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
1840-60

1840’s MANN COMMON SCHOOLS

PBL HAS LIMITED & HAP-HAZARD APPLICATIONS

1860-80

1860

AMERICAN MONTESSORI SOCIETY REBIRTH

1880-00

1907

START OF MONTESSORI SCHOOLS

WHOLE CHILD, PEER & PROJECT BASED LEARNING

1900-20

1900’s DEWEY
RELEVANCY, OWNERSHIP & PBL

1920-40

1940-60

1960

1960-80

1980-2k

2000’s

PBL HAS LIMITED & HAP-HAZARD APPLICATIONS

1980-2k

2000’s
1840-60 | 1860-80 | 1880-00 | 1900-20 | 1920-40 | 1940-60 | 1960-80 | 1980-2k | 2000's

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REBIRTH

1990's STEM
ORIGINALLY ‘SMET’
BECOMES PART OF EDUC. INITIATIVES NATIONALLY

1862 Morrill Act
LAND GRANTS FOR AG/SCI/TECH

1842 EISENHOWER/KENNEDY PUSH FOR AMERICAN LEADERSHIP IN SCI/TECH

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- Rejects dividing students into college bound & working trade

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1840-60
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### Timeline of Educational Initiatives

**1840’s**
- MANN Common Schools

**1862**
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- Comm. of 10: Rejects dividing students into college bound & working trade

**1917**
- Barden Act: Expanded vocations

**1946**
- Voc. Educ. Act: Expanded to all ages & communities

**1900’s**
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**1907**
- Start of Montessori Schools: Whole child, peer & project based learning

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1917: Barden Act
- Expanded vocations

1946: Perkins Act
- Obligation to educate all students

1862-80: 1840-60
- Crafts & trades apprenticeships meet industrial revol.

1880-00: 1860-80
- Factory training, guilds & formation of unions

1900-20: 1920-40
- Early vocational education fitted people to probable destiny (separate tracks)

1920-40: 1940-60
- Students w/ LRNG/BEHAV. disabilities often sent to Voc-Ed.

1940-60: 1960-80
- New CTE model focuses on transferable skills

1963: Perkins Reauth
- Renamed CTE (college ready, transferable)

1984: Perkins Act
- Expanded to all ages & communities

1998: Perkins Act
- OBLIGATION TO EDUCATE ALL STUDENTS

2006: Perkins Reauth
- THE FIRST FEDERAL FUNDING FOR VOC-EDUC. IN AMERICA (FOR PROBABLE DESTINYS)
- EXPANDED VOCATIONS
- OBLIGATION TO EDUCATE ALL STUDENTS

1840-60: EARLY VOCATIONAL EDUCATION FITTED PEOPLE TO PROBABLE DESTINY (SEPARATE TRACKS)
- Morrill Act
- Smith-Hughes Act
- Barden Act
- Perkins Act
- Perkins Reauth

1860-80: FACTORY TRAINING, GUILDS & FORMATION OF UNIONS

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PBL
HANDS-ON/ACTIVE
STUDENT CENTERED
APPLIED LEARNING
COLLABORATIVE
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STE(A)M
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TRANSPARENT LRNG
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Envisioning 21st Century Schools

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CTE
INHERENTLY STEM &
INTERDISCIPLINARY
COMMUNITY, BUSINESS
& ADULT CONNECTIONS
IDENTITY/BELONGING
INTRINSICALLY RIGOROUS
(HALF TIME COLL-READY)
HIGHLY RELEVANT
WHAT DOES RESEARCH TELLS US?

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

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

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
WHAT DOES RESEARCH TELLS US?

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

Schools That Work

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Dr. B. Barron and Dr. L. Darling-Hammond,
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A SENSE OF BELONGING & IDENTITY
(Academies, Career Tracks & Pathways)

COMMUNITY CONNECTIONS/ENGAGEMENT
(Civic, Business & Public Engagement/Use)

Schools That Work

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

Dr. B. Barron and Dr. L. Darling-Hammond,


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
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 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
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
21\textsuperscript{st} Century Teaching and Learning

<table>
<thead>
<tr>
<th>The 6 Rs</th>
<th>The 4 Cs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading WRiting ARithmetic</td>
<td>Critical Thinking Communication Collaboration Creativity plus Citizenship</td>
</tr>
<tr>
<td>Rigor Relevance Relationship</td>
<td></td>
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</table>

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

Head & Hand

Growth Mindset
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

<table>
<thead>
<tr>
<th>Science Practices</th>
<th>Ask Questions</th>
<th>Investigate</th>
<th>Use Math</th>
<th>Communicate</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>What am I observing?</td>
<td>Use the Scientific Method</td>
<td>Use computers to analyze very large data sets for patterns and trends</td>
<td>Be a critical consumer of information about science</td>
</tr>
<tr>
<td></td>
<td>What does this evidence mean?</td>
<td>State the goal of the investigation</td>
<td>Plan a course of action that will provide the best evidence to support conclusions</td>
<td>Critically read scientific texts to determine the central ideas and obtain scientific information to describe patterns in evidence.</td>
</tr>
<tr>
<td></td>
<td>What is the relationship between these variables?</td>
<td>Predict outcomes</td>
<td>Use mathematical representations to support scientific conclusions</td>
<td>Use multiple sources to obtain information used to evaluate the validity of claims and methods.</td>
</tr>
<tr>
<td></td>
<td>How can I make my model more accurate?</td>
<td>Plan a course of action</td>
<td>Create algorithms (a series of ordered steps) to solve a problem</td>
<td>Communicate ideas by using tables, diagrams, graphs, models, interactive displays, and equations as well as orally, in writing, and discussion.</td>
</tr>
<tr>
<td></td>
<td>What evidence do I need to answer my question?</td>
<td>Use scientific ideas to show why data can be considered evidence.</td>
<td>Use digital laboratory tools to observe, measure, record, and process data.</td>
<td>Argue when investigating a phenomenon, resolving questions about measurements, building data models, and using evidence to evaluate claims.</td>
</tr>
<tr>
<td></td>
<td>What hypothesis can I state based on my observations?</td>
<td>Reduce error in procedures.</td>
<td>Make quantitative predictions.</td>
<td>Arguing happens when listening, comparing, and evaluating competing ideas and methods.</td>
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<td>Is the data used correctly in the argument?</td>
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<td>Respectfully provide and receive critiques about one’s explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions.</td>
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<th>Science Practices</th>
<th>Design a Model</th>
<th>Analyze Data</th>
<th>Explain</th>
<th>Argue</th>
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<td></td>
<td>Models include diagrams, physical replicas, mathematical representations, analogies, and computer simulations.</td>
<td>Construct and interpret graphical displays of data.</td>
<td>An explanation includes qualitative or quantitative relationships between variables that predict and describe phenomena.</td>
<td>Argue when investigating a phenomenon, resolving questions about measurements, building data models, and using evidence to evaluate claims.</td>
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<td>Models highlight some ideas and simplify others.</td>
<td>Use computers to tabulate, graphically represent data, visualize, and statistically analyze.</td>
<td>Design investigations that generate data to determine explanations to questions.</td>
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<td>Models are used to help find questions and explanations.</td>
<td>Use math to represent relationships between variables and identify patterns.</td>
<td>Apply scientific reasoning to show why the data or evidence is adequate for the explanation or claim.</td>
<td>Respectfully provide and receive critiques about one’s explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions.</td>
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<td>Models are based upon evidence. New evidence, changes the model.</td>
<td>Take into account sources of error.</td>
<td>Construct an explanation using models or representations.</td>
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<td>Is one variable the cause (causal), or do both just happen at the same time (correlational)?</td>
<td></td>
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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
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

- Professional Learning Communities
- Core Values
- Departmental Teams
- Focus on What Students Know and Do
- Embedded Academics
- Day On, Day Off

Self-Reflective / Raising the Bar
- Small and Personalized
- Academic and Tech/Voc Integration
- State-of-the-Art Academic/Vocational
- Aligning to Common Core Standards
- Developing a Common Language
- Differentiated Instruction
- Integrating Technology
- Full Inclusion

North Shore Tech

- Build Your Own Curriculum
- Co-Teaching
- Writing Across the Curriculum
- “Related” Academic Instruction
- Week On, Week Off

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
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)
Overhead Services

Demountable Walls

Flexibility

Plug/Play Surround

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
WELCOMING ARRIVAL / A PLACE TO GATHER
Horizontal Stacking
- Lower Level - High Bay Labs
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ACADEMIC NEIGHBORHOODS / CLUSTERS
VARIED SPACES
MEDIA CENTER AS LEARNING COMMONS
INFORMAL LEARNING & PRESENTATION SPACE
FLEXIBLE / ADAPTABLE CLASSROOMS
ADJUSTABLE / MODULAR FURNITURE

Small Groupings

Medium Groupings

Large Groupings

Lecture Arrangement

Project Arrangement

Debate Arrangement
SCHOOL AS TEACHING TOOL
DISPLAY & CELEBRATING STUDENT ACHIEVEMENT
Future Ready Examples
DEARBORN EARLY COLLEGE STEM ACADEMY

1. Mastery-Based Learning
2. Trans-disciplinary Instruction
3. Design-Focused
4. Personalized
5. Community
Envisioning 21st Century Schools

With New Vista Design

PERKINS EASTMAN

newvista design
Envisioning 21st Century Schools
“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”
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
LEVEL 3-5

**MUSIC**

**VISUAL ARTS**

**DANCE**
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
Envisioning 21st Century Schools

With New Vista Design

PERKINS — EASTMAN

newvista design
Envisioning 21st Century Schools
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.
Envisioning 21st Century Schools
With New Vista Design
Envisioning 21st Century Schools

With New Vista Design

Envisioning 21st Century Schools
Envisioning 21st Century Schools

With New Vista Design

Gensler

PERKINS EASTMAN

newvista
design
Envisioning 21st Century Schools
With New Vista Design
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