High Quality CTE: A Systems Approach to Benefitting All Students

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The Origins of the Challenge
Analyzing the Problem

If your assumptions about a problem are wrong, then it is very likely your solution will be as well.
Public education serves multiple purposes, productive citizenry is but one of many:

• Engaged citizen
• Contributing community member
• “wise” consumer
• others

CTE also serves multiple purposes:

• Education about work
• Education through work
• Education for work (productive citizen)

Caveats
The *raisons d'être* for CTE
National Perspectives (BLS)

Largest Growth Jobs

1. Registered Nurse (+712,000)
2. Retail Sales Person (+707,000)
3. Home Health Aide (+706,000)
4. Personal Care Aide (+607,000)
5. Office Clerks (+490,000)
10. PS. Teachers (+306,000)
15. Elementary Teacher (+249,000)

Fastest Growth Jobs (%)

1. Personal Care Aides (+600,000)
2. Home Health Aide (+706,000)
3. Biomedical Engineer (+ 9,700)
4. Construction Helpers (+ 17,600)
5. Carpenter’s Helpers (+ 25,900)
6. VetTech (+ 41,700)
8. Physical Therapist Asst (+45,7000)
Why are recent college graduates unemployed

Vedder, R., Denhart, C., Robe, J. (2010).
Too Many College Grads?

- ...turning out vastly more college graduates than there are jobs in the relatively high-paying managerial, technical and professional occupations to which most college graduates traditionally have gravitated.

- Roughly one of three college graduates is in jobs the BLS says require less than a bachelor's degree.

Richard Vedder, director of the Center for College Affordability and Productivity WSJ 6/21/2012
Problem: Credential Inflation

- Jobs resist credential inflation when there are good alternatives for identifying skill proficiency.
- Health care and engineering technician jobs show little sign of upcredentialing.
- When governed by strict licensing or certification standards, well-developed training programs, or by measurable skill standards such that employers do not need to look at a college degree as a proxy for capability.
Middle Skill Pathways: Another Way of Winning (What you do!)

47% of all new job openings from 2010 to 2020 will fall into the middle-skill range

Source: Harvard Business Review, 2012/12, Who Can Fix the “Middle Skills” Gap?
- STEM accounts for 11% of all jobs requiring a college degree.
- STEM is the second highest group of jobs advertised online — 28%.
- STEM jobs take more than twice as long to fill as other openings.


“such (STEM) claims are now well established as conventional wisdom” and “there is almost no debate in the mainstream.” “They echo from corporate CEO to corporate CEO, from lobbyist to lobbyist, from editorial writer to editorial writer,” “But what if what everyone knows is wrong? What if this conventional wisdom is just the same claims ricocheting in an echo chamber?”

*The evidence shows that the conventional wisdom is terribly wrong.*

**Is CTE STEM? Or STEAM? Of STEMM?**

Sources: *The Online Labor Market: Where the Jobs Are*. Center on Education and the Workforce, Georgetown University, April 2014; *Still Searching: Job Vacancies and STEM Skills*, Brookings Institute, June 2014.
STEM: To 2020

Projected STEM Openings
• 2,537,060

Projected STEM Graduates
• Associates 440,000
• Bachelors 2,652,000
• Master’s 569,000
• PhD’s 258,000
• Total 3,919,000

Ratio of Projected Degrees to Openings = 1.55

If STEM Jobs are so hard to fill: Most with bachelor's degrees in science, technology and math don't get STEM jobs.

Amid a U.S. push to get more students interested in science, technology and math, often called STEM, the Census Bureau reported Thursday that 74% of those with a bachelor's degree in these subjects don't work in STEM jobs. (Census Report: July 14, 2014)

<table>
<thead>
<tr>
<th>Engineering majors and majors in Computer, Math and Statistics</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Science</td>
<td>26%</td>
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<tr>
<td>Psychology</td>
<td>10%</td>
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<tr>
<td>Social Science</td>
<td>7%</td>
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</table>
Mfg tell us most adults cannot pass a 4th grade math test

AIB
Q17: You are going to see a list of skills and attributes that employees could have. Please rank how important each skill or attribute is for your employees to have right now using a 7 point scale.

Q18: Indicate the level of your current employees' skills overall, for each of the following skills, using a 7 point scale.

- Severe Deficit
- Moderate Deficit
- Small Deficit
- No Deficit

The Real Skills Gap: Business Roundtable Survey 2009

Gap Between Importance of Skill & Workers' Current Skill Level (As Perceived By Employers)
An Evolving Disrupter

• 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)
• Jobs vs. Work
Technology’s Impact on Jobs
(The Machines are Winning?)

The Google car(truck?)
IBM Watson (+240%)
Deep Blue
The “Square”
Text readers/ Pattern recognition (goodbye legions of lawyers-only 60% accurate)
Automated ‘call centers’ (goodbye India)
Amazon Drone Delivery
“Everyone Knows Your Name”

Then

Now: A TEAM OF MIT BARTENDER ROBOTS SERVES BEER MORE EFFICIENTLY
The integrated system, which is referred to as FIREFLY, was cleared for use in robotic surgery by the FDA in February 2011 with initial use in applications ranging from urology to gynecology.
NOW & The Future
Dark (Lights Out) Manufacturing

• FANUC Robotics operates a lights-out factory employing robots to make other robots.
• Japanese camera giant Canon recently announced that it is phasing out human workers at camera factories
• And in the Netherlands, Philips produces electric razors in a facility with 128 robots and nine human quality assurance workers.
Algorithms Make Better Hiring Decisions Than Humans

- On average, the employees who were evaluated by a machine stayed in the job 15% longer than those who were hired without being rated by an algorithm.
- NBER, 2015 Working Paper
Future Manufacturing?

3D Printing

Manufacture Your Own Products
Risk of Jobs to Computerization

% of Jobs by Risk Level

- High Risk: 47%
- Medium Risk: 19%
- Low Risk: 33%

Frey & Osborne, 2013
Can People Win?

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

***THIS IS YOU!

- Khan Academy
- CTSOs/WBL***
- **Hyperspecialists, entrepreneurship***
- Physicality of work
- Advanced pattern recognition
- General problem solving***
- Creativity***
Education Solution?

Pile on more academics

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

(ACT College Ready Math=22)

- Only 26% of students who took Alg I, II & Geometry scored a 22 (ACT Benchmark for CCR) on the ACT exam. \(X=17.7\)^1
- Adding Trig increases to the average score to 19.9; 37% are CCR\(^1\)
- Not until calculus is added, does the average score exceed 22; 55% are CCR – 5 years of high school math.
- 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\(^2\)

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1. ACT, Inc (2004) Crisis at the Core
Math for College & Career Readiness

NCEE, 2013

- Math needed is mostly middle school
- Alg II is not a prerequisite for CC success or most careers
- College reading requires 11th/12th grade skills
- Students enter CC weak in needed math and reading skills

NRCCTE, 2013

- Math associated with an ACT score of 22 is mostly middle school math, Algebra I and some geometry.
- Math associated with middle skill job employment tests is higher than that required for an ACT score of 22 but still found in middle school math, Algebra I and some geometry
In the Meantime:
We have a ‘boy’ problem

- By 12th grade, male reading scores are below females’
- 11th grade boys write at an 8th grade girl level
- Boys advantage in math and science is nearly gone.
- Boys are more likely to have discipline problems
- Boys account for ¾ all D’s and F’s
- Fewer boys than girls finish high school, start and finish college, start & finish grad school (Brooks, 2012)

http://blogs.edweek.org/edweek/college_bound/2013/03/career_technical_education_linked_to_boys_high_school_survival.html
Employment of Young Men

SOURCE: GEORGETOWN UNIVERSITY CENTER ON EDUCATION AND THE WORKFORCE ANALYSIS OF CURRENT POPULATION SURVEY, MARCH, 2000-2012, CPS UTILITIES, UNICON RESEARCH CORP.
CTE Keeps Boys in School!

A Survival Analysis

NS=Statistically not significant
“There is one approach that does tend to improve graduation rates and labor market earnings, especially for at-risk youth: high-quality career and technical education (CTE)”

Where are all the good jobs going.
While test scores remain flat, Student Engagement plummets
Good News: Graduation Rates are up (81%)
And 63% Go Directly to College
Research Points Toward A Systems Response

• Partnerships
• Programs
• Pedagogies
Building Quality Career Pathways to CCR

**Partners**
- Align the College & Career Ready System Components

**Programs**
- Bring existing programs to standards & add new programs

**Pedagogy**
- Ensure all CTE faculty are highly skilled in pedagogy and in their professions
Support A Systems Approach

System Of Innovative Partnerships

- Vertical Integration: Secondary - Postsecondary – Business & Industry
- K-12 Career Development
To Address College & Career Readiness: *Make High School Matter*

**Increase Engagement**
Completing HS
Completing PS/Industry credential

**Enhance Transition**
Through School
To continuing education
To the workplace
To a successful adulthood

**Improve Achievement**
Academic
Occupational
Technical
Building the CCR system with High Quality CTE
Audit The System

• What is working well?
• What is not working well?
• What is missing?
Effective CCR Requires a Career Development Framework

K-5: Career Awareness
Introduction to health careers

6-8: Career Exploration
Discovering interest in health careers
Begin Individualized Graduation Plan

Grade 8: Transition
Choosing a health career focus (can change easily at any time later)

9-12: Career Preparation
Academics and technical courses, intensive guidance, individual graduation plans

Postsecondary: Career Preparation
Achieving credentials: college, certification, apprenticeship, military

Employment: Career Development
Continuing Education and Lifelong Learning

A Developmental ILP that Drives Program Choice & Student Course Assignments
Imagine Involving All Faculty in Career Pathways

Individualized Career Plan
(5-year rolling)

- AAI in English
- AAI in Social Studies
- AAI in Science
- AAI in Math

Distributed Guidance

Career Pathway

9th Grade Career

Post secondary Planning
Imagine this: A Robust I.L.P.

ILP
- 9th Grade
  - Science
  - Social Studies
  - ELA
  - Math

ILP-R
- 10th
  - Science
  - Social Studies
  - ELA
  - Math

ILP-R²
- 11th
  - Science
  - Social Studies
  - ELA
  - Math

ILP-R³
- 12th
  - Science
  - Social Studies
  - ELA
  - Math
ELA: Write a paper explaining infection control practices and procedures documenting examples of when safety protocols were violated.

Science: Conduct a study of local health care facilities to determine how medical waste is disposed.

Social Studies: Study the impact of war-time medical care on the advancement of medical techniques.

Math: Compute the number of calories in the school lunch and then calculate how long a person would have to walk to burn off those calories to maintain body weight.
A Credentialed Career Pathway

(Pathway to Where?)

- From High School to ...
- Work and (NOT OR)
- Continuing Education and Training

Goal: Productive Adult in a Global Economy
Career Pathway – Stackable Credentials

A recent McKinsey Global Institute study concludes, “policymakers and business leaders across the globe will need to find ways to vastly improve their capacity to provide job-relevant education and training. And, in both developing and advanced economies, new approaches to job creation for low and middle-skill workers will be required” (Dobbs, et al, 2012)

- More than course credit pathways
- **Portable:** trusted by employers and institutions of higher education (external validation)
- **Stackable:** each credential has value (labor market signal) leads to another credential:
  - 51% of CC certificates require less than one year
  - Offer accelerated entry into the labor market
  - Credentialing process can begin in upper secondary education
- Part of a career pathway **system**
Teach Entrepreneurship

STANDARDIZED TESTS: THE DEATH OF ENTREPRENEURS?

Negative correlation between PISA and GEM scores

Ranking by PISA Math Score and Perceived Entrepreneurial Capability

Erik Brynjolfsson
Andrew McAfee
Race Against The Machine

How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy
Designing the CTE/CCR Program: Evidence?

- Linked to Industry Standards and skills in demand (Audit)
- Integrated Academic, Industry, Non-Cognitive Skills (Curriculum Mapping)
- Forward focused programs focused on emerging occupations (e.g., Advanced Career)
CCR Requires 3 Skill Sets (Developed through HQ CTE)

Occupational Expression of Academics
- Mathematics
- Science
- Communications

Personal Effectiveness & Foundational Workforce Competence
- SCANS
- 21st Century Skills
- “Soft” Skills

Technical
- Job specific skills valued by employers

College & Career Ready

Required skills
## High Quality CTE Perspectives

<table>
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<tr>
<th>Agency</th>
<th>Common Characteristics</th>
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<tbody>
<tr>
<td>National Academy Foundation</td>
<td>Career Pathways</td>
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<tr>
<td>Linked Learning</td>
<td>Project Based Learning</td>
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<tr>
<td>Southern Regional Education Board (SREB)</td>
<td>Work Based Learning</td>
</tr>
<tr>
<td>AFT</td>
<td>Robust Advisory Boards (HS &amp; PS shared)</td>
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<tr>
<td>Georgetown Center for Law and Poverty</td>
<td>Strong career guidance</td>
</tr>
<tr>
<td>Harvard University</td>
<td>Contextualized Learning</td>
</tr>
<tr>
<td>USDOL</td>
<td>Industry Aligned Curriculum</td>
</tr>
<tr>
<td></td>
<td>Rigorous Technical Skill Development</td>
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Improved Pedagogy-Evidence?

- CTE General Teacher Effectiveness
- Contextualized academics in CTE
- New pedagogies (e.g. PBL) Work-Based learning (WBL)
- Integrated CTSOs
Key CTE Pedagogies

- Classroom instruction
- Work based learning (WBL)
- Contextualized learning
- Quality of Assignments
- Skilled Professionals
- Job shadowing
- Internships
- School-based enterprise
- Cooperative education
- Apprenticeships
- Leadership development
- Professional development
- Service/social engagement
- Competitive events
Classroom Instruction: Contextualized Academics

- Mathematics
- Literacy
- Science
Science Integration: Experimental Studies

- Overall, no effect
- Significant effect for nonwhite males and females
Your challenge is to connect:

Skills in Every Lesson
Building A Competitive Workforce: A Systems Approach

The system for students begins in the K-12 system and continues throughout a lifetime and includes:

- Active and real partnerships that lead to real credentials that have meaning in the labor market
- A High Quality CTE that includes significant and meaningful career development, credential-based programs and work-based learning.
And CTE Teachers Who:

- Skilled at managing a standards-based classroom
- Make extensive use of curriculum integration opportunities
- Use project based learning to enhance the CTE classroom
- Engage all students in developmentally appropriate work-based learning
- Use the engaging power of CTSOs as another pedagogic tool for all students
Shameless Promotion . . .

COLLEGE AND CAREER READY IN THE 21st CENTURY

Making High School Matter

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