Evidence Based Curriculum Integration

Presented by
Dr. James R. Stone III
NCPN
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2013 National Technology Centers That Work Leaders’ Forum: Technology Centers of the Future
Agenda for Technology Centers of the Future

- Future Scan: Wither our students?
- Where have we been: 30 years of ‘reform’
- Where do we need to go: Evidence based curriculum integration
What do the data say about where the jobs are?

High Growth? High Demand? High Wage?
Another Perspective
63% of all jobs will require some college or better by 2018.

Source: Analysis of March CPS data, various years, Center on Education and the Workforce forecasts of education demand to 2018.
Sub-Baccalaureate Credentials Pay Off

- 43% of PS Credential Programs earn more than Associate Degrees
- 27% of PS Credential Programs earn more than Bachelor's Degrees
- 31% of all credentials & associate degrees earn more than bachelor’s degree

Licenses and Certificates Earn More Than:

- Associates: 43% of PS Credential Programs earn more than Associate Degrees
- Bachelor's Degrees: 27% of PS Credential Programs earn more than Bachelor's Degrees
- Bachelor's Degree: 31% of all credentials & associate degrees earn more than bachelor’s degree
Education and Future Work: BLS & CEW

Bar chart showing the distribution of educational levels and work experience for USDOL-BLS and CEW. The chart includes categories such as BS/BA or more, Some College, Associate, PS Award, Work Experience, OJT-Short to Long, HS or less, and CEW. The bars indicate the percentage or number of individuals in each category.
Why Technical Education Matters

Credential Growth

- Associates
- Bachelor's
- Master's
- Doctorate

Labor Market Demand

- College Graduate Supply
- College Graduate Demand

Labor Market Demand B

- Taxi Drivers w/ BA/BS
- Sales Clerks
- Janitors

Vedder, R., Denhart, C., Robe, J. (2010). Why are recent college graduates unemployed.
College for all? Only 40% of 27-year olds have earned an A.A. degree or higher.

Note: Represents data collected in surveys between 2006-2008; GED is approximation based on data from GED Testing Program.

What about the 60%?
What about career development for the 40% - TCTW!!!!!
Computers now exhibit human-like capabilities not just in games such as chess, but also in complex communication such as linguistic translation and speech (Think Siri)
A 3rd Perspective: The Race Against the Machine (The Machines are Winning?)

- The Google car(truck?)
- IBM Watson
- Deep Blue
- The “Square”
- Text readers/ Pattern recognition (goodbye legions of lawyers-only 60% accurate)
- Automated ‘call centers’ (goodbye India)
- GeoFluent (goodbye translators)
- Vending machines for ... everything
Can People Win?

- Instructional methods
- Softer skills
- Instructional focus
- The Human Advantage (for now)

- Khan Academy
- CTSOs/WBL
- Hyperspecialists, entrepreneurship
- Physicality of work
- Advanced pattern recognition
- General problem solving
- Creativity
Getting students ready for careers and college: Their future

**Academic**
- Mathematics
- Science
- Communications

**Occupational**
- SCANS
- 21st Century Skills
- “Soft” Skills
- Employability Skills

**Technical**
- Job specific skills valued by employers

**College & Career Ready**

**Required skills**
Where Have We Been: 30 Years of “Reform”

Rigor = More

A narrow curriculum
High school has become the new middle school
Context: Since the mid-1980s we have:

- Added the equivalent of one full year of core academics (math, science, language arts) to high school graduation requirements.

- (NAEP) **Reading scores have not improved or significantly declined***

- (NAEP) **Science scores have not improved or significantly declined***

- (NAEP) **Math scores have remained relatively unchanged**

*Depends on the starting and ending timeframe*
Taking more math is no guarantee

- Only 13% of students who took Alg I, II & Geometry scored a 22 on the ACT exam\(^1\)
- Adding Trig increases to 37%\(^1\)
- 43% of ACT-tested Class of 2005\(^1\) who earned A or B grades in Algebra II did not meet ACT College Readiness Benchmarks in math\(^2\) (75% chance of earning a C or better; 50% chance of earning a B or better in college math)

1. ACT, Inc (2004) *Crisis at the Core*
It is not getting much better

The United States, once the world leader in high-school completion, now trails 22 other leading industrialized countries that have graduation rates higher than the American rate of 72 per cent, according to a report released last week by the Organization for Economic Cooperation and Development. Chronicle of Higher Education (December 4, 2008)

Your child is less likely to graduate from high school than you were; the United States is now the only industrialized country where young people are less likely than their parents to earn a diploma. Houston Chronicle, Libby Quaid 10/23/08

*NCES, 2012
To Address College & Career Readiness: Make High School Matter

Increase Engagement
Completing HS
Completing PS/industry credential

Improve Achievement
Academic
Occupational
Technical

Enhance Transition
Through School
To continuing education
To the workplace
To a successful adulthood
TCTW Key Practices

**What** - Academic studies

- Teach more students the **essential concepts** of the college-preparatory curriculum by
- encouraging them to apply academic content and skills to real-world problems and projects within their CT studies

**How** - Students actively engaged

- Engage students in CT
- and academic classrooms in rigorous and challenging assignments using research-based strategies and technology.
3 Integrations for TCTW

**System**
- Vertical Alignment, “Articulation”
- Career Clusters/Pathways
- Dual Credit/Enrollment
- Career Academies/MCHS

**Curricular**
- Incorporate more academics into CTE
- Incorporate more CTE into Academics
- Senior projects

**Instructional**
- CTE to Academic & Academic to CTE
- Pedagogic framework
- Teacher skill/performance
Curriculum Integration
Experimental Research
(Instructional)

- Math-in-CTE: complete
  - Technical Assistance – 7 yrs

- Literacy-in-CTE: complete
  - Technical Assistance – 2 yrs

- Science-in-CTE:
  - Study recently concluded
Why We do Experimental Research: A Cautionary Tale

- The Japanese eat very little fat and suffer fewer heart attacks than the British or Americans.

- The Mexicans eat a lot of fat and also suffer fewer heart attacks than the British or Americans.

- The French eat a diet rich in calories, fats and wine but suffer fewer heart attacks than British or Americans.

- The Italians drink excessive amounts of red wine and also suffer fewer heart attacks than the British or Americans.

- The Germans drink a lot of beer and eat lots of sausages and fats and suffer fewer heart attacks than the British or Americans.

CONCLUSION: Eat and drink what you like.

Speaking English is apparently what kills you.
Experimental design

- Random Assignment (classroom level)
- Pretest and posttest using established tests
- Fidelity of treatment
- Monitoring of counterfactual group(s)
What we tested: Math Pedagogic Framework

1. Introduce the CTE lesson
2. Assess students’ math awareness
3. Work through the embedded example
4. Work through related, contextual examples
5. Work through traditional math examples
6. Students demonstrate understanding
7. Formal assessment

The students whose teachers used the problem based curriculum in their classrooms scored significantly higher on measures of problem-solving skills (Institute Of Education Sciences, August 9, 2010)
## Authentic Literacy: What we tested

<table>
<thead>
<tr>
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<th>MAX</th>
<th>ASH</th>
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</thead>
<tbody>
<tr>
<td><strong>Before Reading</strong></td>
<td><strong>M</strong>otivation</td>
<td>Introduction and modeling of the skill</td>
</tr>
<tr>
<td></td>
<td>Reducing the anxiety and improving the probability of success in reading</td>
<td></td>
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<tr>
<td><strong>During Reading</strong></td>
<td><strong>A</strong>cquisition</td>
<td>Guided practice in learning skill</td>
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<tr>
<td></td>
<td>Individual silent reading for personal interpretation</td>
<td></td>
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<tr>
<td><strong>After Reading</strong></td>
<td><strong>E</strong>xten<strong>s</strong>ion</td>
<td>Reflection on how the skill worked</td>
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<td></td>
<td>Cooperative construction of meaning through discussion, writing, etc.</td>
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</table>
Science-in-CTE “Six Elements”

What We Tested

1. Introduce the CTE lesson
2. Assess students’ pre-understandings of CTE and the embedded science
3. Walk through the CTE content and the embedded science within it
4. Students participate in an authentic application of the CTE using inquiry approach
5. Students demonstrate what they have learned about the explicit science
6. Formal assessment of CTE and science knowledge and skills
What We Learned: Experimental Test of Math Integration

- Students in the experimental classes scored significantly higher on Terra Nova and Accuplacer
- The effect: 71st percentile & 67th percentile
- No negative effect on technical skills
- 11% of class time devoted to enhanced math lessons
Power of the New Professional Development Model

Math in CTE Use 1 Year Later

Total Surprise!
What We Learned: Experimental Test of Science Integration

Reading
- Two approaches tested
- Both significantly improved reading scores
- Students of teachers’ with years of PD significantly out performed groups

Science
- Overall, no effect
- Significant effect for nonwhite males and females
What We Have Learned: From Research to Technical Assistance

How to Make Curriculum Integration Effective
Core Principles

• Begin with the CTE curricula, not with academics
• Approach academics as essential workplace skills
• Maximize the academics in CTE
• Support CTE teachers as “teachers of academics-in-CTE”; not as academic teachers
• Foster and sustain a Community of Practice
Begin with the CTE curricula, not with the academics
What is Curriculum Mapping?

- Genesis of the academic integration
  - You have to know where the academic opportunities are located to begin the process
  - Precedes integrated lesson development

- A “process” of investigating the CTE curriculum:
  - What do I teach and
  - Where do the academics naturally occur?

- An ongoing process (not a one-time only)
  - Growing with the process; Revisiting the maps
The Mapping Process…

- Create a “map” for the term or school year in the course/program selected
  - Use the mapping template
- Identify the CTE concepts worthy of academic enhancement.
  - Opportunities may outweigh the time available: Think about what will most help CTE students.
  - Maintain authenticity: Avoid “academics for the sake of academics”
<table>
<thead>
<tr>
<th>CTE UNIT/TOPIC</th>
<th>CTE CONCEPTS</th>
<th>MATH CONCEPTS</th>
<th>ACADEMIC STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Structure and Function</td>
<td>Compare cell, tissue, organ and body systems relationships</td>
<td>Solve linear equations</td>
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<tr>
<td></td>
<td></td>
<td>Read and interpret graphs and charts</td>
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<td>Problem solving involving statistical data</td>
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<td>Ratio and proportion</td>
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Only then do you “align” standards (e.g. CCSS)

Map the Math onto the CTE

CTE PROGRAM: HEALTH OCCUPATIONS
Creating opportunities for students to apply academic knowledge:

- generate examples and lessons in which students solve **authentic workplace problems**

- introduce and reinforce academic skills as "**tools**" needed in the "**real world**"

- **bridge CTE and academic vocabulary** in developing and teaching integrated lessons
Maximize the academics in CTE

Approach Academics as a Workplace Skill
The Occupational Expression of Academics

A career ready person is proficient in the core academic subjects, as well as in technical topics. This foundational knowledge base includes competence in a broad range of academic subjects grounded in rigorous internationally benchmarked state standards... Career Readiness Council 2012

Math-in-CTE Curriculum Map: Health Science

<table>
<thead>
<tr>
<th>CTE Course/Unit</th>
<th>CTE Concepts</th>
<th>Math Concepts</th>
<th>Common Core Math Standards Middle School</th>
<th>Common Core Math Standards High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient assessment</td>
<td>Input/output; Vital signs; Height/weight; Conversions; Instrument reading</td>
<td>Reading measurement; Basic operations; Ratio/Proportion; Solving equations; Scales</td>
<td>6.NS.2; 6.NS.3; 7.NS.1; 6.RP.1; 6.RP.2; 6.RP.3; 7.RP.1; 7.RP.2; 7.RP.3; 6.EE.2; 7.EE.3</td>
<td>A.APR.1; A.APR.7; N.RN.3; N.Q.1; G.MG.3; A.CED.4</td>
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</table>

http://www.nrccte.org/professional-development/math-cte/curriculum-maps
A Process and A Pedagogy

“More than a set of lesson plans…”

a continuous process…

…using pedagogic frameworks through which to enhance and teach the embedded academics
Support CTE teachers as “teachers of academics-in-CTE”; not as academic teachers
OTHER LESSONS

- Maintaining the CTE in integration
- Not a replacement of CTE curriculum
- Rather, an enhancement of existing curricula
- Do-able for CTE teachers
- The tipping point
- Maintaining authenticity
Foster and sustain a Community of Practice
Extended Professional Development

- Convening teachers on a regular basis
  - Offering opportunities for partnerships with academic teachers to grow
  - Clustering CTE teachers of common content – sharing the load

- Extended PD = 10 days per year
  - Summer = 5 days
  - Fall = 2 days
  - Winter = 2 days
  - Spring = 1 day

- Ongoing accountability

- Long-term planning for sustainability
Changing the Paradigm in Practice

**Old Models**
- A box of curriculum
- Short term “training”
- Little or no support after the “sage on the stage” goes away
- Replicable by individual teachers (assumed)

**New Models**
- Process not an event
- Built on communities of practice
- On-going support – the learning curve
- Requires teams of committed teachers working together over time
High school is the last education opportunity paid for wholly by the public. It’s purpose has to be to do the best it can to provide all who leave it the foundation necessary to enter, or further prepare for, adult life.

Barton, 2006
As I Imagine the future...

- **World class curriculum…**
  - Critical thinking developed by using academic skills to solve real problems in class and on the job
  - Builds related academic, occupational and technical skills
- **Delivered by world class teachers who**
  - are technical masters
  - can link related academics to technical content
  - supported by employers who engage your students
- **Situated in programs** that build on intensive career development, provide career pathways that link K-12 to postsecondary education and industry recognized credentials for careers that matter
Homework: For the “Flat World”
Shameless Promotion...
VISIT OUR WEBSITE OR SEND ME A NOTE

www.nrccte.org

James.stone@nrccte.org