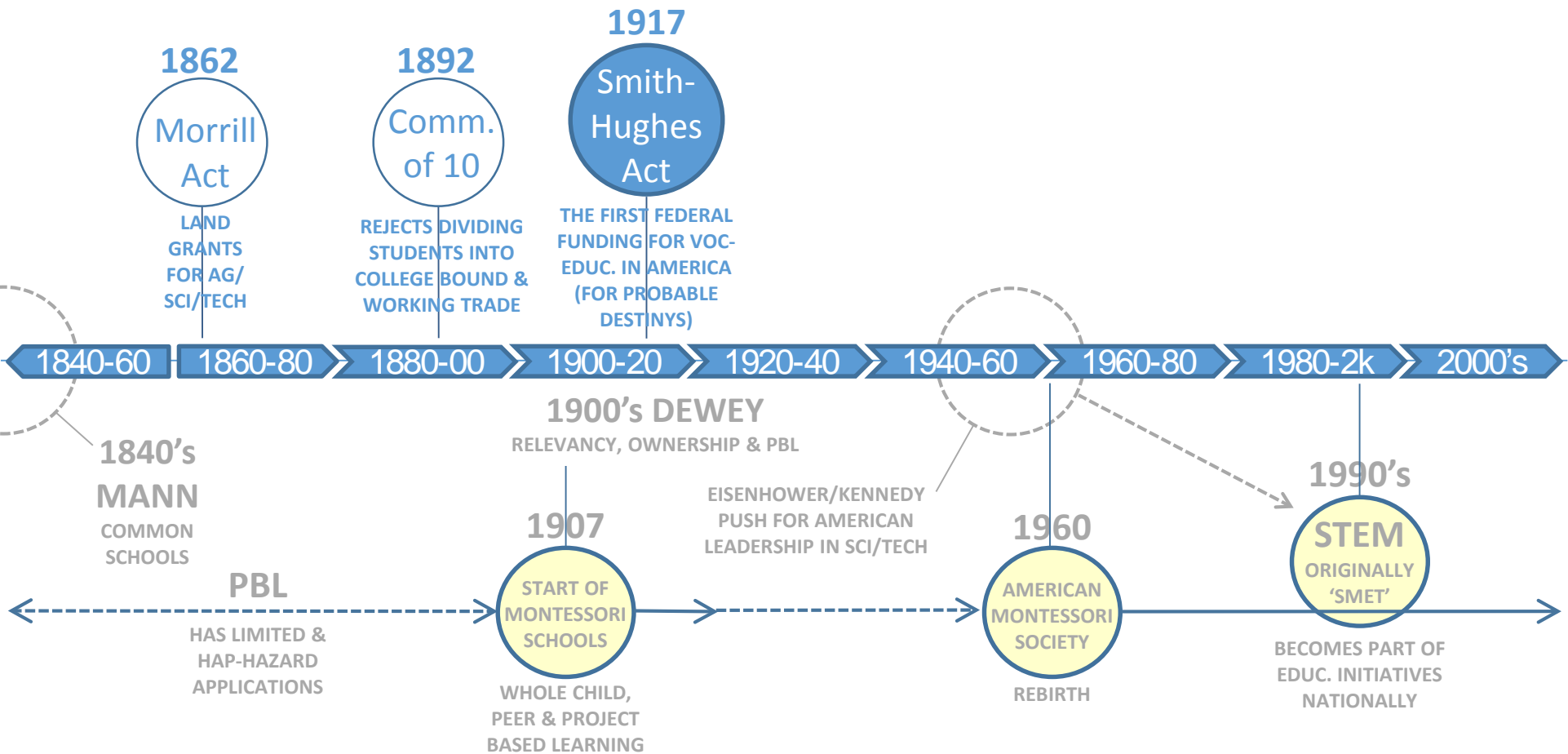


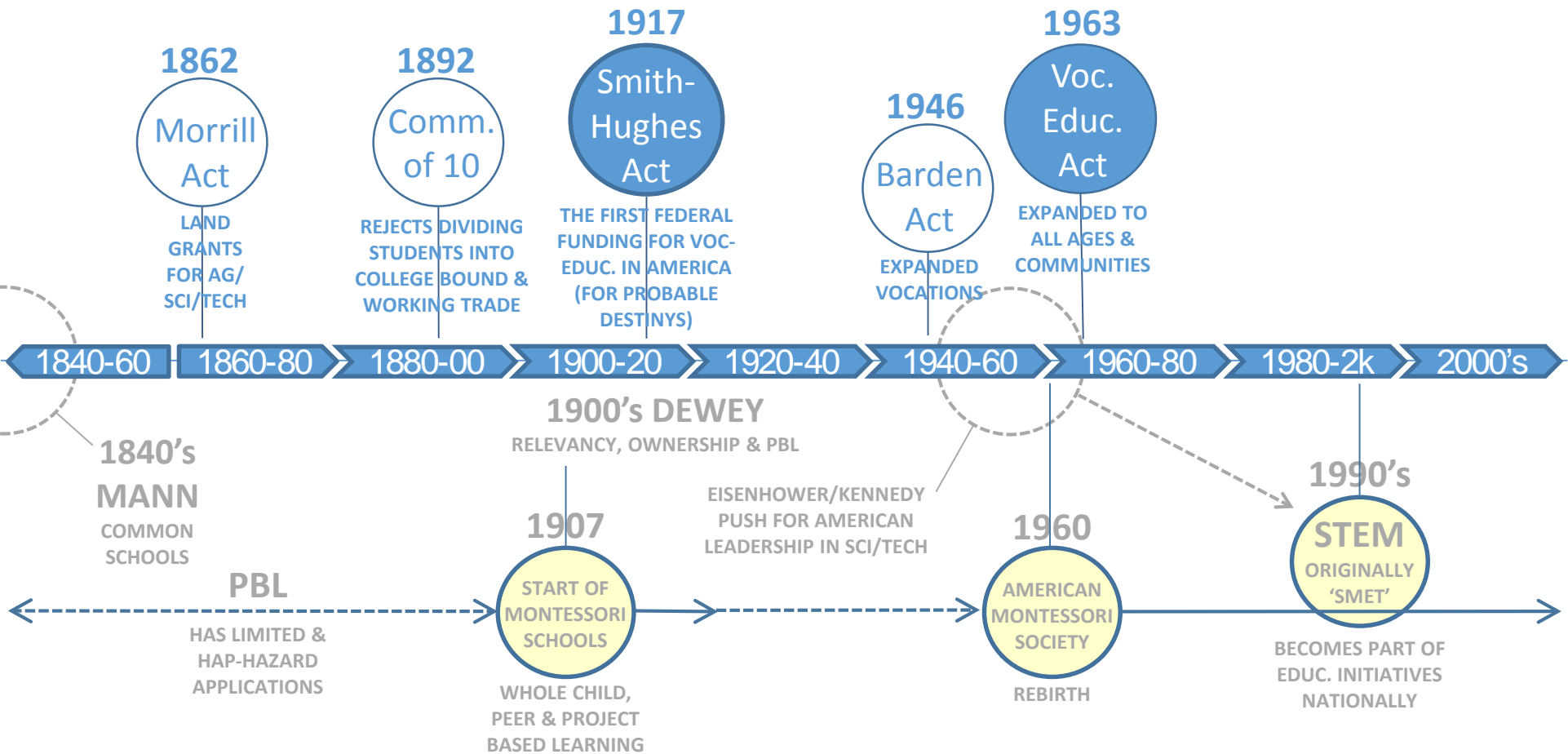
1840's
MANN
COMMON
SCHOOLS

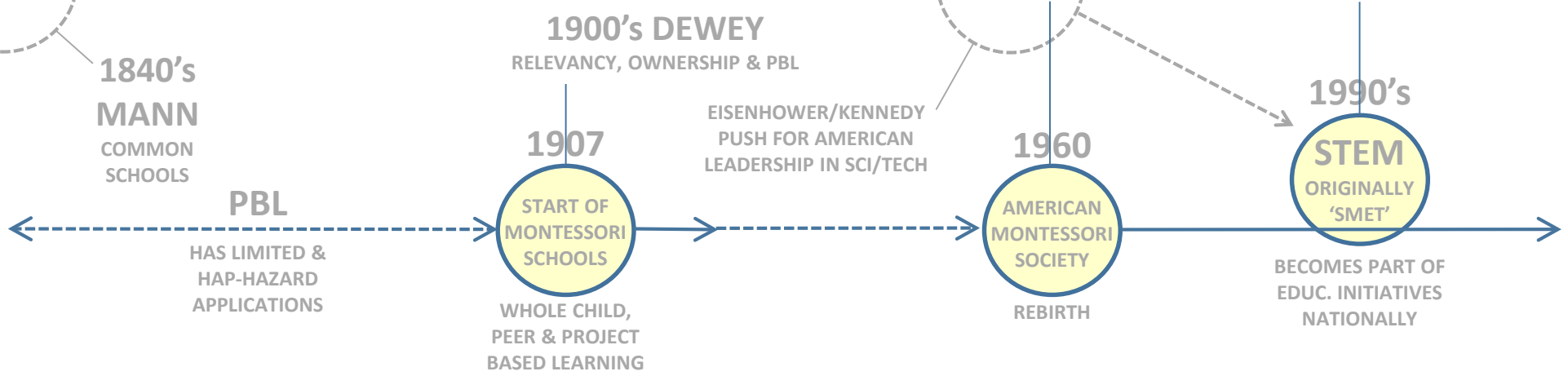
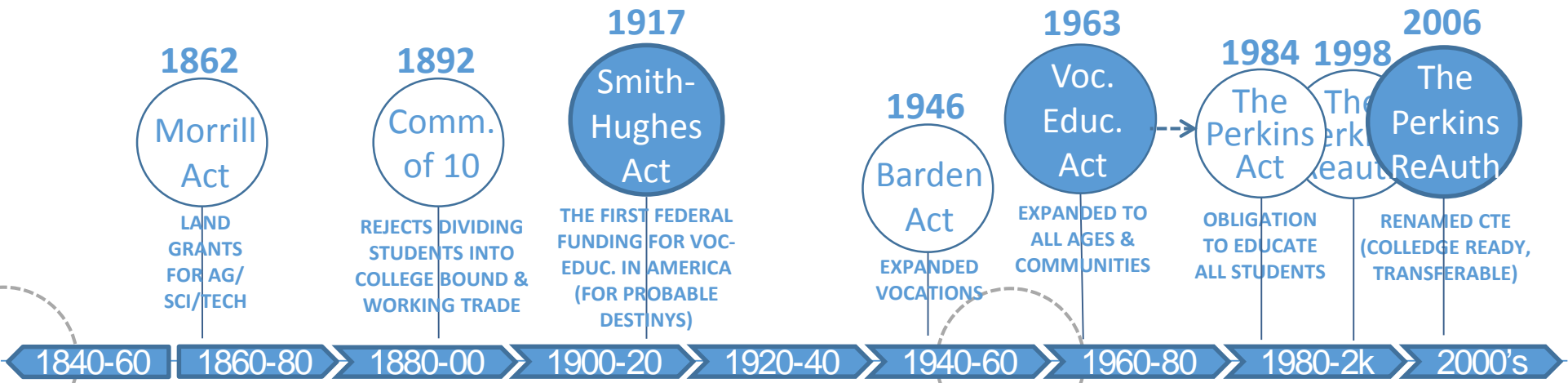


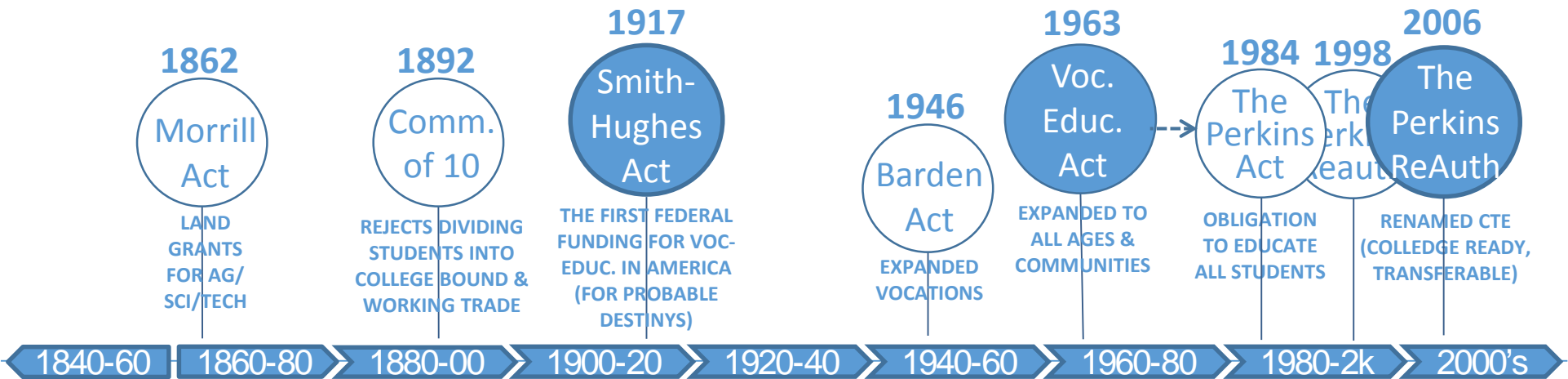












CRAFTS & TRADES APPRENTICESHIPS MEET INDUSTRIAL REVOL.

FACTORY TRAINING, GUILDS & FORMATION OF UNIONS

EARLY VOCATIONAL EDUCATION FITTED PEOPLE TO PROBABLE DESTINY (SEPARATE TRACKS)

STUDENTS w/ LRNG/BEHAV. DISABILITIES OFTEN SENT TO VOC-ED.

NEW CTE MODEL FOCUSES ON TRANSFER-ABLE SKILLS

PBL

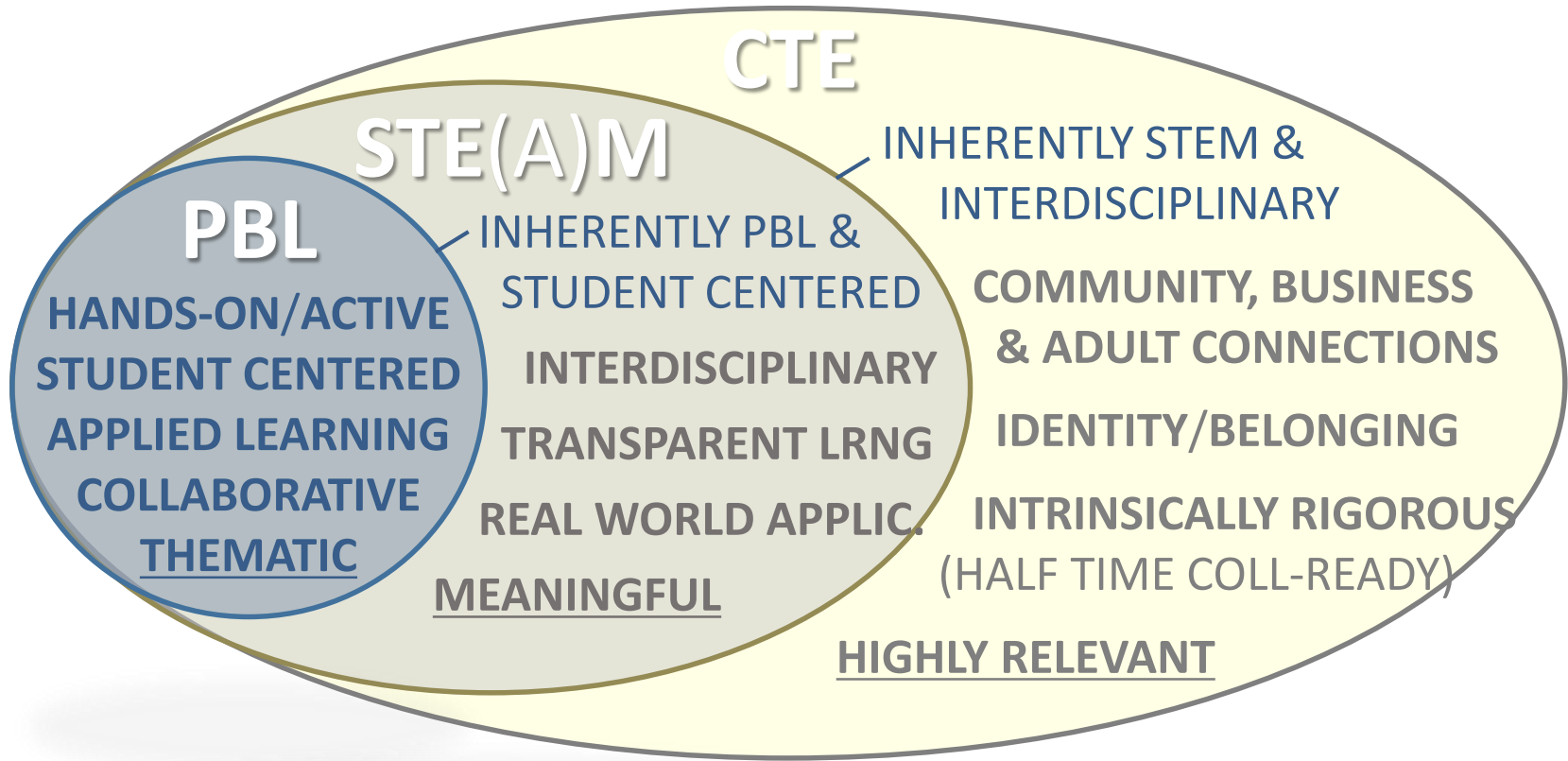
**HANDS-ON/ACTIVE
STUDENT CENTERED
APPLIED LEARNING
COLLABORATIVE
THEMATIC**

STE(A)M

PBL

HANDS-ON/ACTIVE
STUDENT CENTERED
APPLIED LEARNING
COLLABORATIVE
THEMATIC

INHERENTLY PBL &
STUDENT CENTERED
INTERDISCIPLINARY
TRANSPARENT LRNG
REAL WORLD APPLIC.
MEANINGFUL



WHAT DOES RESEARCH TELLS US?

ACTIVE/STUDENT CENTERED LEARNING
(PBL, Differentiation & Movement)

COLLABORATIVE/INTERDISCIPLINARY
(Cross-Content, STEM/STEAM & CTE)

Schools That Work
“Research-Supported PBL
Practices,” Edutopia, 2012.

Shown to develop students’
critical thinking skills, long-
term retention of content +
experience of satisfaction
(see Ravitz 2009 for review)



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AUTHENTIC & REAL WORLD APPLICATIONS
(Thematic, Meaningful & Relevant)

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Dr. B. Barron and Dr. L. Darling-Hammond,
“Teaching Meaningful Learning – A Review of Research on
Inquiry-Based and Cooperative Learning,” Edutopia, 2008.



WHAT DOES RESEARCH TELL US?

ACTIVE/STUDENT CENTERED LEARNING

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COLLABORATIVE/INTERDISCIPLINARY

(Cross-Content, STEM/STEAM & CTE)

AUTHENTIC & REAL WORLD APPLICATIONS

(Thematic, Meaningful & Relevant)

A SENSE OF BELONGING & IDENTITY

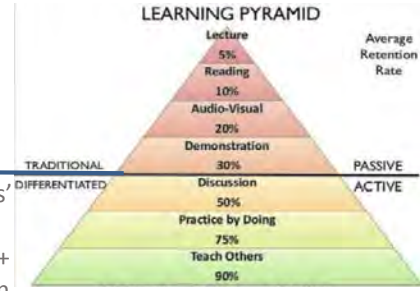
(Academies, Career Tracks & Pathways)

COMMUNITY CONNECTIONS/ENGAGEMENT

(Civic, Business & Public Engagement/Use)

Schools That Work
“Research-Supported PBL Practices,” Edutopia, 2012.

Shown to develop students’ critical thinking skills, long-term retention of content + experience of satisfaction (see Ravitz 2009 for review)



National Training Lab Research, ME

Dr. B. Barron and Dr. L. Darling-Hammond, “Teaching Meaningful Learning – A Review of Research on Inquiry-Based and Cooperative Learning,” Edutopia, 2008.

M. Whiting, D. Nesbit and L. Spaulding, “Relationship Between Sense of Community and Academic Achievement: A Comparison Among High School Students,” 2009, (Online).

Dept. of Education Employment and Workplace Relations, “Belonging, Being and Becoming: The Early Years Framework for Australia,” Comm. of Australia. Barton, 2009.

K. Osterman, “Students Need Belonging in the School Community,” Review of Educ. Research, pp 323-367, 2009.

Rindge School of Technical Arts

Formerly known as Rindge
Vocational Technical School “For
Boys of Strong Physique and
Average Intelligence”

THE PROBLEM:

“Nobody knows who I am.”



“I’ m not good at school.”



“I don’ t see the relevance.”

“Understanding derives
from activity.”

John Dewey



The Coalition of Essential Schools

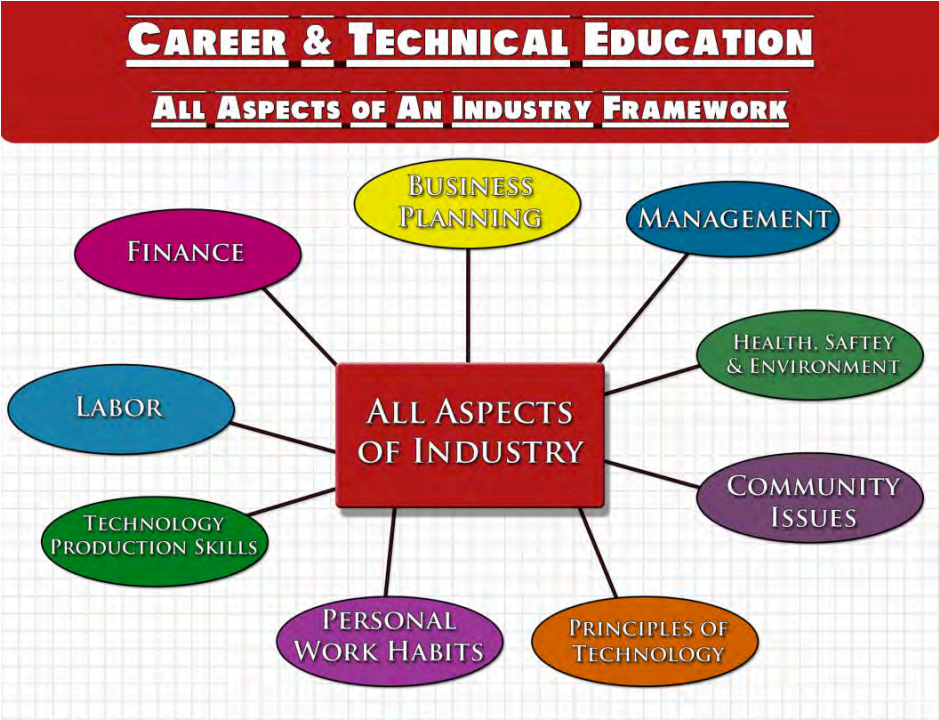
- Learning to use one's mind well
- Less is More, depth over coverage
- Student-as-worker
- Teacher as coach



Montessori and Horace Mann Constructivist approaches to learning

- Values the human spirit and the development of the whole child—physical, social, emotional, cognitive.

Perkins reauthorization - Broad-Based Transferable Skills



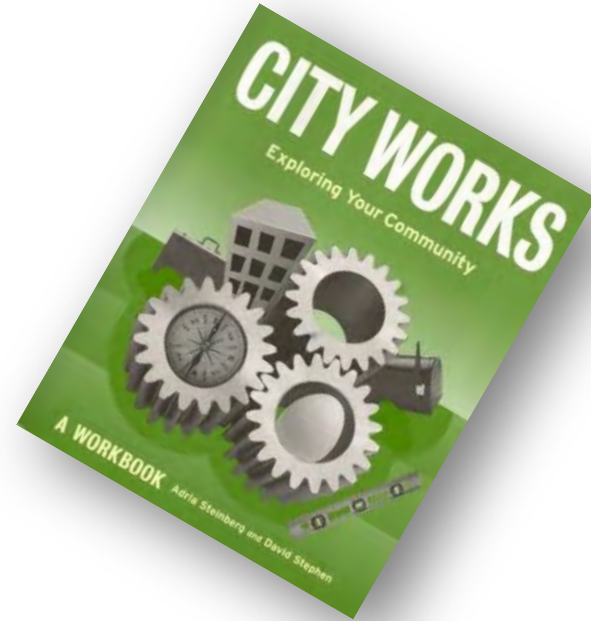
School-to-Work Opportunities Act

- Work-Based Learning
- School-Based Learning
- Connecting Activities

Internships
Field Studies
Student Projects



Integrated Academics and Vocational

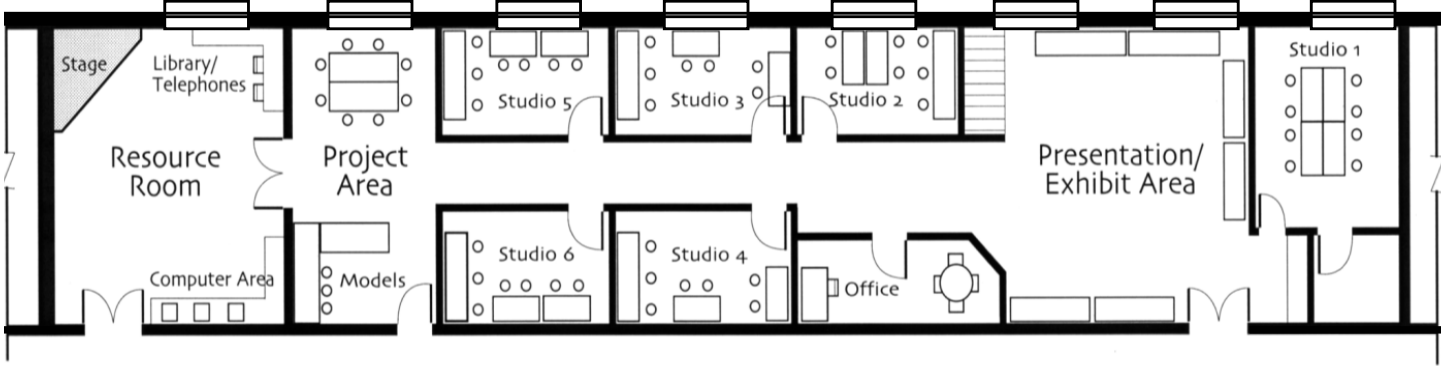


CityWorks

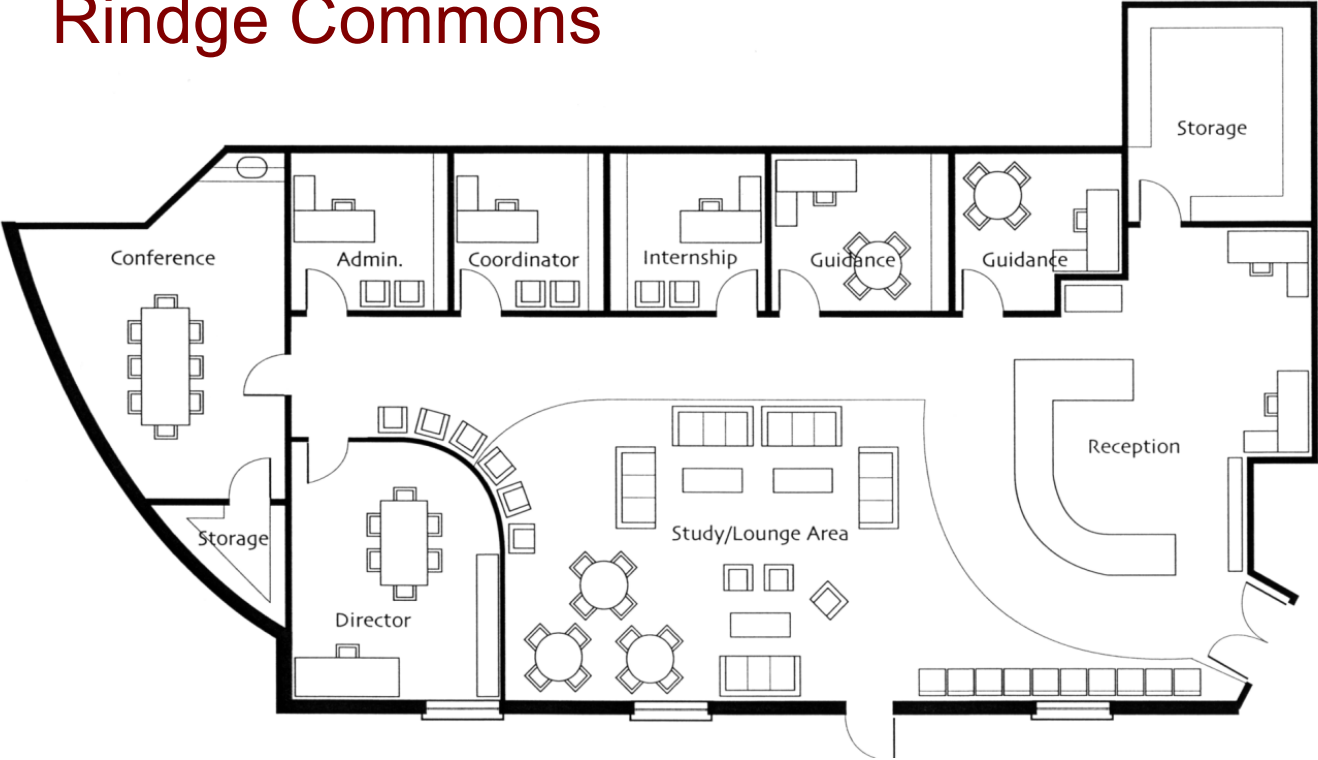
- 9th Grade Exploratory
- Community as Text
- Authentic Projects
- Real Audience
- Presentations and Exhibition



CityWorks Classroom Plan



Rindge Commons



Rindge Commons



RSTA Presentations of Learning



High Tech High

A Hybrid Academic and Vocational Program



High Tech High

- Founded as one HS school in 2000
- Now a network of 14 schools
- 5 High schools, 4 Middle schools, 2 K-8s, and 3 Elementary
- Graduate School of Ed

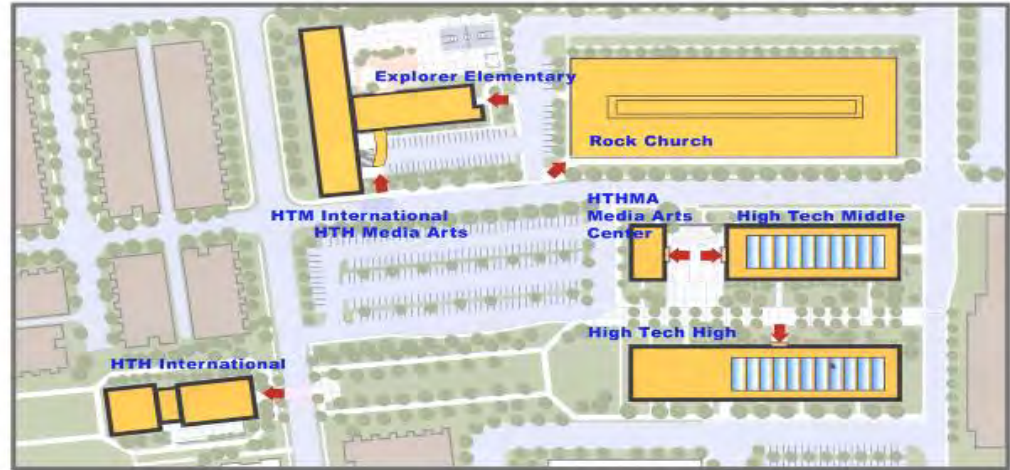
High Tech High Design Principles

- Personalization
- Common Intellectual Mission
- Adult World Connection
- Teacher as Designer



Village Concept

- 3 Villages with some shared amenities
- 300-550 students per school
- Autonomous budgets and leadership

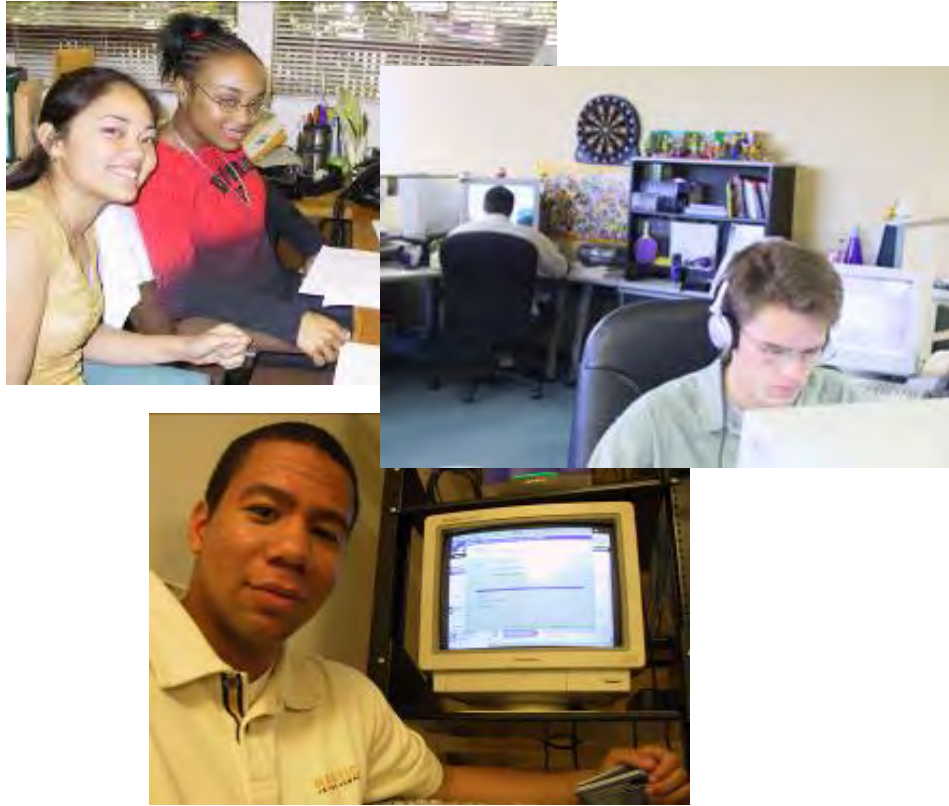


Key Elements

- Engaging
- Relevant
- Project-Based
- No Tracking
- Seamless Academic and Vocational Integration



Internships



HTH has developed academic internships with with over 400 local businesses and organizations including:

Qualcomm Incorporated
Kyocera Wireless
FOX 6 News
San Diego Supercomputer Center
Wirestone
Fish & Richardson
San Diego Regional Economic Dev. Corp.

Capstone Projects



Exhibitions and Presentations



Digital Portfolios



Internship 2010



HTH Stats

- Blind lottery by zip code
- \$7,400 per year per student
- 50 – 60% students of color
- 35 – 50% free and reduced lunch
- Top 20% in STAR and CAHSEE
- Strong communication skills



HTH Outcomes

- 100% HS Graduation
- 92% College Entry
- 80% 4-Year College
- 35% First Generation
- 76% Retention after 4 years.
- Alumni report being well prepared
- +38% entering STEM fields

California Average

- 50% HS Graduation / 17% STEM fields /
- 60% Retention





Project-Based Teaching and Learning

Project-Based Instruction

- Authentic Contexts
- Performance assessment
- Product creation



Inquiry-Based Continuum

- Comprehensive Schools
- Project-Based Learning
- Expeditionary Learning
- CTE Programs
- STEM and STEAM
- Progressive & Constructivist Programs
- IB Schools
- No Excuses Schools
- Charter Schools

STUDENT PROJECTS

- Classroom
- School-Wide
- After School
- Intersession
- Senior
- Capstone
- ELOs
- Internships
- Community Service

The 6 A's of Powerful PBL



1. Academic Rigor
2. Authenticity
3. Applied Learning
4. Active Exploration
5. Adult Connections
6. Assessment Practices

Adria Steinberg – Real Learning Real Work



Vocational Education in the 21st Century

21st Century Teaching and Learning

The 6 Rs

Reading
WRiting
ARithmetic

Rigor
Relevance
Relationship

The 4 Cs

- Critical Thinking
- Communication
- Collaboration
- Creativity

plus Citizenship

Head & Hand

Growth Mindset

- Student-Centered
- Interdisciplinary
- Technology-Infused
- Fully-Inclusive
- Differentiated
- Community Connected
- Problem & Project-Based
- Process & Product Oriented

Top 10 Skills

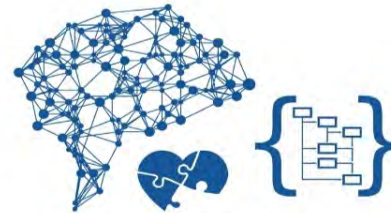
in 2015

1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity



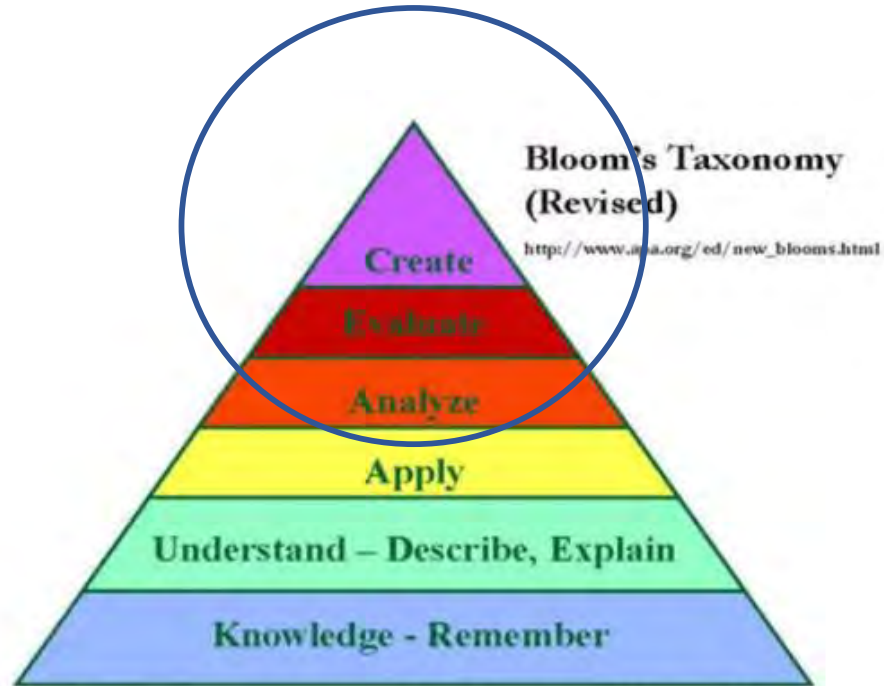
in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility



Source: Future of Jobs Report, World Economic Forum

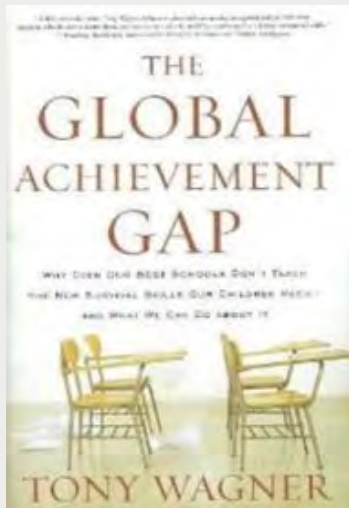
Bloom's Taxonomy (Revised)



Based on an APA adaptation of Anderson, L.W. & Krathwohl, D.R. (Eds.) (2001)

Focus on Doing not Knowing

The world no longer cares about how much you know, the world cares about what you can do with what you know – *Tony Wagner*



- Critical Thinking and Problem Solving
- Communication, oral and written
- Collaboration and Leadership
- Creativity, Curiosity and Imagination
- Accessing and Analyzing Information
- Initiative and Entrepreneurialism
- Agility and Adaptability

Focus on Learning NOT Teaching









- High-performance work environments
- Varied and collaborative
- Lifelong learning



Common Core ELA and Math Shifts

- Complex Text
- Academic Language
- Evidence from Text
- Building Knowledge
- Content-Rich Nonfiction
- Concepts and Skills
- Problem Solving
- Thinking Across Grades
- Conceptual Understanding
- Fluency
- Application

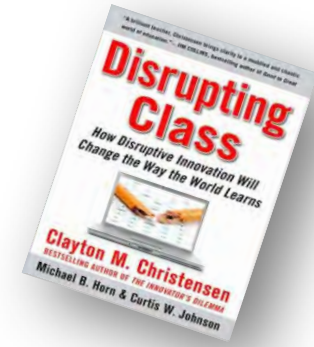
Next Gen Science Standards

Science Practices Next Generation Science Standards	Ask Questions 	Investigate 	Use Math 	Communicate 
	<ul style="list-style-type: none">• What am I observing?• What does this evidence mean?• What is the relationship between these variables?• How can I make my model more accurate?• What evidence do I need to answer my question?• What hypothesis can I state based on my observations?• Is the data used correctly in the argument?	<ul style="list-style-type: none">• Use the Scientific Method.• State the goal of the investigation.• Predict outcomes.• Plan a course of action that will provide the best evidence to support conclusions.• Use scientific ideas to show why data can be considered evidence.• Reduce error in procedures.	<ul style="list-style-type: none">• Use computers to analyze very large data sets for patterns and trends.• Use mathematical representations to support scientific conclusions.• Create algorithms (a series of ordered steps) to solve a problem.• Use digital laboratory tools to observe, measure, record, and process data.• Make quantitative predictions.	<ul style="list-style-type: none">• Be a critical consumer of information about science• Critically read scientific texts to determine the central ideas and obtain scientific information to describe patterns in evidence.• Use multiple sources to obtain information used to evaluate the validity of claims and methods.• Communicate ideas by using tables, diagrams, graphs, models, interactive displays, and equations as well as orally, in writing, and discussion.
	Design a Model 	Analyze Data 	Explain 	Argue 
	<ul style="list-style-type: none">• Models include diagrams, physical replicas, mathematical representations, analogies, and computer simulations.• Models highlight some ideas and simplify others.• Models are used to help find questions and explanations, to get data to predict, and to communicate ideas.• Models are based upon evidence. New evidence, changes the model.	<ul style="list-style-type: none">• Construct and interpret graphical displays of data.• Use computers to tabulate, graphically represent data, visualize, and statistically analyze.• Use math to represent relationships between variables and identify patterns.• Take into account sources of error.• Is one variable the cause (causal), or do both just happen at the same time (correlational)?	<ul style="list-style-type: none">• An explanation includes qualitative or quantitative relationships between variables that predict and describe phenomena.• Design investigations that generate data to determine explanations to questions.• Apply scientific reasoning to show why the data or evidence is adequate for the explanation or claim.• Construct an explanation using models or representations.	<ul style="list-style-type: none">• Argue when investigating a phenomenon, resolving questions about measurements, building data models, and using evidence to evaluate claims.• Arguing happens when listening, comparing, and evaluating competing ideas and methods.• Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions.

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Blended Learning

- Seamless Technology Integration
- Online and Virtual Delivery
- Production of Technology and Information



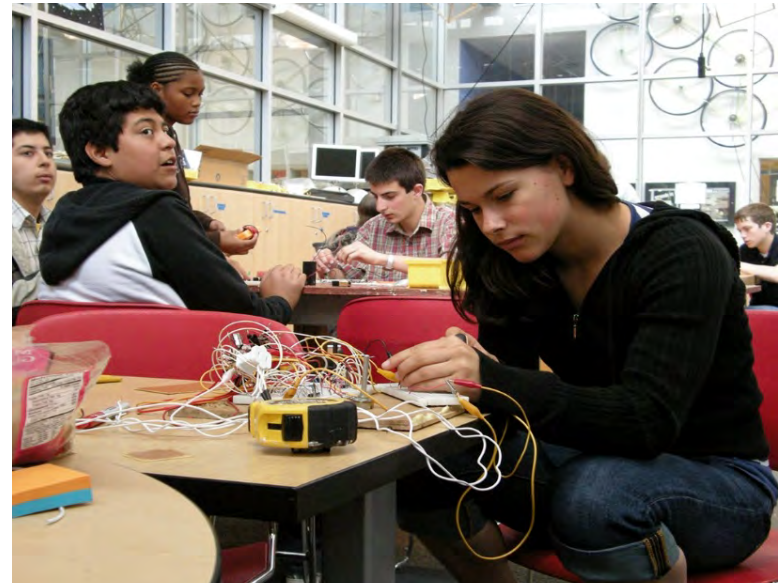
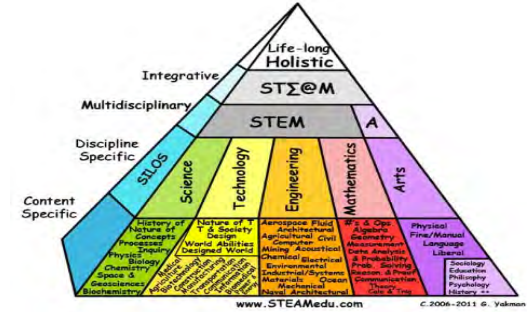
Differentiated Instruction

- Full Inclusion
- Personalization
- Self-Paced and Small Group
- Anywhere, anytime learning



STEM and STEAM

- STEM as meta-discipline
- Art and Humanities as Glue
- Design Thinking Process



Head and Hand

- Project and Problem-Based Learning
- Heads On Vocational, Hands-On Academics Authentic and Community Contexts for Learning



Design/Engineering Thinking

- Maker Movement
- Academic Tech Integration
- Art Integration
- Problem Solving



Community Partnerships

- Permeable School Walls
- Adult-World Connections / Internships
- Leveraged Resources



Future Ready Schools Activity



Integrated CTE Model



ESSEX TECHNICAL
HIGH SCHOOL

21%
AP Classes

1200
APPLICANTS FOR 360 SEATS
ESSEX TECHNICAL
HIGH SCHOOL

78%
ONTO POST-SECONDARY
EDUCATION



99%
GRADUATION
RATE

1
A LEVEL SCHOOL

19%
Into Workforce

Admission is based on grades, attendance, conduct, counselor recommendation and an interview. It is blind to income and any special needs



**NEW AGRICULTURAL & TECHNICAL HIGH SCHOOL
MERGED PROGRAMS FROM 3 SCHOOLS**

**SERVES 17 NORTH SHORE COMMUNITIES
1440 STUDENTS, GRADES 9-12
23 CAREER TRACKS**

**165 ACRE SITE
328,000 GSF (+42,000 GSF FARMSTEAD)
228 GSF/STUDENT (NOT INCLUDING FARMSTEAD)**

**\$293/SF (NOT INCLUDING FARMSTEAD)
\$104,900,000 CONSTRUCTION COST
\$133,770,000 TOTAL PROJECT COST (BUDGET)**

CONSTRUCTION JUNE 2012 - SEPTEMBER 2014

COMPARISON OF PROGRAM CHARACTERISTICS AND INITIATIVES



Essex Aggie

North Shore Tech



1. **CTE SCHOOL w/ Ag.**
(authentic/relevant)
2. **Hands-On Learning & Interdisciplinary**
(collaboration)
3. **Flexib./Adaptability**
(varied instruction)
4. **Small Communities, Large School Pride**
(identity/belonging & relationship bldg)
5. **Community & Real World Connections**



- A. Animal & Plant Science
- B. Technology & Services
- C. Community/Active Core
- D. Life & Natural Sciences
- E. Construction Technology
- F. Equine Barn
- G. Maintenance Garage
- H. Press Box/Bleachers
- I. Storage Building
- J. Concessions
- K. Team Rooms
- L. Livestock Barn
- M. Small Engine Repair
- N. Riding Arena
- O. Hay Barn
- P. Landscape Equipment
- Q. Animal Science
- R. Farm Stand
- S. Central Administration



EE

CC

BB

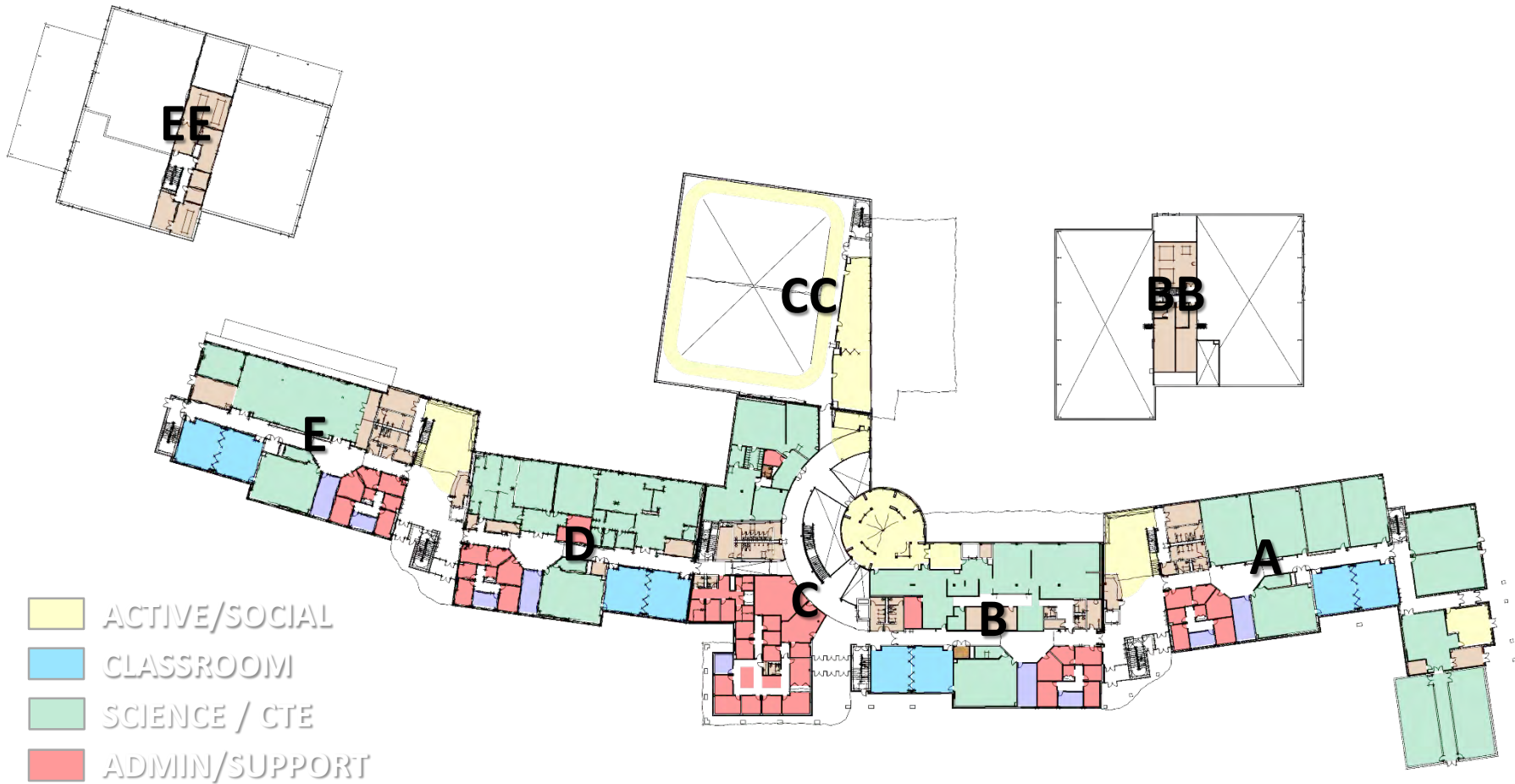
E

D

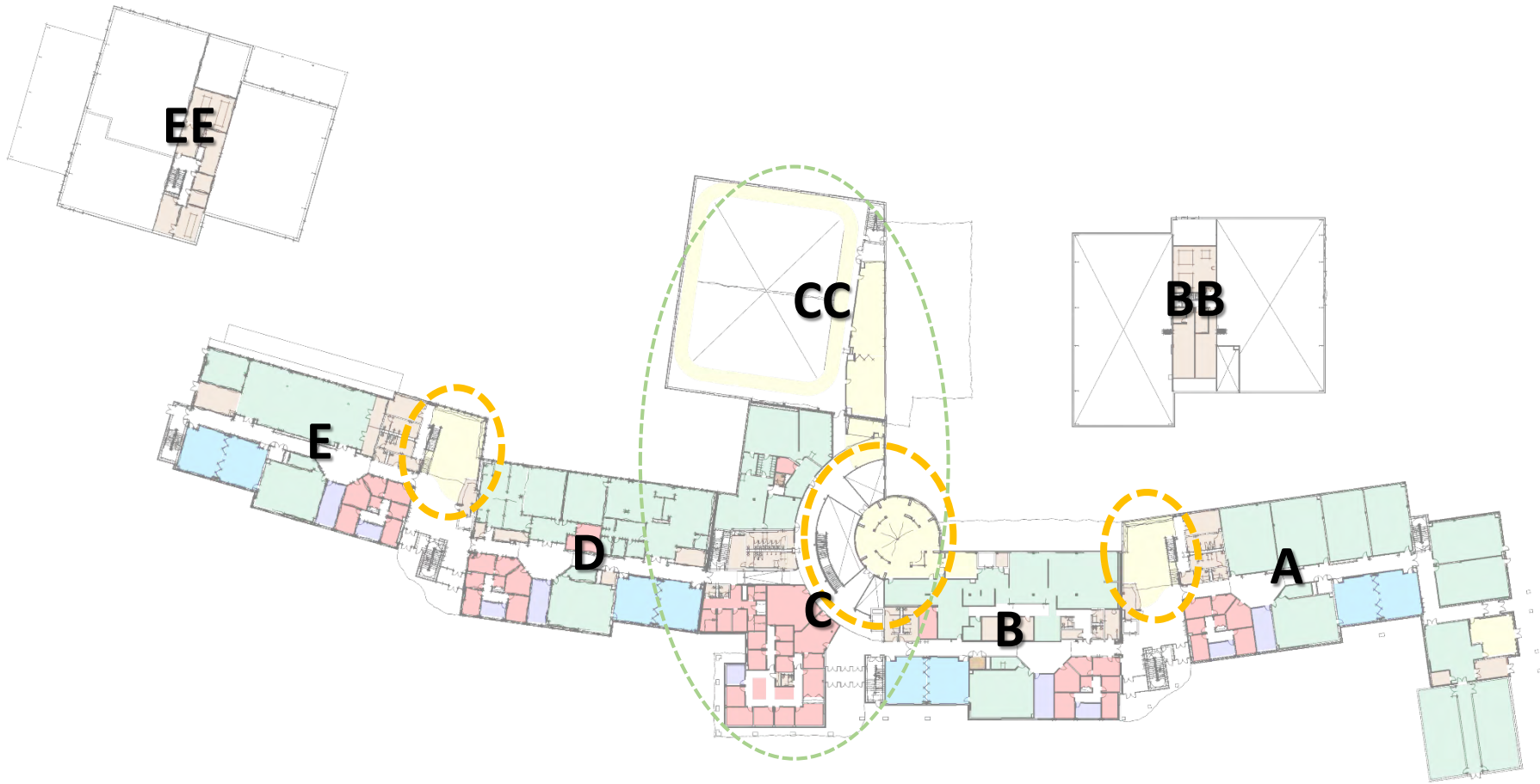
C

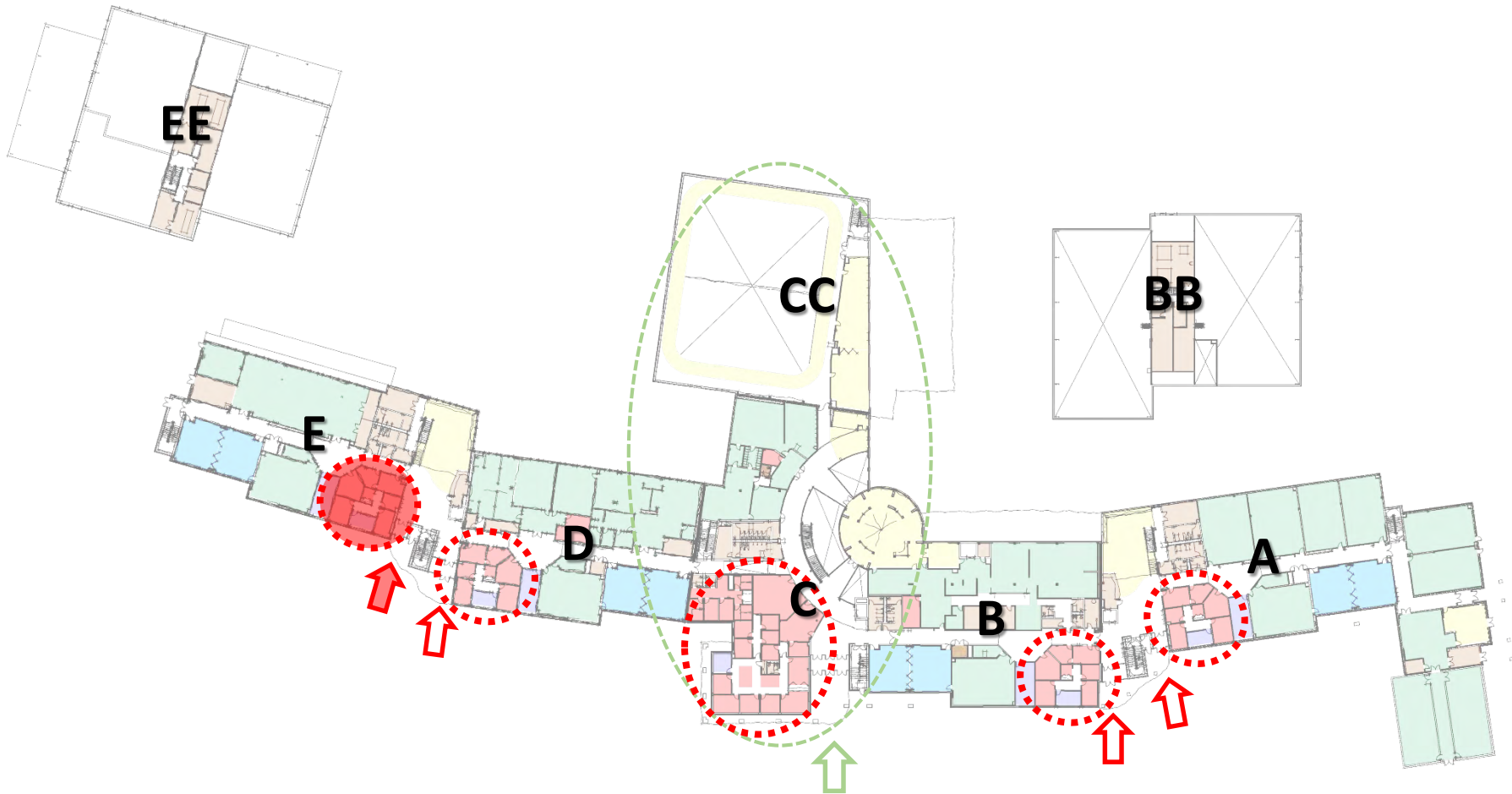
B

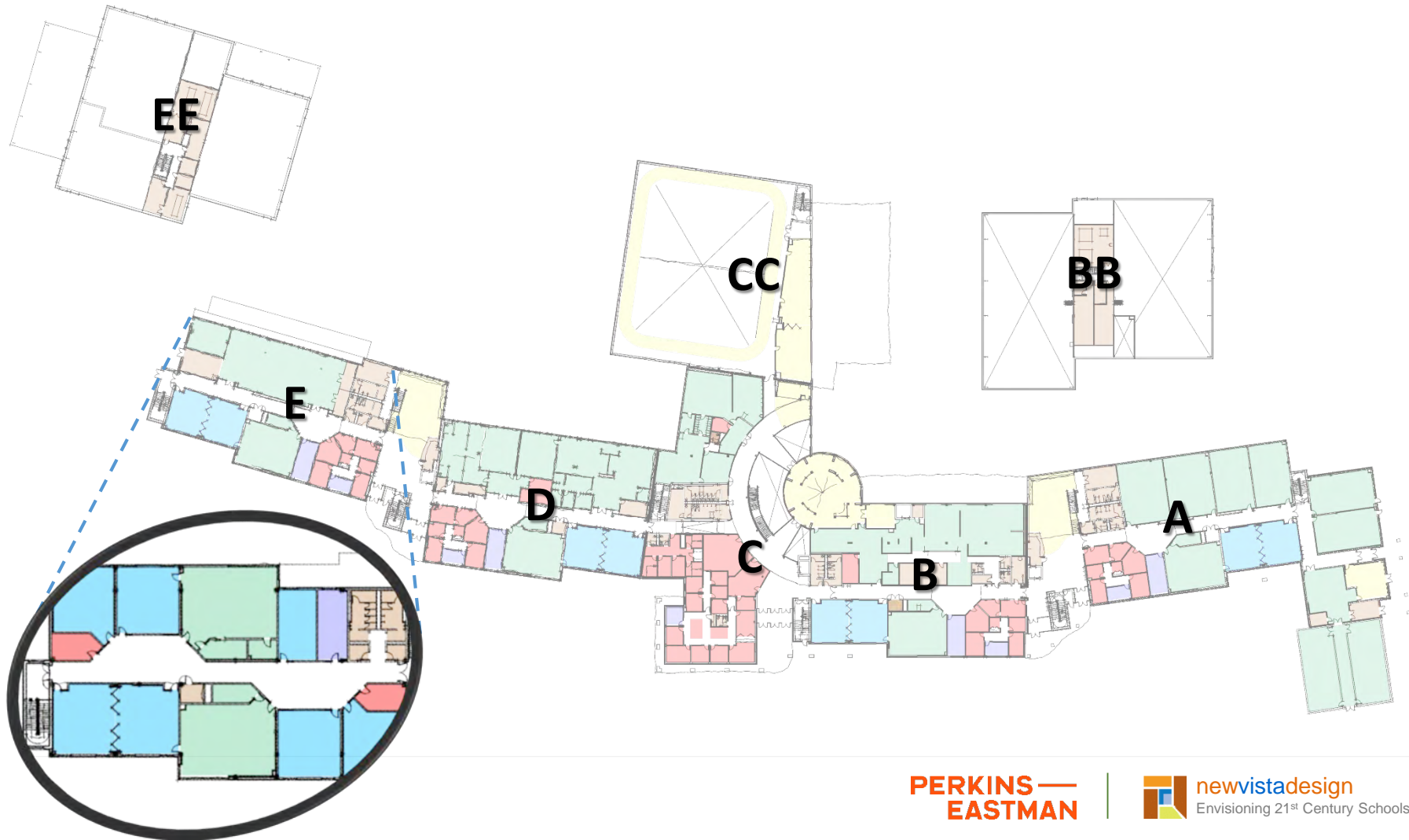
A

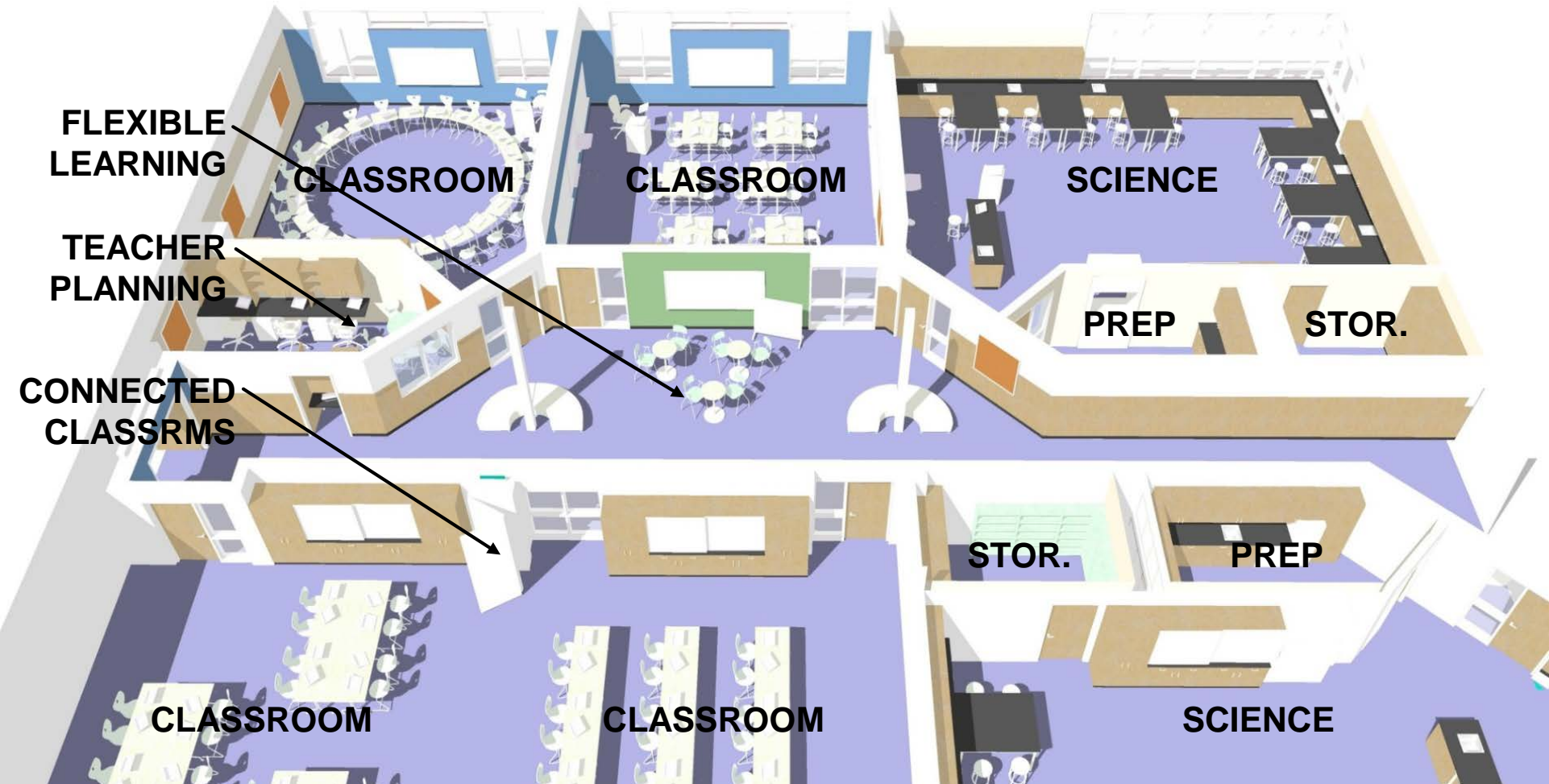


- ACTIVE/SOCIAL
- CLASSROOM
- SCIENCE / CTE
- ADMIN/SUPPORT









**FLEXIBLE
LEARNING**

CLASSROOM

CLASSROOM

SCIENCE

**TEACHER
PLANNING**

PREP

STOR.

**CONNECTED
CLASSRMS**

STOR.

PREP

CLASSROOM

CLASSROOM

SCIENCE

HIGH PERFORMANCE/GREEN ENVIRONMENT

- Super-insulated cavity
- High efficiency systems
- High efficiency MEP systems
- Quality IAQ/ventilation (displaced)
- Daylight/occupancy sensors
- Enhanced daylight & indirect lighting
- High acoustics
- Durable/low-maintenance

OCCUPANT COMFORT/CONTROL

- Operable windows & ceiling fans
- In-room thermostat
- Multiple switching/light levels

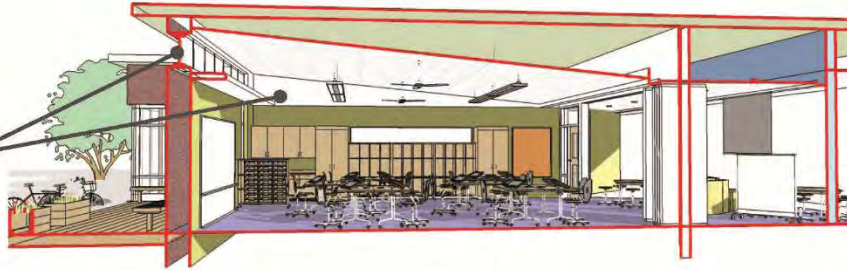
FLEXIBILITY/COLLABORATION

- Dispersed teaching walls
- Good visibility/connected clusters
- Break-out (flexible space)
- Adjacent to planning rooms
- Operable wall (large group)

UBIQUITOUS TECHNOLOGY

- Interactive display and resources
- Wireless environment
- 1 on 1 computing
- Distance learning capable

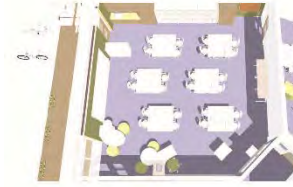
MOBILE/ADJUSTABLE FURNISHINGS
(inc. storage)



CLASSROOM SECTION



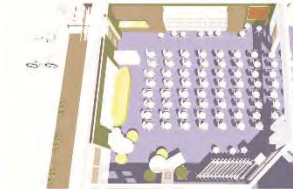
CLASSROOM PERSPECTIVE



Small Groupings



Medium Groupings



Large Groupings



Lecture Arrangement



Project Arrangement



Debate Arrangement



OVERHEAD SERVICES



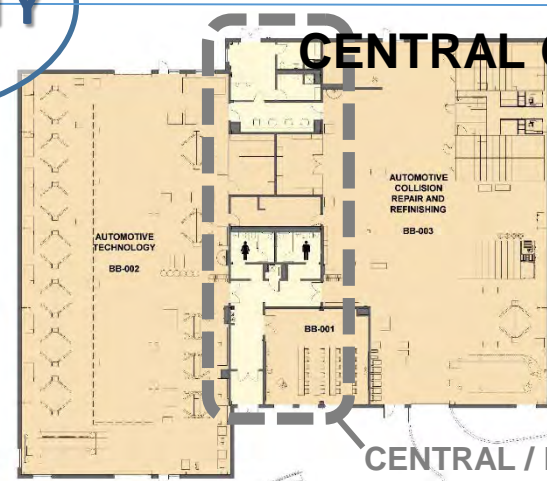
PLUG/PLAY SURROUND

FLEXIBILITY

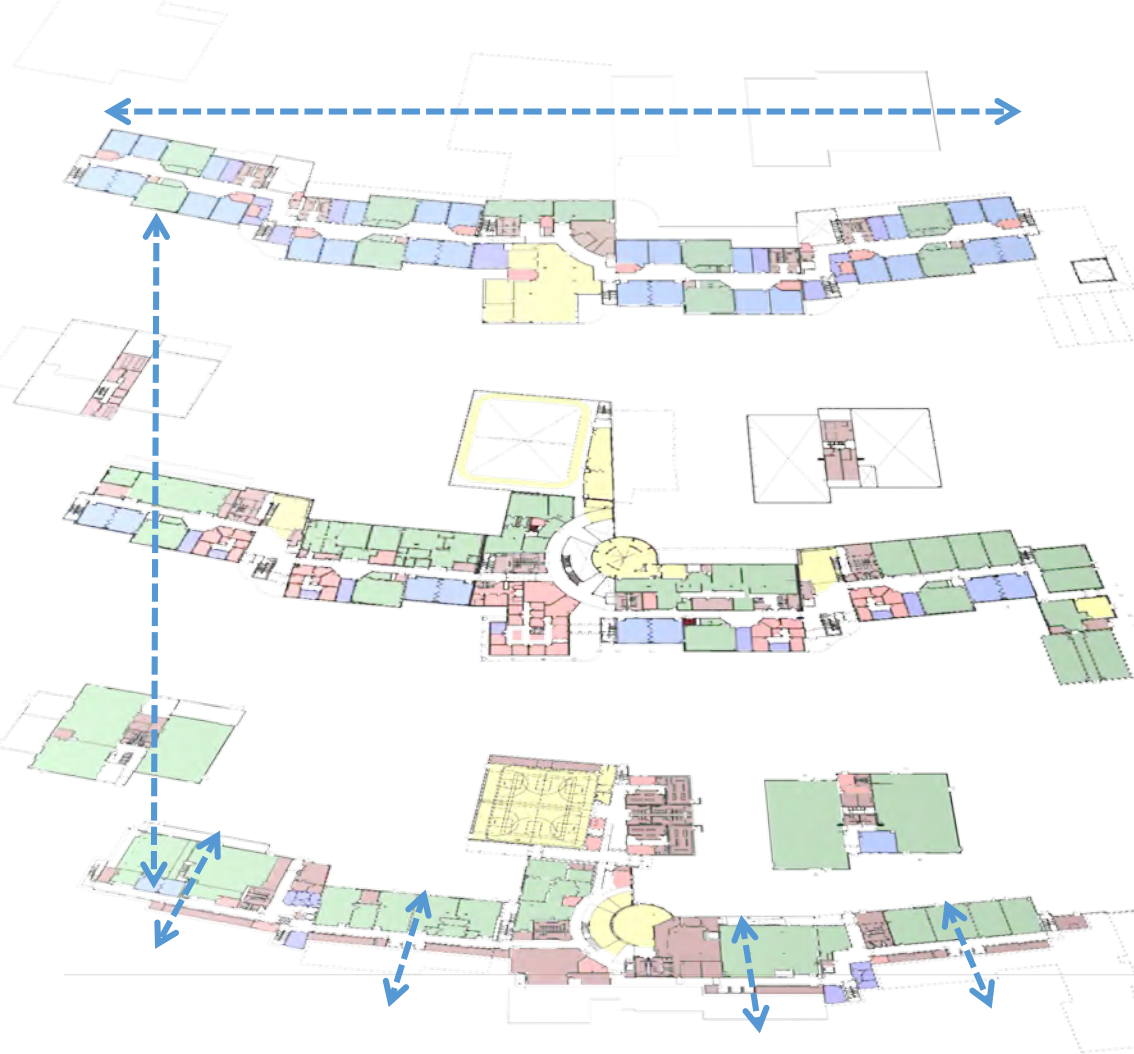


DEMOUNTABLE WALLS

CENTRAL CORE



CENTRAL / FIXED SPINE



Horizontal Stacking

- Lower Level - High Bay Labs
- Main Level - Mid Height Labs
- Upper Level - Labs/Academics

Vertical Organization

- (4) Academy Structure
- Academic/Career Integration

Front to Back

- Stacked/Fixed Academy Fronts
- Program Push/Pull Flexibility in Back
- 3-Grade Construction Types

Design Patterns

Collaboration

Planning
Knowing
Creating



 **newvistadesign**
envisioning 21st century schools & more

Ubiquitous Technology



Cloud
Computing
Tablets
1:1 Ratio



 **newvistadesign**
envisioning 21st century schools & more

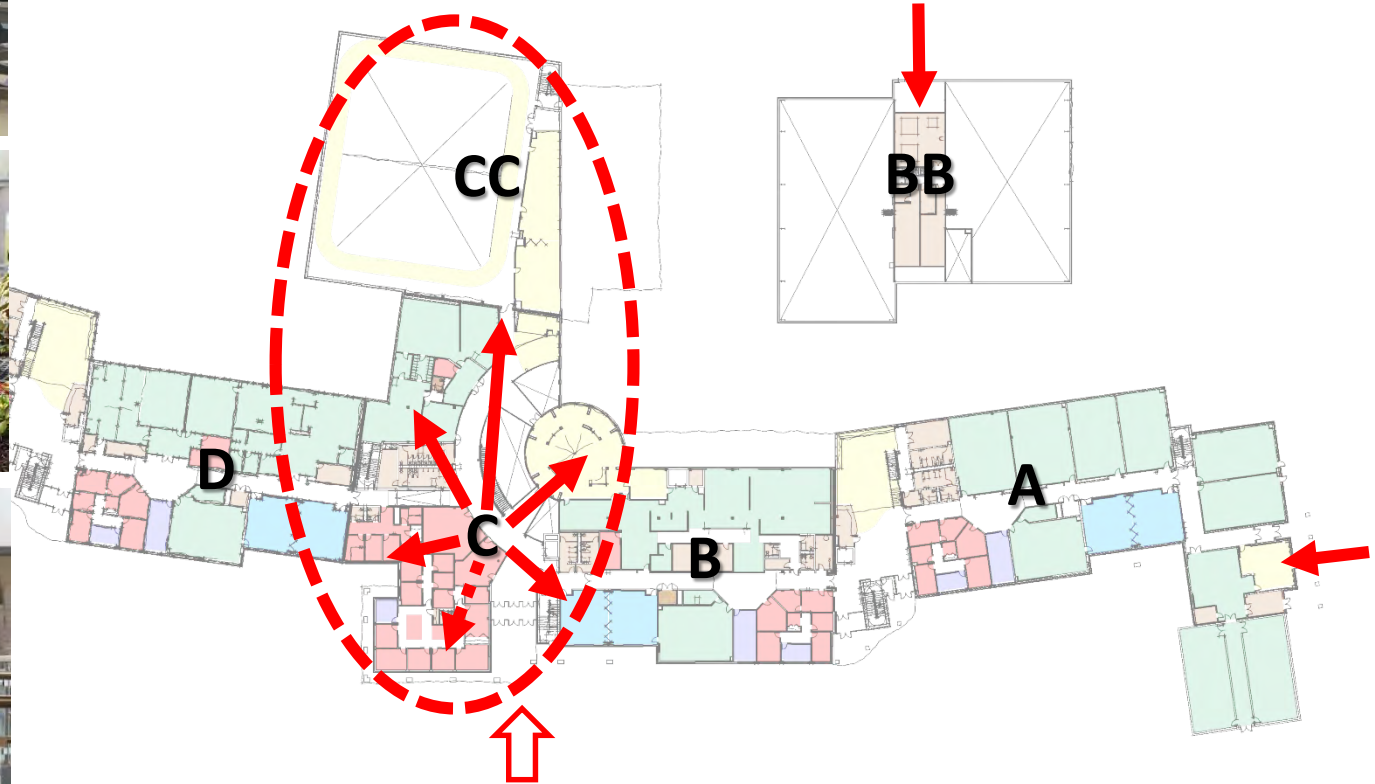
WELCOMING ARRIVAL / A PLACE TO GATHER



WARM GREETING / GATE KEEPING



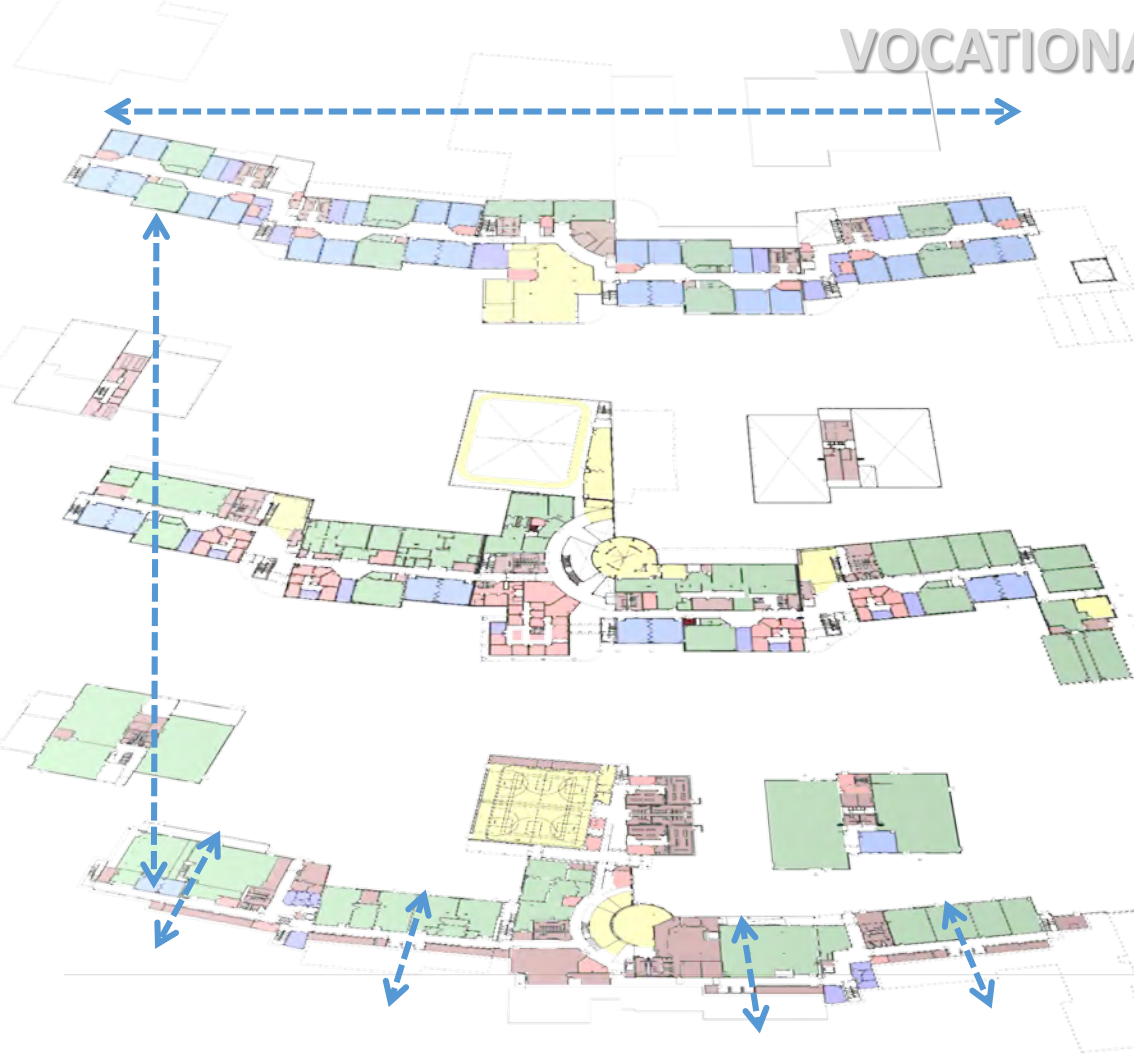
ZONED FOR COMMUNITY USE & ACCESS



HEART OF THE SCHOOL



VOCATIONAL / ACADEMIC ADJACENCIES



Horizontal Stacking

- Lower Level - High Bay Labs
- Main Level - Mid Height Labs
- Upper Level - Labs/Academics

Vertical Organization

- (4) Academy Structure
- Academic/Career Integration

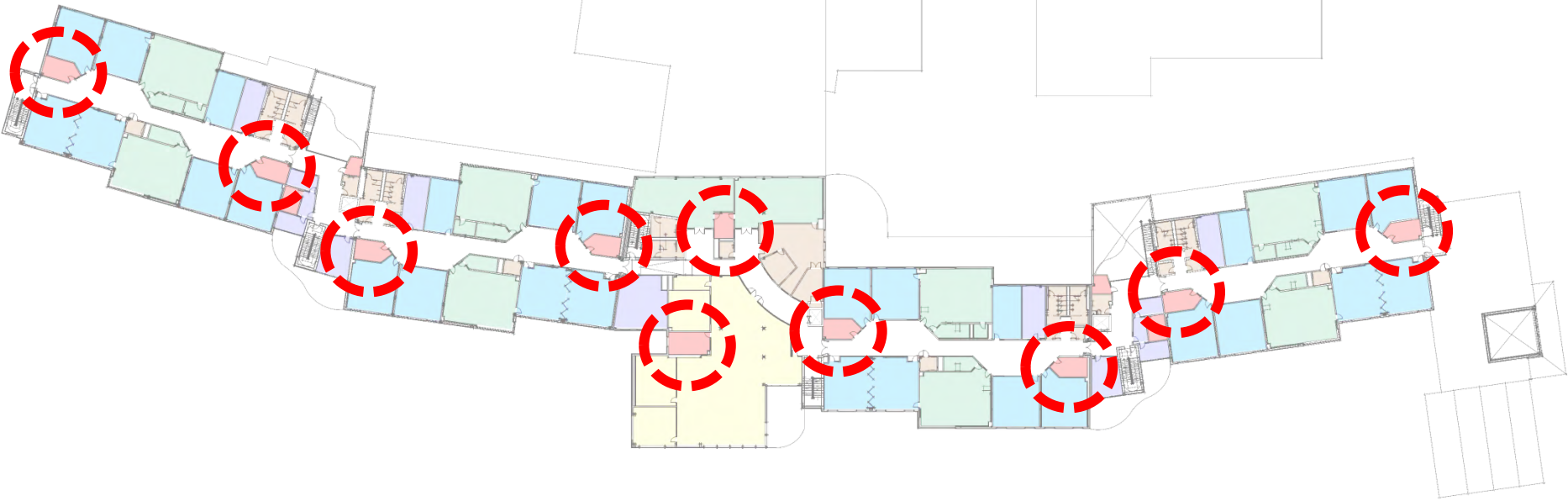
Front to Back

- Stacked/Fixed Academy Fronts
- Program Push/Pull Flexibility in Back
- 3-Grade Construction Types



DISTRIBUTED DINING

DISPERSED RESOURCES & EYES ON THE STREET



ACADEMIC NEIGHBORHOODS / CLUSTERS



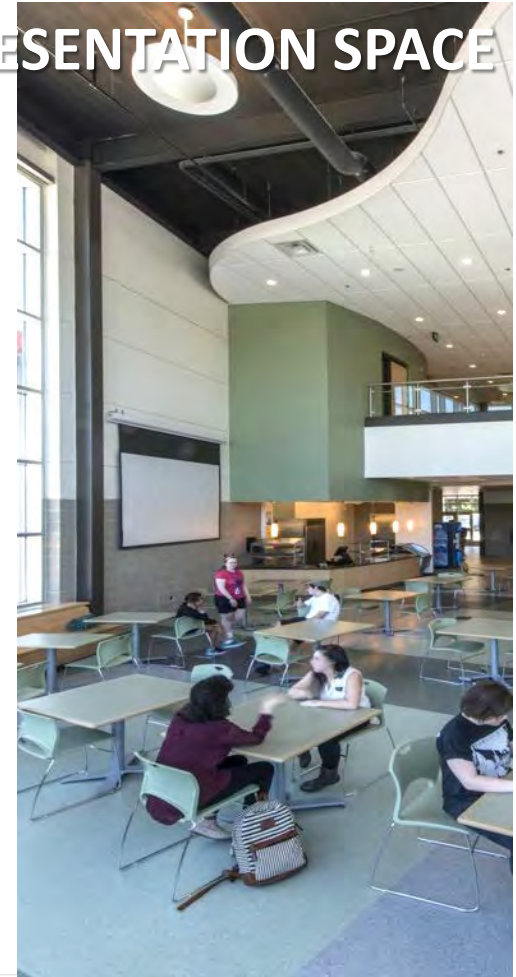


VARIED SPACES

MEDIA CENTER AS LEARNING COMMONS



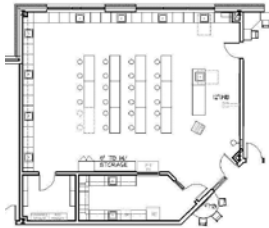
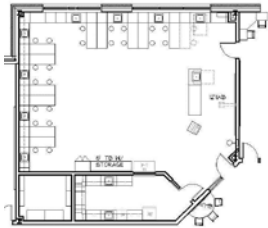
INFORMAL LEARNING & PRESENTATION SPACE



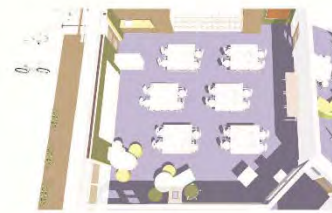
EXTENDED LEARNING BEYOND THE CLASSROOM



FLEXIBLE / ADAPTABLE CLASSROOMS



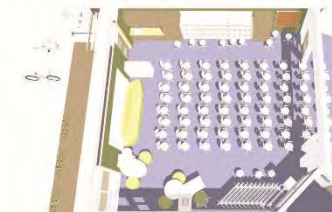
ADJUSTABLE / MODULAR FURNITURE



Small Groupings



Medium Groupings



Large Groupings



Lecture Arrangement



Project Arrangement



Debate Arrangement



SEAMLESS TECHNOLOGY



OUTDOOR CONNECTIONS



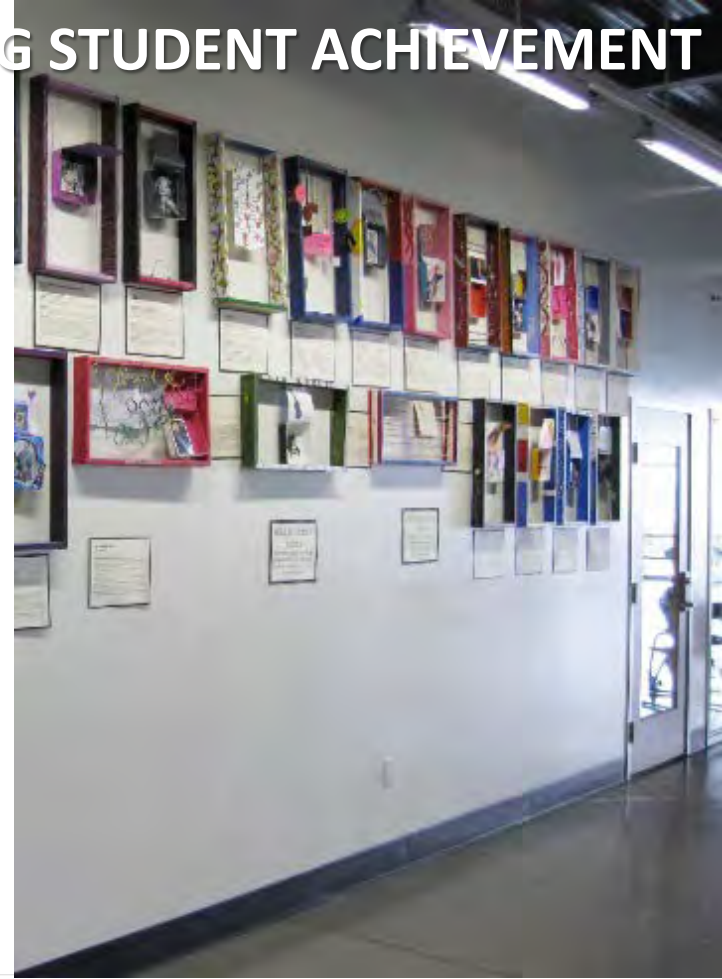
SCHOOL AS TEACHING TOOL



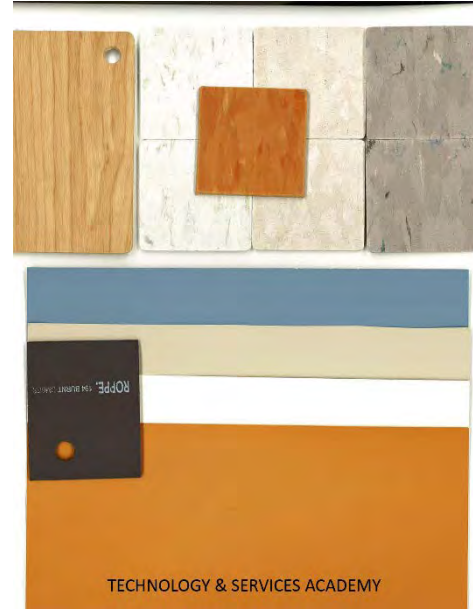
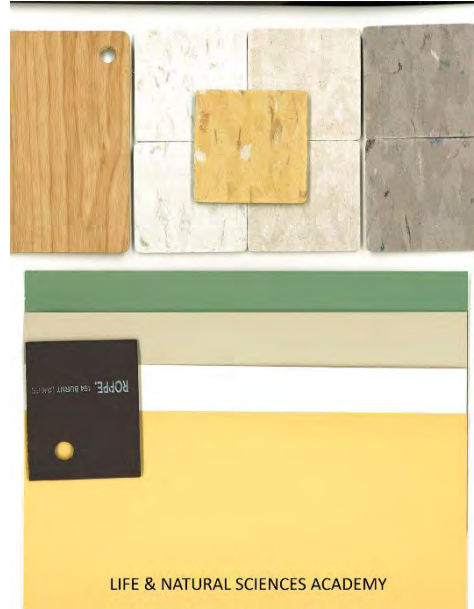
TRANSPARENCY / LEARNING ON DISPLAY



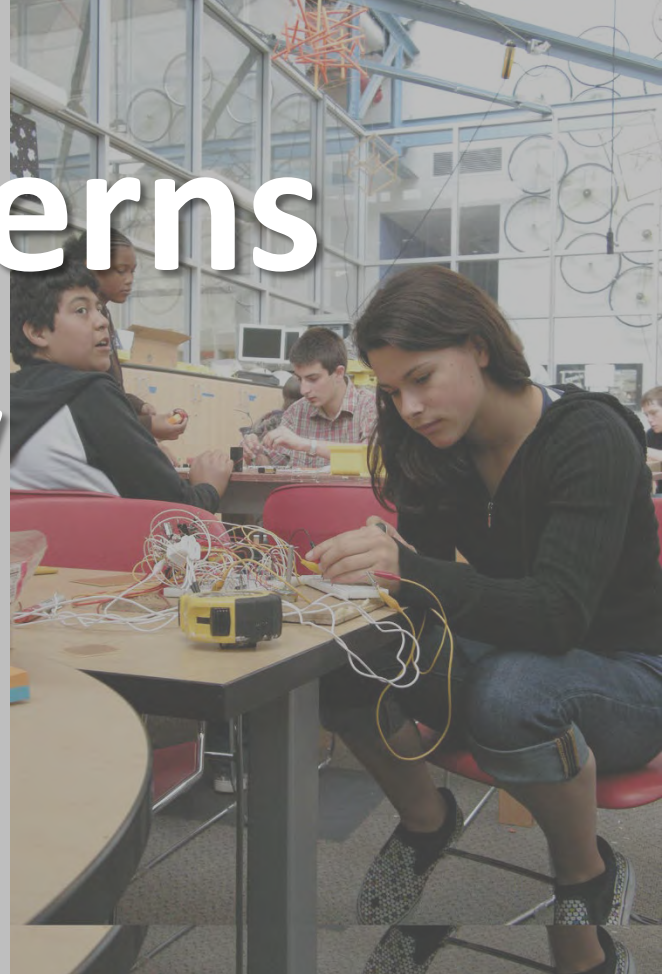
DISPLAY & CELEBRATING STUDENT ACHIEVEMENT



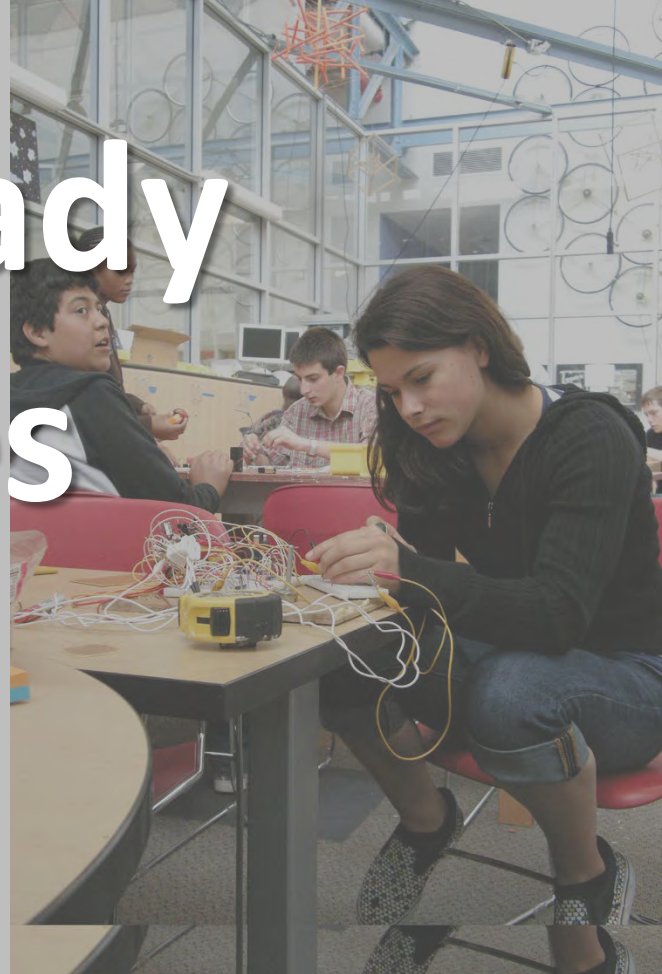
BRANDING & IDENTITY



Design Patterns Activity



Future Ready Examples

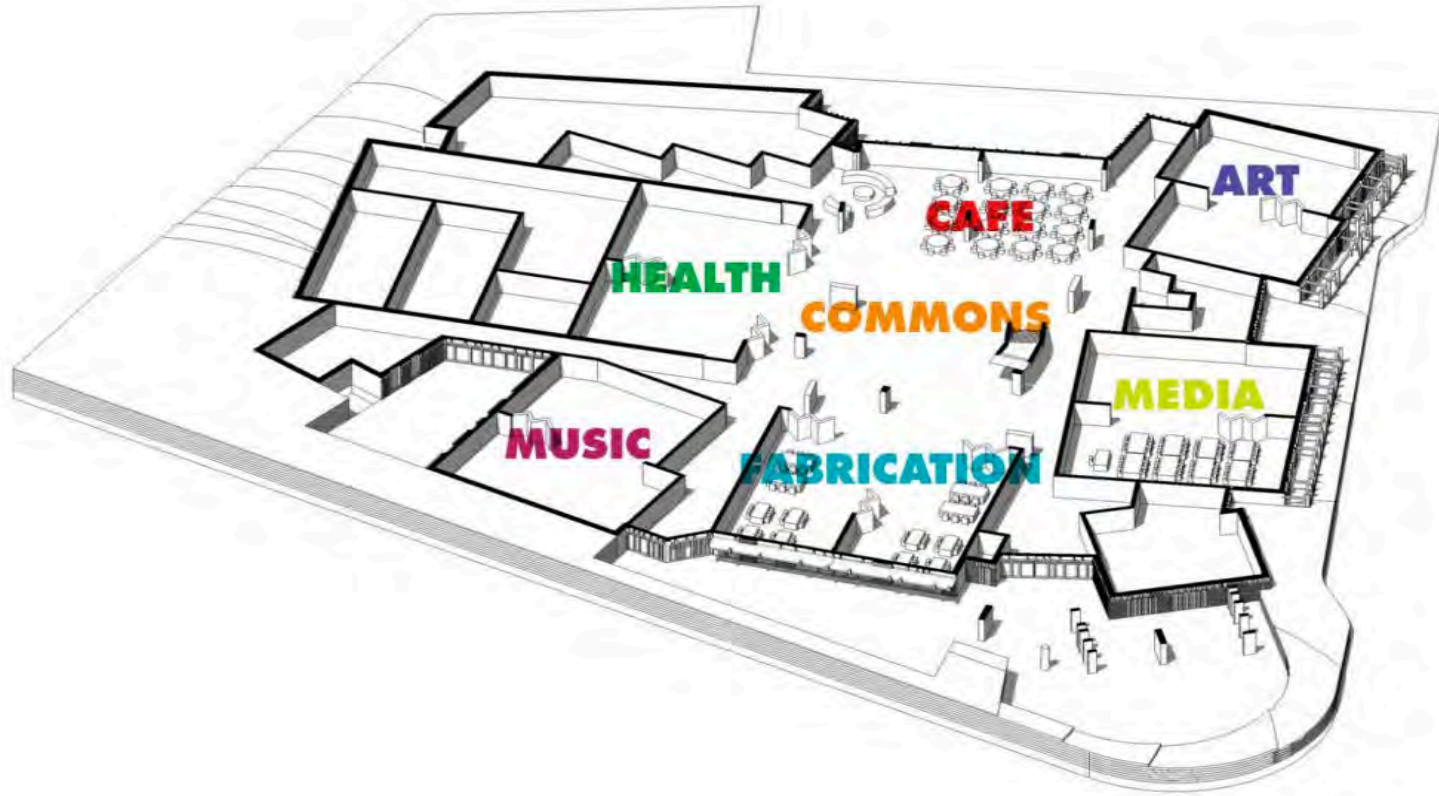


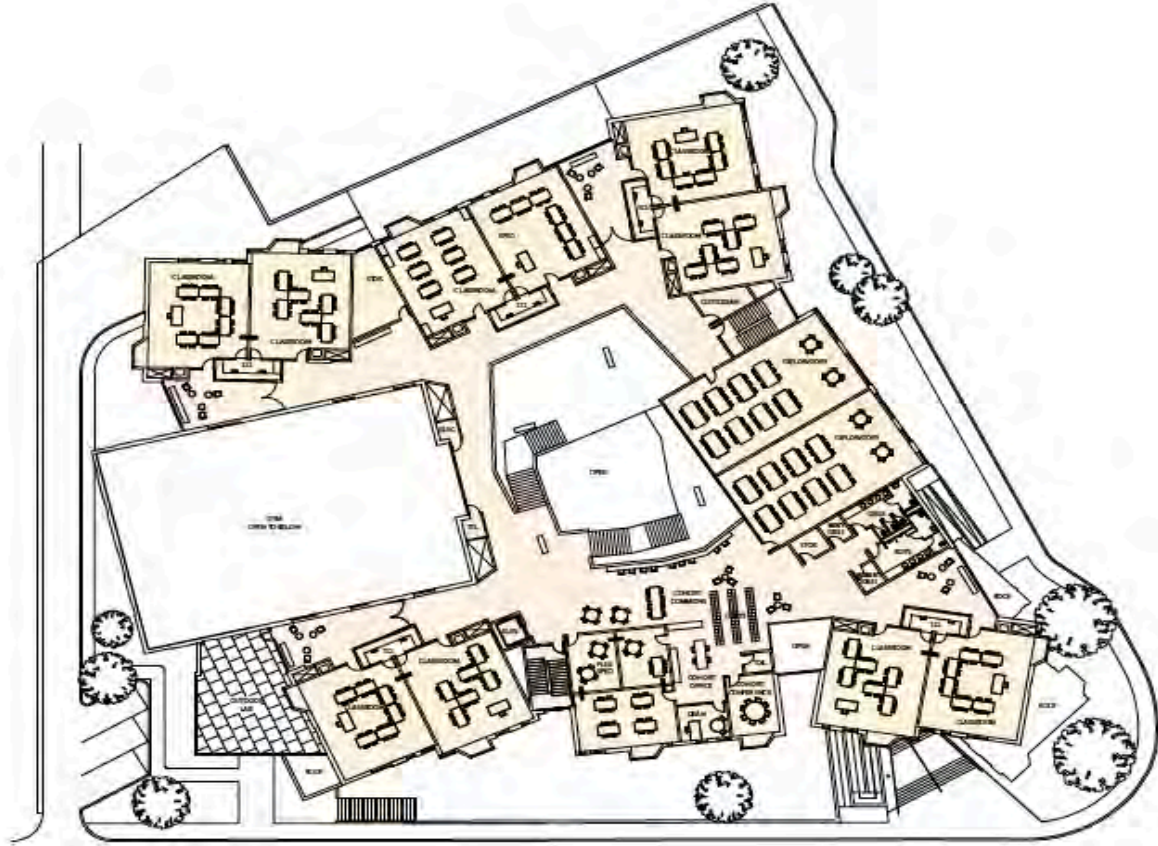
DEARBORN EARLY COLLEGE STEM ACADEMY

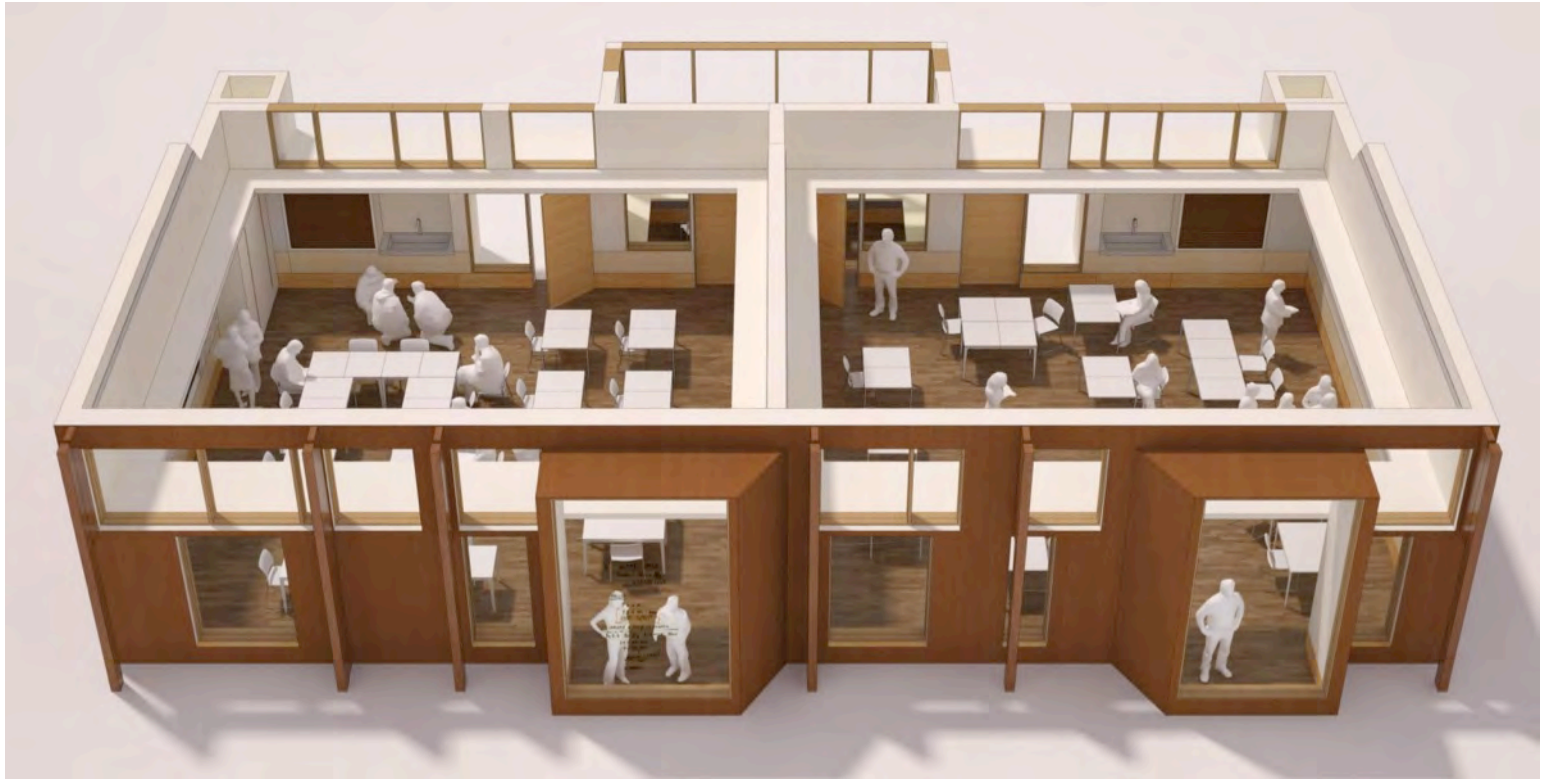


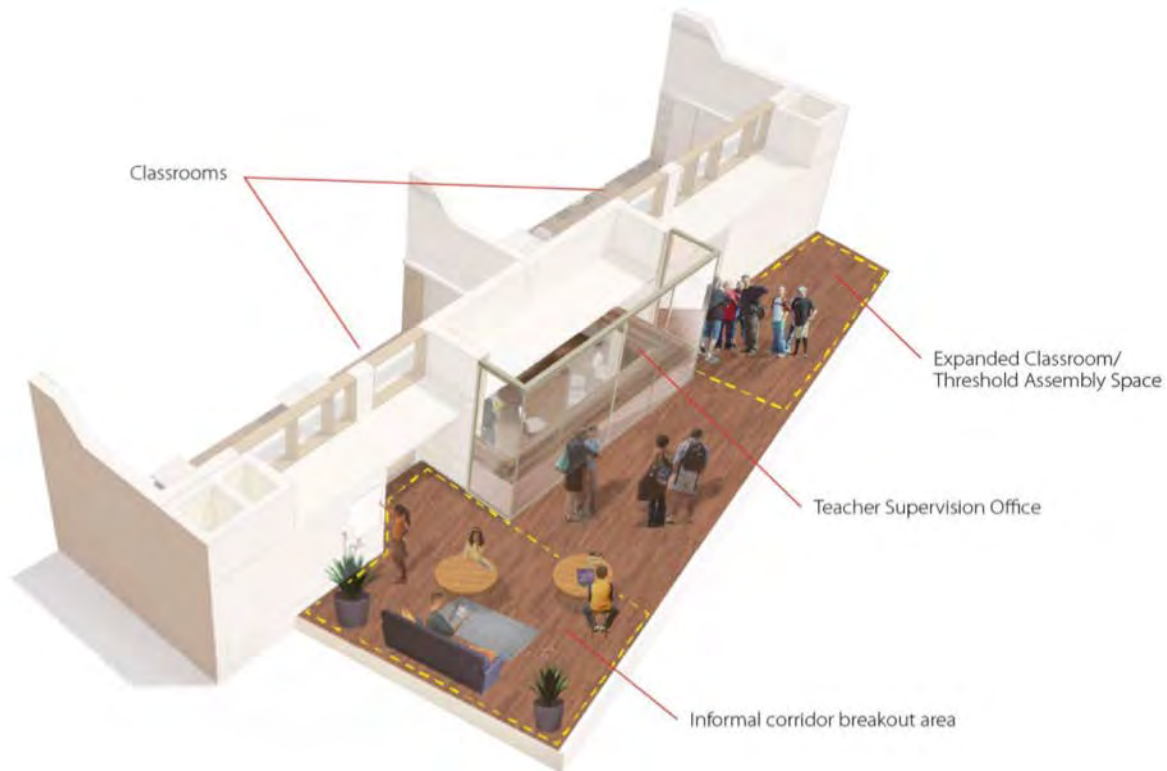
1. Mastery-Based Learning
2. Trans-disciplinary Instruction
3. Design-Focused
4. Personalized
5. Community











Classrooms

Expanded Classroom/
Threshold Assembly Space

Teacher Supervision Office

Informal corridor breakout area

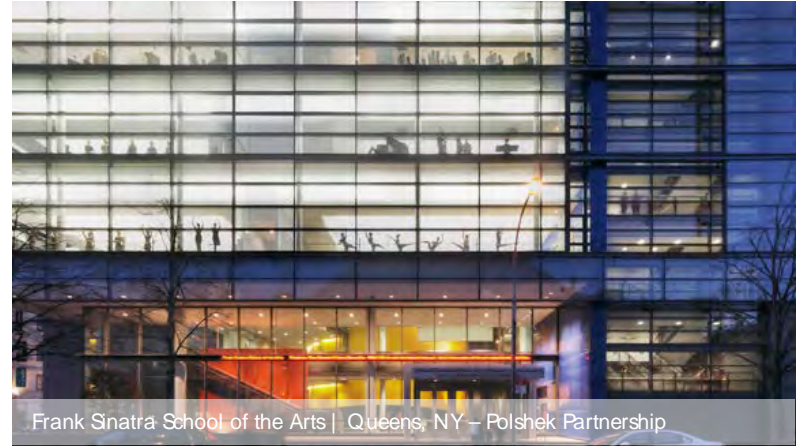
"by varying the width of the interior space framed between the classrooms, which would traditionally be conceived of as simply corridors, the spaces are transformed into educational environments by creating unique breakout areas"



BOSTON ARTS ACADEMY

GUIDING DESIGN PRINCIPLES

- A Beacon for the Community
- Express Interconnected Nature of the Program
- A Place for Expression and Ideas (process and creation celebrated)
- Heart of the School
- School as Teaching Tool
- Offer Glimpses of Artists Evolving and Opportunities for Revealing Work Thru Performance Display





Google

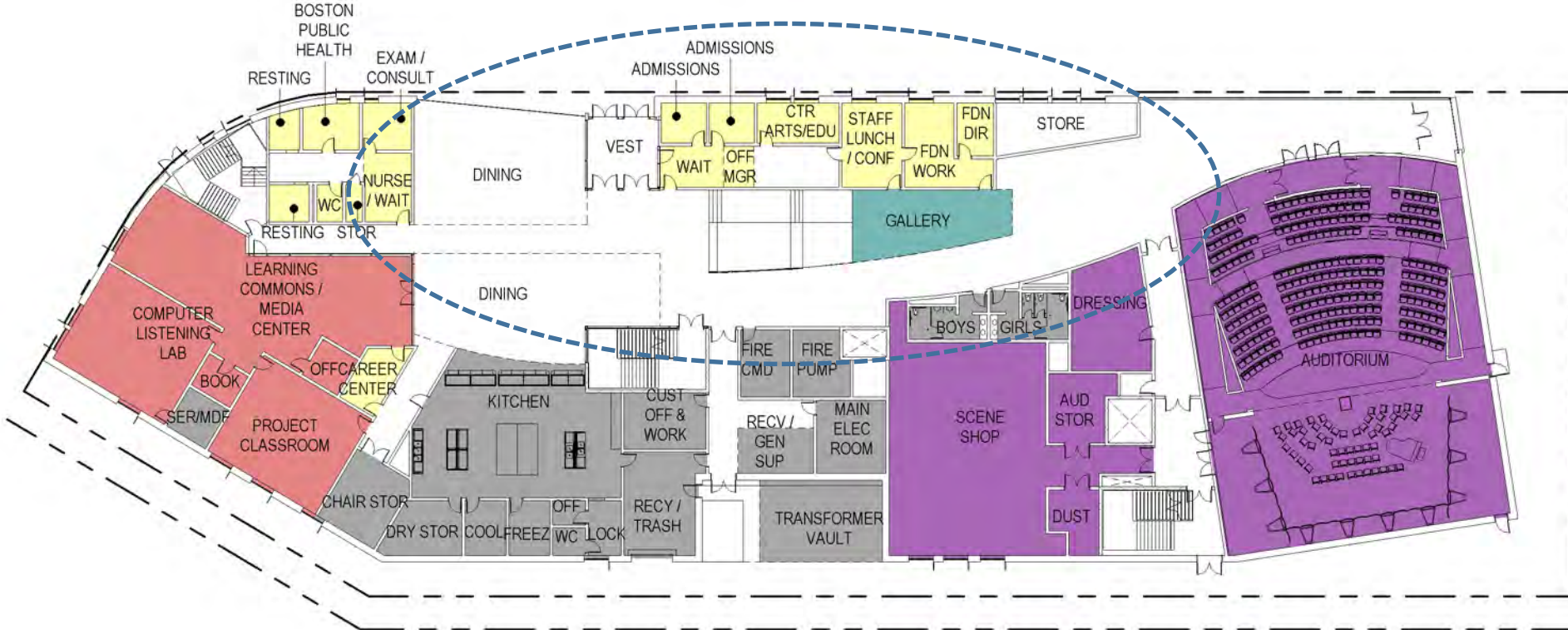
**PERKINS —
EASTMAN**



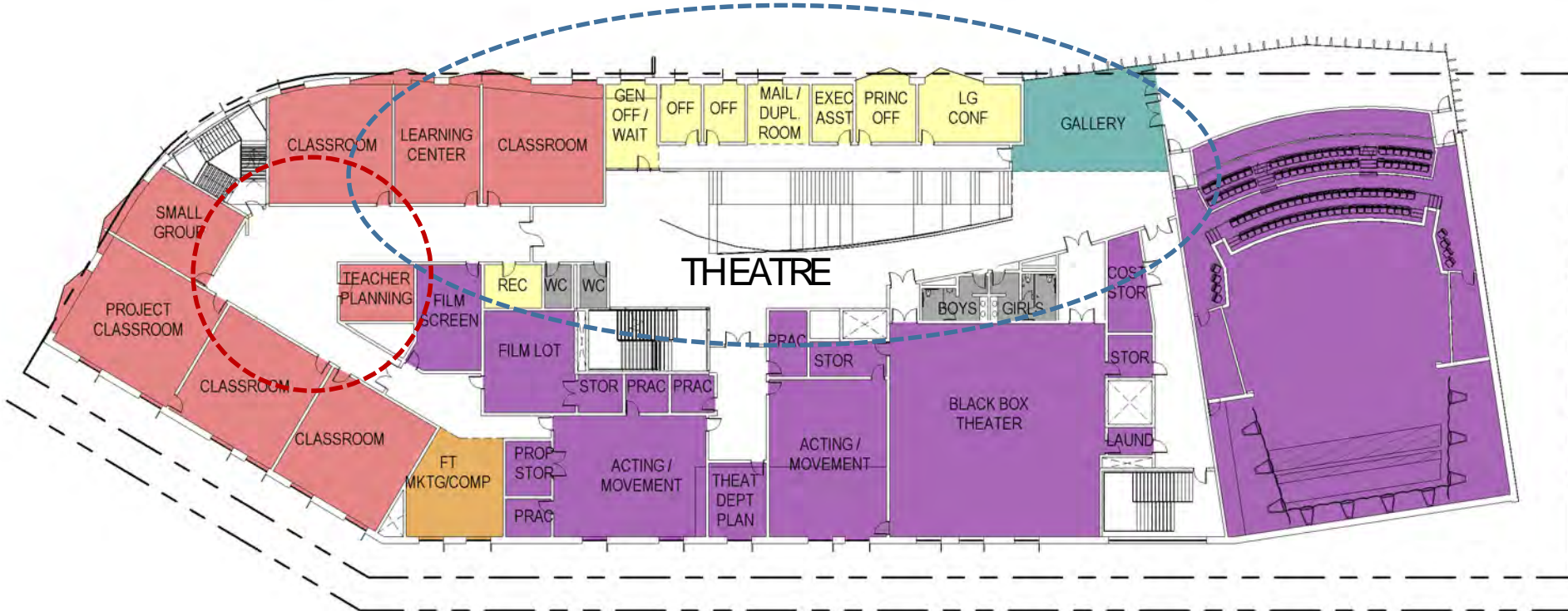
newvistadesign
Envisioning 21st Century Schools



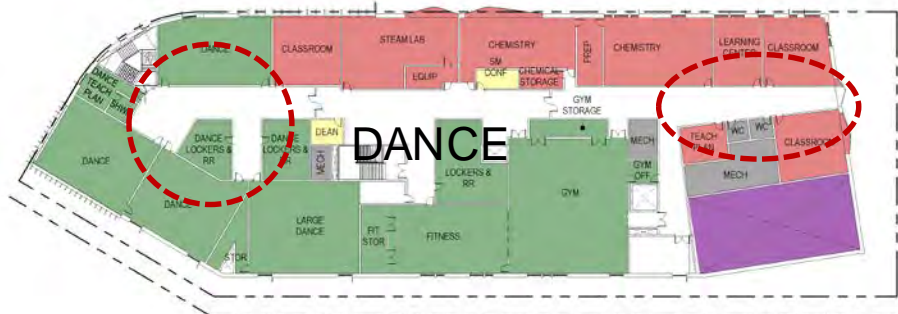
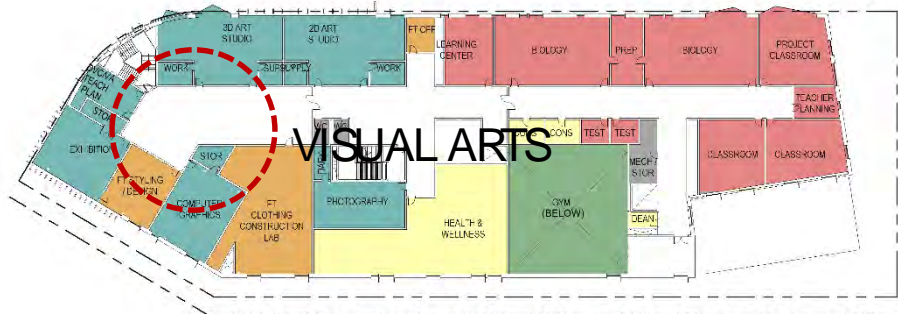
LEVEL 1



LEVEL 2



LEVEL 3-5







ORACLE DESIGN TECH HIGH SCHOOL

Guiding Principals

1. Explore, Create, Learn
2. Extreme Personalization
3. Real World Education
4. Flexibility and Adaptability
5. Empathic Engagement
6. Technology Integration
7. Keep it Fun and Engaging



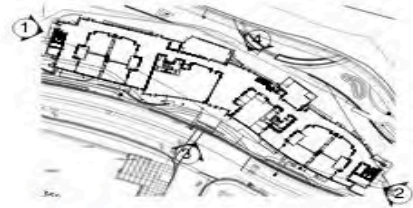




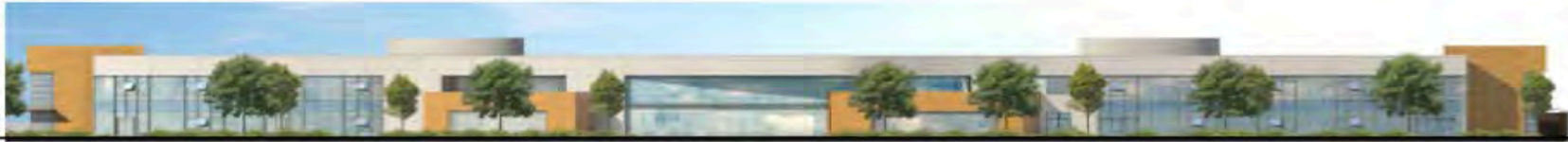
1. WEST FACADE



2. EAST FACADE



3. SOUTH FACADE ALONG ORACLE PARKWAY



4. NORTH FACADE - BELMONT SLOUGH SIDE

Next file >



DES
ARCHITECTS
ENGINEERS

With New
Vista Design

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ARCHITECTS
ENGINEERS

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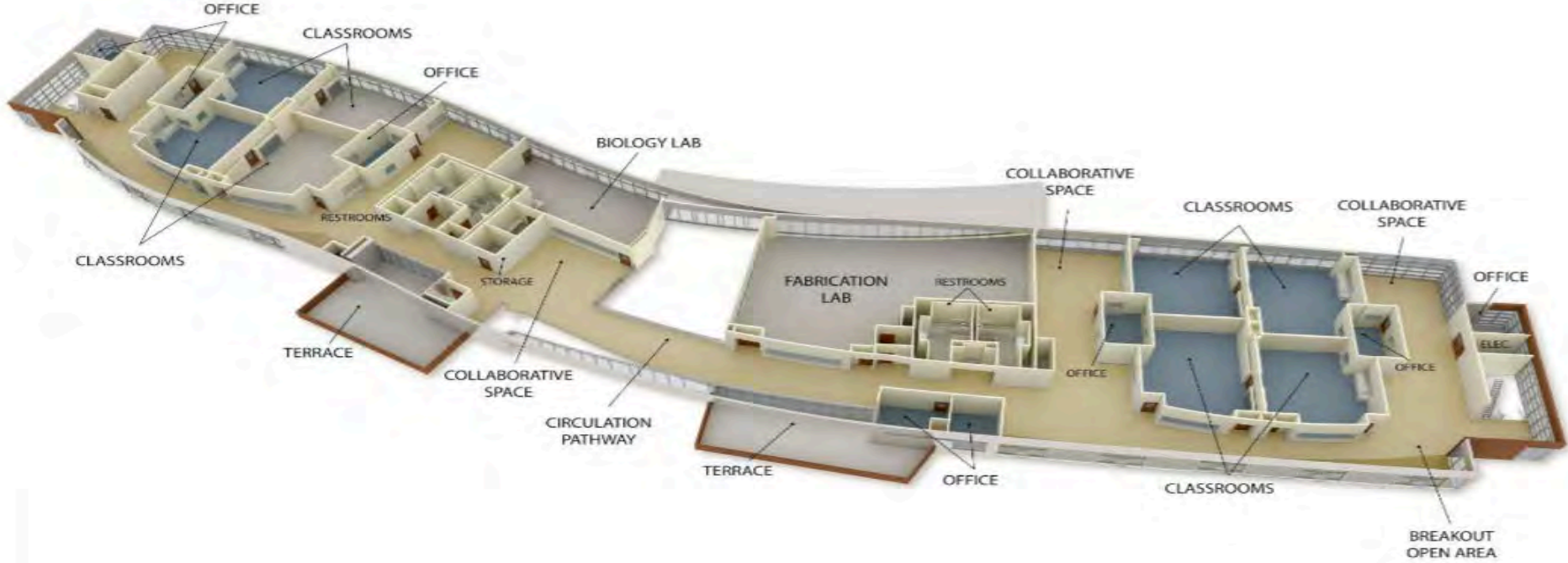
DES
ARCHITECTS
ENGINEERS

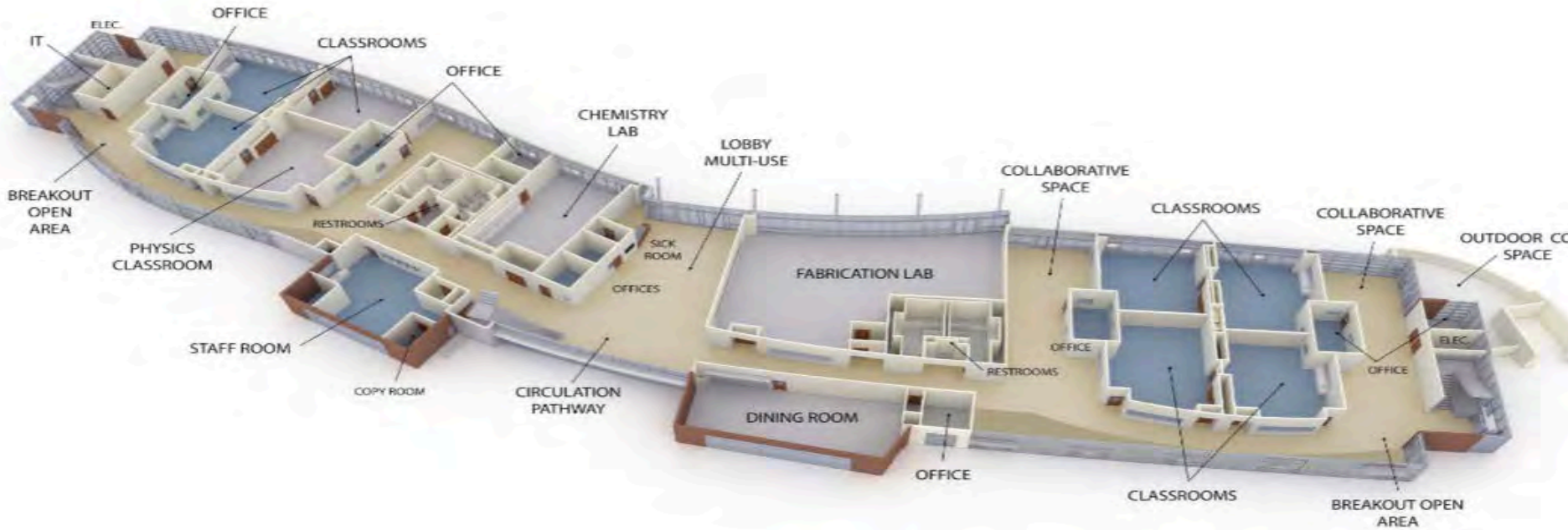
With New
Vista Design

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WISEBURN HIGH SCHOOL

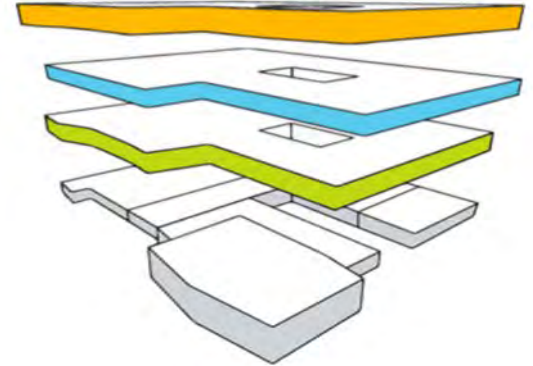
1. Personalization
2. Autonomy, Community and Synergy
3. Small Learning Neighborhoods
4. Flexibility and Utility
5. Community Access
6. Transparency
7. Outdoor Connectivity





THREE IN ONE

Wiseburn's collocated programs share an atrium and common-use facilities.



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WISEBURN HIGH SCHOOL
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INTERIOR SECTIONAL PERSPECTIVE

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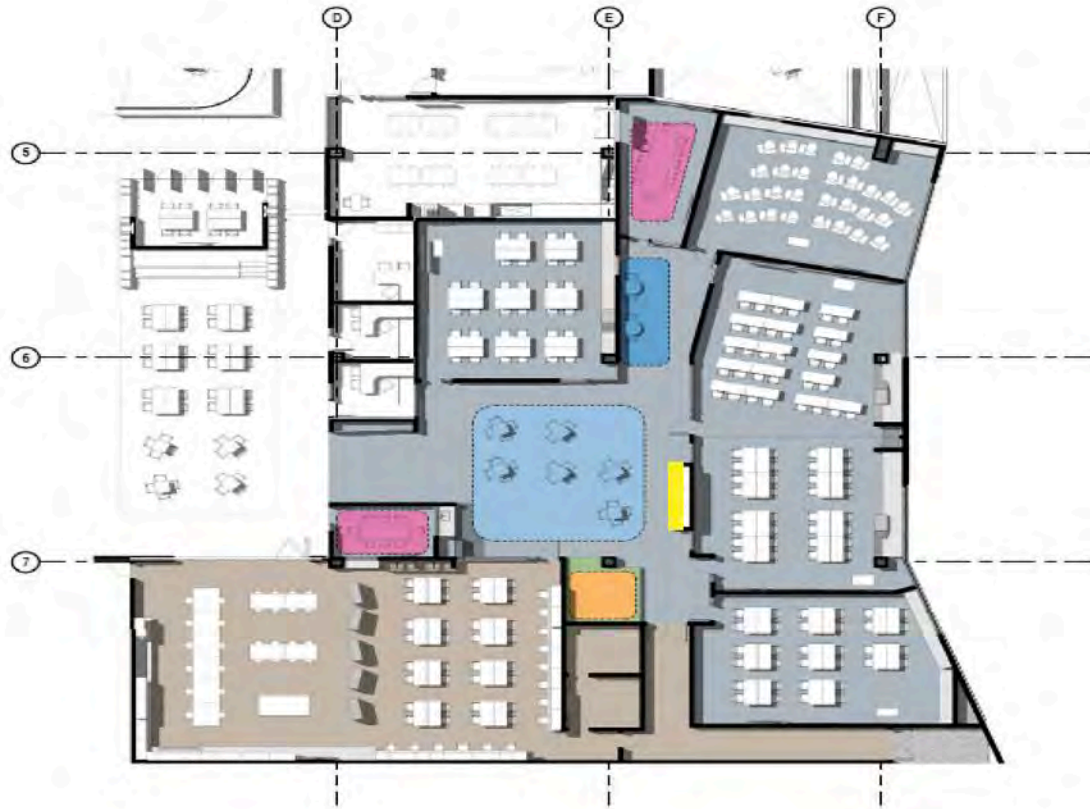
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- Hub Activity Zones*
- **LARGE GROUP**
 - **SMALL GROUP**
 - **NOOK**
 - **SEMINAR ROOM**
 - **TEACHING WALL**



key plan



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BAVARIAN INTERNATIONAL STEAM ACADEMY





CTE, PBL and STEM at Work in Education